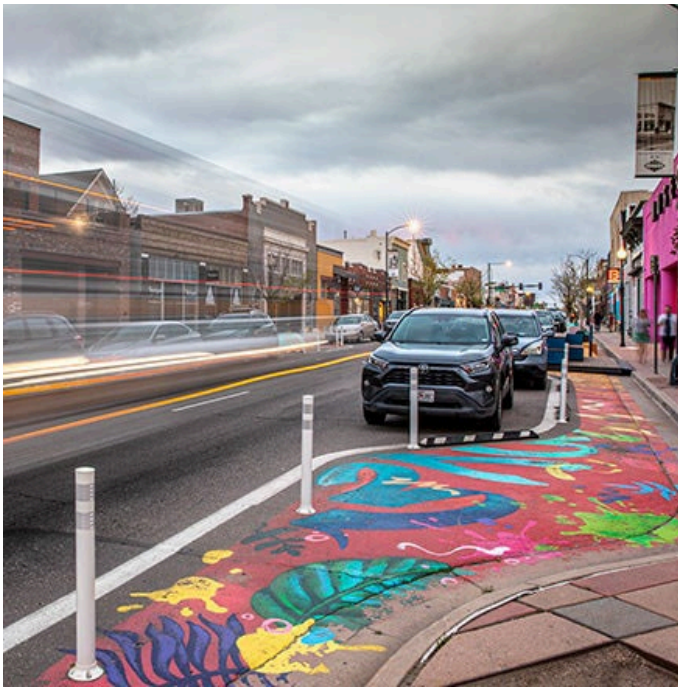

Maximizing Value for Transportation Infrastructure

Final

Vaughan Transportation Plan

City of Vaughan, ON

October 14, 2022

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1 Introduction

The City of Vaughan is developing a new Vaughan Transportation Plan (hereinafter referenced as the VTP), which will update the City's 2012 Transportation Master Plan (TMP) and develop a blueprint for moving people and goods sustainably for the next 20 years and beyond. It will establish a vision for the future, identify transportation needs, opportunities, and improvements, as well as recommend actions and policy directions.

This white paper focuses on strategies to maximize value of existing City of Vaughan transportation infrastructure assets. Maximizing value refers directly to monetization (or generating revenues to the City) and indirectly to generating benefits to Vaughan's local economy and residents of Vaughan. **Section 2** of this white paper inventories existing transportation asset infrastructure owned by the City and costing information where data was provided in previous reports or the City's budget. **Section 3** provides an overview of best practices offering a description of strategies to maximize infrastructure value (including revenue to the City and local economy), examples of use, potential applicability to Vaughan, and additional considerations for each strategy. **Section 4** identifies opportunities for Vaughan in the short and long term to maximize value from existing assets.

2 Existing Asset Inventory

Section 2 documents the City's existing transportation infrastructure assets and summarizes a list of transportation assets by type and quantity.

2.1 City of Vaughan Asset Management Plan, 2021

The City of Vaughan's 2021 Asset Management Plan (AMP), identifies roads, bridges, and culverts as the City's core transportation infrastructure assets.

According to the AMP, Operations and Maintenance costs are large expenses for the City's transportation infrastructure assets. Approximately 60% of the City's Operations and Maintenance budget is dedicated to winter control activities, 10% to regular maintenance activities, and roughly 30% is reserved for overhead costs. The AMP identifies the City's current replacement value for roads, bridges, and culverts at over $1.5 billion.

The transportation infrastructure identified in the AMP is generally in very good condition. Approximately 93% of roads and 85% of bridges and culverts were found to be in very good condition. The current replacement value of the identified assets is estimated to be over $1.5 billion. The AMP did not complete a risk assessment but noted that economic, operational, social, and environmental risks may impose budget risk on the current assets.

2.2 Additional Infrastructure Assets

Beyond the roads, bridges, and culverts documented in the AMP (Asset Management Plan), additional transportation infrastructure assets that can be leveraged to maximize value for the City and community are documented in this section. An extended inventory including additional

transportation infrastructure assets, such as multi-use trails and streetlights, is presented in **Table 1** using data provided by the City of Vaughan.

Table 1: Vaughan Transportation Asset Inventory

Mode/User	Asset	Total	Unit	Operations and Maintenance (Budget 2021)	5-Year Average Maintenance (Regular)	5-Year Average Maintenance (Winter)	Replacement Cost	Replacement value
Vehicle	Urban Road	2,162	km	$1,500,00	$1,899,000	$10,958,000	$160/m^2	$1,438,928,000
Vehicle	Arterial Road	48	km				$160/m^2	$26,866,000
Vehicle	Rural Road	110	km				$160/m^2	$57,045,000
Vehicle	Laneway	15	km				$160/m^2	$9,633,000
Vehicle	Bridges	33	km				$36,000 - $11,935,000	$101,815,000
Pedestrian	Bridges	41	km				$92,999 - $3,374,000	$17,652,000
Vehicle	Culverts	115	km				$137,000 - $3,791,000	$86,659,000
Pedestrian	Culverts	4	km				$334,000 - $459,000	$1,654,000
Pedestrian	Sidewalks	~1,194-1,201	km					
Bike	Arterial Road	30.177	km					
Bike	Bike Lane	0.241	km					
Bike	Collector	6.172	km					
Bike	Local Street	415	km					
Bike/Pedestrian	Multi-use and Recreational Trail	170	km					
All	Street Poles	23,597	each					
All	Streetlights	25,244	each					

Source: City of Vaughan's 2021 Municipal Budget

3 Best Practice Review

Section 3 summarizes the review of best practices related to maximizing the usage of the City's infrastructure assets and potential monetization opportunities. A wide variety of measures has been identified for consideration and include:

- Curbside management
- Congestion pricing
- Gondolas
- Low and Zero Emission Zones
- Electric Vehicle (EV) charging streetlights
- Shared and micro-mobility
- Mobility-as-a-Service permits
- Flex Streets and temporary road closures
- Automated Speed Enforcement

3.1 Curbside Management

From the perspective of curbside management, the curb is a shared multi-purpose space separating the roadway and sidewalk. The curb has typically been used for vehicle loading and delivery, on-street parking, and pick-up and drop-offs. However, the use of the curbside, particularly the frequency of use is changing due to evolving market sectors such as transportation (Uber, Lyft, etc.) and e-commerce (Amazon, Shopify, Etsy, DoorDash, etc.). Management of the supply and demand of the curb is critical in maximizing existing infrastructure value, particularly in intensification areas. **Section 3.1** discusses different curbside management practices. These include time-of-day restrictions, dynamic parking prices, parklets, and freight zone pricing. Curbside management practices discussed in this section may be integrated to support the City's Request for Proposal (RFP) in establishing a Parking Authority.

3.1.1 Time of Day and Specific-Use Restrictions

The goal of Time-of-Day restrictions is to manage high curbside demand periods through restrictions on usage during peak periods. This is done by imposing time limits and/or fees to curbside activities during high-demand periods of the day and/or week to maximize value on in-demand curbside space by encouraging high turnover. High turnover can assist businesses with goods movement activities (such as loading, delivery, pickup, etc.) while ensuring that in-demand curbside space is not limited by long-term parking. Furthermore, time-of-day restrictions can benefit other road users like pedestrians, cyclists, and vehicle-for-hire drivers during periods of high demand.

Specific-use restrictions aim to manage curbside space in a way that supports mobility and access for people and goods. Prioritizing curbside uses is critical to ensure that economic activity is supported while limiting impacts on traffic movement. The City of Toronto has explored some specific-use restrictions[1], including:

- Taxicab Stands at hydrants
- Motorcycle parking zones
- Designated Delivery Vehicle Parking Zones (DDVPZ)
- Accessible Loading Zones

Taxicab stands at hydrants allow taxicab operators to park or stand at hydrant locations to wait for hire or engagement provided they always remain with their vehicles and vacate the spot when required by Vaughan Fire and Rescue Services, or other authorized officials. New penalties for taxicab operators that do not abide by these rules will need to be administered.

The goal of motorcycle parking zones is to provide safe, convenient parking and encourage motorcyclists and motor scooters to park legally on city streets within the pay-and-displace areas in a controlled fashion to maximize parking.

DDVPZ allow couriers and other delivery vehicles to quickly and conveniently deliver or pick up packages and other goods. DDVPZ should have a time limit (typically 30 minutes or less) and

[1] Curbside Management Strategy – Parking Amendments – Non-Delegated Locations. Source: https://www.toronto.ca/legdocs/mmis/2018/te/bgrd/backgroundfile-110832.pdf

should be enforced. Once in place, these zones would operate according to adjacent posted times per signage and/or daily restrictions.

Parked vehicles may occasionally obstruct access to accessible vehicles, hindering safety and loading activities. Furthermore, residents requiring the use of accessible vehicles may be required to walk further distances due to parked vehicles. The goal of Accessible Loading Zones is to help improve safety and loading activities by providing dedicated zones for vehicles with an accessible parking placard. This also includes accessibility transit services such as the TTC Wheel-Trans service.

Time-of-day and specific-use restrictions can be generally applied to existing and future on-street parking spaces, for areas with heavy curbside uses and areas frequented by vehicle-for-hire pick-ups and drop-offs for events or nightlife districts. An example of time-of-day and specific-use restrictions applied to a busy mixed-use street with high curbside demand can be found on the City of Toronto's King Street Transit Priority Corridor. Typical configurations on King Street can be found in **Figure 1**.

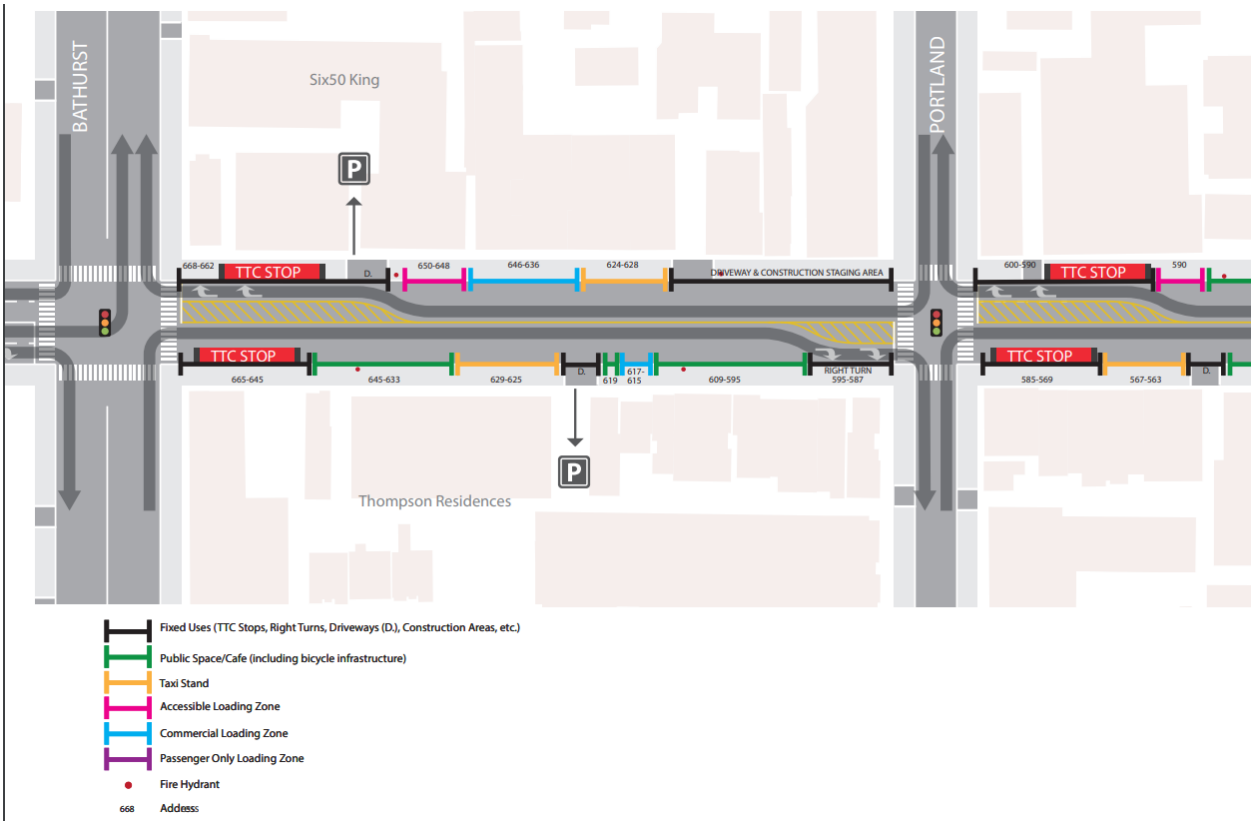

Figure 1: Typical Street Configuration for King Street Transit Priority Corridor
Source: https://www.toronto.ca/legdocs/mmis/2019/ex/bgrd/backgroundfile-131385.pdf

There is some existing use of time-of-day restrictions in Vaughan, such as on Barnes Court and Portage Parkway near the Vaughan Metropolitan Centre (VMC). Comprehensive time-of-day and specific-use restrictions can be further studied in Vaughan, especially for intensification areas with heavy curb traffic. Implementation of this measure should be determined in

collaboration with relevant stakeholders like businesses using curbside spaces for loading/delivery to understand requirements and/or develop alternative options.

3.1.2 Dynamic Parking Prices

Dynamic pricing is a responsive curbside management strategy to static parking rates that do not appropriately match demand with supply for limited on-street parking spaces. Dynamic pricing assists in alleviating congestion and emissions caused by cruising for limited parking spaces in high traffic areas. Dynamic pricing can be applied spatiotemporally or in fixed high-demand areas. The implementation of dynamic parking pricing is possible with smart meters, which allow for predictive pricing based on data per annum or fixed intervals or real-time adjustment based on present supply and demand.

The City of Hamilton is currently considering incorporating a smartphone parking app and parking occupancy technologies to track parking utilization[2], which is a crucial step in setting up a dynamic parking pricing system. Furthermore, the City of Hamilton's Parking Master Plan recommends the implementation of dynamic parking pricing for their high demand areas with the following pricing structure[3]:

- Increase parking prices by $0.25/hour when occupancy exceeds 80%
- Maintain parking prices for parking occupancy between 60% and 80%
- Decrease parking prices by $0.50/hour down to a pre-determined minimum price that covers operations and maintenance when parking occupancy is less than 60%
- Limit dynamic parking pricing to 150% of the base rate.

Another example of dynamic parking pricing can be found in San Francisco, California, USA. **Figure 2** illustrates the locations where dynamic parking prices are implemented in San Francisco.

[2] Background Report 1 – Existing Conditions and Best Practices. Source: https://www.hamilton.ca/city-planning/master-plans-class-eas/parking-master-plan
[3] City of Hamilton's Parking Master Plan. Source: https://pub-hamilton.escribemeetings.com/filestream.ashx?DocumentId=282343

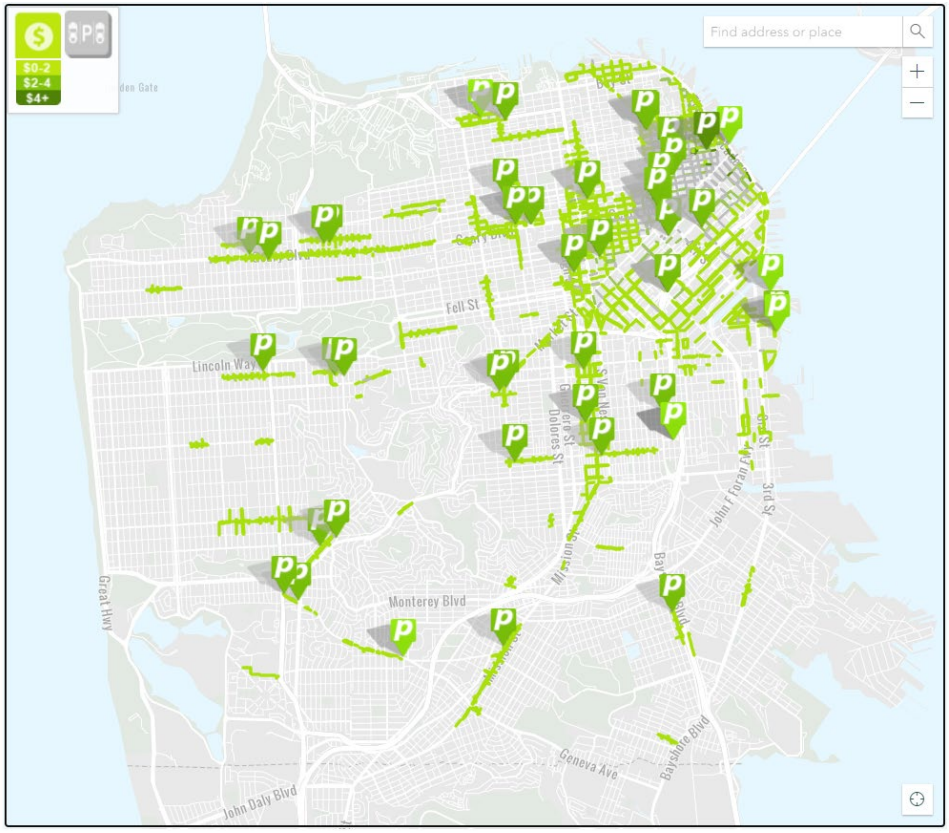

Figure 2: Locations of Dynamic Parking Prices in San Francisco, California, USA
Source: https://www.sfmta.com/demand-responsive-parking-pricing

Dynamic parking prices can be implemented in high-demand areas like downtowns, large trip-generating sites, or pedestrianized spaces. This may help reduce cruising and emissions and increase revenue compared to static parking pricing approaches. Implementation of dynamic parking prices will benefit from the creation of phone applications for drivers to use. Consequently, a database system will need to be created to inventory, analyze, and display live parking prices and spots available. A downside to dynamic parking prices is that they may place an undue burden on low-income drivers and must be implemented with careful planning.

3.1.3 Parklets

Parklets refer to the expansion of public space into the roadway by changing the use (permanently or temporarily) from vehicular storage or travel to non-vehicular public use. Typically, parklets involve some type of public seating, greenery, or local business use. Parklets are most often applied where demand for public space is unmet due to insufficient or highly congested boulevard space. Although Parklets do not generate revenue, they improve City landscapes and bring positive social impacts. A Parklet impact study conducted in San Francisco found that parklets increased pedestrian and cycling traffic, and increased social activities and positive behaviors[4]. Furthermore, businesses observed that customer levels have increased and that there are no concerns associated with loss of nearby street parking or other

[4] Parklet Impact Study, San Francisco Great Streets Project, 2011

impacts on their businesses. An increase in the number of customers may then increase revenues of businesses in the vicinity of a parklet (although studies measuring this impact were not identified).

Many cities adopted parklets during the COVID-19 pandemic as a way of supporting local businesses and expanding access to outdoor public spaces. The CaféTO program is one example, where the City of Toronto implemented this program to provide space for expanded outdoor dining areas to help restaurants and bars impacted by COVID-19. The City of Vaughan can implement a parklet program on commercial main streets, retail streets, and streets with large rights-of-way. The City of Vaughan can work with local businesses, neighbourhood associations, and local business improvement areas (BIA) to determine permit pricing and delineation of responsibilities.

Parklet regulations will need to be considered to ensure accessibility, maintenance, and stormwater drainage. Due to the need for snow removal, parklets will likely be seasonal.

3.1.4 Freight Zone Pricing

The use of the curb for goods movement has evolved and is growing due to the introduction of e-commerce. Furthermore, lockdown restrictions due to the COVID-19 pandemic have accelerated this trend. The package delivery market is changing with increasing business-to-consumer (B2C) delivery over conventional business-to-business (B2B) deliveries. As a result, delivery trucks are demanding more usage of the curb.

The curb and adjacent travel lanes may experience congestion without proper curbside management of goods movement. **Figure 3** illustrates an example where vehicle lanes and bike lanes are encroached due to on-street parking and/or undesignated freight loading/unloading zones**.**

Figure 3: Delivery Trucks Occupying Adjacent Right-of-Ways
Source: Battle for the Curb: Truck Parking Edition, HDR 2021

Implementation of paid access to freight loading and unloading zones can be a means of reducing the duration and occupancy of vehicles and ensuring that these zones are more frequently unoccupied when needed. Paid permit control is used to allow commercial vehicles to park in loading zones during designated periods while requesting payment for loading space. A study from the District of Columbia (Washington DC) found that delivery companies are willing to pay for freight zones because of the time savings, and reduction in parking violations brought upon by the reliability of using the real-time app. Another example is from the City of Hamilton, where monetizing the use of the curb is being considered for companies such as Canada Post and Uber. The City of Hamilton plans to identify zones for monetization and then require these companies to pay monthly or annual permits for curb usage within the zones.

Freight Zone Pricing may be applied on busy streets where there are front-facing retail stores that require trucks to park on the side of the street to unload goods. It may also be applied on any roads that encounter parked trucks unloading goods. Freight Zone Pricing should be coordinated with goods movement companies and other relevant stakeholders like businesses to understand requirements or processes.

3.1.5 Truck Loading Zones

An alternative to Freight Zone Pricing is to establish truck loading zones (TLZ) to allow for efficient delivery of freight to businesses. A TLZ helps to enhance mobility and accessibility in business districts while prioritizing other curb users' experiences. Also, it helps create streets

that are well planned, adaptable, and readily maintained[5]. TLZ do not generate revenue, but they help with the management of curb usage which may help reduce congestion of the curb.

To achieve desired outcomes of TLZ, several factors should be considered in their implementations[5].

- TLZs should be established in areas that are as close to businesses' shipping/receiving areas as possible to reduce delivery/pick-up time and disruption to pedestrian and vehicular traffic.
- TLZs should be designated appropriately to balance the needs of freight while being sensitive to other curbside demands.
- "Combination Zones" could be considered to maximize the efficiency of TLZs to meet demand and capture capacity in periods of low or non-use for freight delivery. Combination zones allow spaces to be served TLZ functions during designated periods and for other usages in other times
- Rigorous enforcement of parking and loading regulation will be needed to ensure the effective use of TLZs without impacting other travel modes.
- Establish standardized loading zone signs that are intuitive to curb users, so that other curb users do not encroach on TLZs during designated loading periods.
- Maintain time limits in truck loading zones to discourage commercial vehicles from occupying loading zones for extended periods
- Limit TLZs to certain types of streets, such as retail/commercial streets and boulevards.

3.2 Congestion Pricing

Congestion pricing is suitable for areas with extreme vehicular congestion, and it addresses the high demand for road space by introducing a price on road usage paid by motorists. Congestion pricing is designed to make roads and networks flow more freely by pricing the use of the road to match the demand[6]. Cities around the world with congestion pricing have seen 10-35% less traffic, improved travel times, reduction in greenhouse gas emissions, and improvement in air quality and traffic safety[7]. Though congestion pricing can raise revenues, it differs from toll roads which primarily seek to raise revenue, where the goal of congestion pricing is to derive value from reduced traffic with the added benefit of revenue[2].

Congestion pricing requires that the affected area has strong networks of alternative travel modes such as public transit and active transportation. It can be incorporated by setting a boundary around highly congested areas, and cameras at entry points can be used to identify motorists utilizing the network and apply tolls based on license plates. Pricing can be adjusted based on demand per annum or at other intervals. Revenue can be reinvested into transportation infrastructure investments. There are opportunities to pair congestion pricing with surface transit priority to instigate mode shift from single-occupancy vehicles to transit on major employment corridors.

[5] https://www.portlandoregon.gov/transportation/article/664196
[6] National Association of City Transportation Officials (NACTO), 2019
[7] Metro Vancouver Mobility Pricing Study. Source: https://www.translink.ca/-/media/translink/documents/plans-and-projects/managing-the-transit-network/mobility-pricing/mpic_full_report_-_final.pdf

Examples of congestion pricing can be found in Stockholm, Sweden, and London, United Kingdom. New York City is in the process of adding congestion pricing for vehicles traveling into or within the central business district of Manhattan. The City of Vancouver in British Columbia is currently in the first phase of its congestion pricing study. By 2026, the City of Vancouver aims to have a fully operational congestion pricing system, if approved by their city council. The City of Toronto explored tolling the Gardiner Expressway-Don Valley Parkway (DVP) but decided not to proceed with it back in 2017. The reasoning for not tolling the Gardiner-DVP was due to a lack of better transit alternatives and lack of Provincial approval. Although congestion pricing is a great source of revenue, like other transportation taxes, it is a potentially regressive financing method that may elicit equity concerns for low-income motorists as well as residents of the areas where charges apply[8].

3.3 Gondolas

Gondolas are cable-propelled transit (CPT) systems utilizing motor and engine-less technology to transport people using steel cables. CPT systems offer travel time benefits by operating entirely out of vehicular traffic flow. An example of Gondola usage can be found in Portland, Oregon; Medellin, Columbia; La Paz, Bolivia; Venezuela; Hong Kong; Cali, Colombia; and Singapore. **Figure 4** illustrates Bolivia's Mi Teleferico ("My Cable Car") CPT system.

Figure 4: Cable Propelled Transit in La Paz Bolivia
Source: https://www.howlanders.com/blog/en/bolivia/la-paz-cable-car-information

The City of Edmonton examined the feasibility of CPT for public transit in 2018. In their study, they reviewed capital costs, revenues, and maintenance and operation costs of CPT systems

[8] National Association of City Transportation Officials (NACTO), 2019

around the world. A review of capital costs from the City of Edmonton's study is shown in **Table 2**.

Table 2: Capital Costs of CPTs (Cable Propelled Transit) around the world

Location	Daily Ridership	Annual Ridership (Million)	Implementation Cost in $ Million USD (year)	Cost per kilometre in USD	Fare Cost (USD, 2011)	Daily Op. Hours
Medellin Line K	~35,000	12 M	$26 M (2004)	$14 M	~$1.00	19
Medellin Line J	~15,000	5 M	$50 M (2008)	$19.2 M	~$1.00	19
Caracas Metrocable	~5,000	~2.8 M	>$21 M	>$9 M	~$0.25	15
Teleferico do Alemao	~13,000	~4 M	$144 M (2011)	$38 M	~$1.00	17
Constatine Telecabine	7,000	2.5 M	$14 M (2008)	$9.3 M	~$0.25	12
Tlemcen Telecabine	1,000-6,000	N/A	$14.7 M (2009)	$9.2M	~$0.25	17
Skikda Telecabine	N/A	N/A	$16.2 M (2009)	$8.5 M	~$0.25	17
Roosevelt Island Tram	6,400	2.4 M	$25 M (2009)	$25 M	~$2.25	22

Source: https://www.edmonton.ca/sites/default/files/public-files/assets/transit/ETSAB_Urban_Gondolas_in_Public_Transit.pdf

At a high level, cost per kilometer ranges from $10 M to $150 M. Factors impacting costs of CPTs include topography (including elevation, contours, vegetation, hydrography, transportation, and existing built form), level of customization, design of the system, technology utilized, number of cabins as well as engineering service/consultant fees. The City of Edmonton found that numerous CPT systems are revenue positive and generate enough revenue to offset operation and maintenance costs. Another benefit that CPT systems provide is the additional tax revenues generated due to higher land and property values in the vicinity. Other sources of revenue for CPT include sponsorships/marketing. For example, the Emirates Air Line in London benefited from a sponsorship deal with Emirates valued at $65 million (CAD) [9].

From an operating and maintenance perspective, costs associated with CPTs are relatively flat as capacity is increased. This is due to several reasons. Firstly, costs for personnel overseeing the operation and maintenance are fixed since additional staff is typically not required onboard cabins. Secondly, CPT systems do not incur costs from deadhead time, unlike buses which must incur costs as they travel empty between routes and operating and maintenance facilities, while CPT systems are maintained on-site[9]. However, it should be noted that property would be required to build an on-site storage facility (connected to a station) for maintenance requirements.

A conceptual alignment was studied in the "Vaughan Aerial Mobility" Report as part of the VTP. It recommended a 3S / tri-cable detachable CPT system utilizing the public right-of-way on Jane Street, connecting major destinations in Vaughan including VMC, Vaughan Mills, Canada's Wonderland, and the Cortellucci Vaughan Hospital. A CPT system could offer Vaughan an

[9] https://www.edmonton.ca/sites/default/files/public-files/assets/transit/ETSAB_Urban_Gondolas_in_Public_Transit.pdf

accessible and reliable transit service that is easy to expand with marginal cost. For this 6.2 km line, the conceptual capital cost was estimated between $174 and 193 million, which is lower than other forms of higher-order transit.

CPT systems may be politically challenging due to a lack of knowledge of technology and minimal case studies of application in metropolitan areas. Furthermore, there may be additional challenges from stakeholders and owners of air space.

Additional information on CPT systems and their applicability to Vaughan can be found in the Aerial Mobility whitepaper of the VTP.

3.4 Low and Zero Emission Zones

Low and Zero Emission zones restrict free access by vehicles based on their emissions. Vehicles that do not meet an emissions threshold are restricted access or charged a fee for using the road network in specific areas[10]. Examples of low and zero-emission zones can be found in London, United Kingdom, which has implemented Low Emission Zones based on time of day and geography.

The City of Vaughan can implement low or zero-emission zones in locations based on factors including air quality, congestion, or active transportation/pedestrianized areas. The emissions threshold could incrementally increase to encourage a modal shift from internal combustion engine vehicles towards electric vehicles and/or active transportation and transit.

Low and Zero Emission Zones may result in equity complications. Stakeholder consultation and equity implementation plans should be considered during the design phase of the program. Exceptions could be made for low-income residents or residents who live within the zone. Long-term targets should be made public to encourage uptake in electric vehicles over other emitting vehicle classes.

3.5 EV Charging Streetlights

Introducing public EV charging streetlights can reduce range anxiety associated with hesitation to purchase electric vehicles, encourage higher uptake in EVs, and thus help cities reduce emissions. Streetlights/light poles can be retrofitted with energy-efficient LEDs to save energy over conventional high-pressure sodium lightbulbs. The excess power can be transferred to electric vehicle (EV) charging infrastructures, and customers pay through meters or smartphone applications. Other benefits of EV charging streetlights from cities' perspective include space efficiency (no extra street furniture), high scalability, relatively low investment and operation costs, and ease of relocation if necessary[11].

Examples of EV charging streetlights can be found in London, Essen, Germany; Melrose, Massachusetts; Los Angeles, Kansas City, Missouri; and Portland, Oregon. An example of an EV charging streetlight is shown in **Figure 5**.

[10] Low emission zones: Effects on alternative-fuel vehicle uptake and fleet CO_2 emissions. Source: https://doi.org/10.1016/j.trd.2021.102882

[11] https://www.ubitricity.com/charge-points/#potentials

Figure 5: City of Toronto's On-street Charging Station Pilot
Source: https://www.cbc.ca/news/canada/toronto/electric-vehicle-toronto-1.6147646

Hardware costs for EV charging streetlights and ground-mounted units are comparable at roughly between $1,500 and $6,000 (USD)[12]. However, compared to in-ground charging stations, EV charging streetlights saves 55% on installation costs and a 30% reduction in overall costs due to quicker installation times and avoided construction. A feasibility study on EV charging streetlights was conducted by the City of Vancouver, with the University of British Columbia in 2019.[13] This study concludes that pilot projects of EV charging streetlights should be implemented in parallel with lighting fixture upgrading programs (LED conversions) to significantly reduce installation costs.

In October 2020, the City of Toronto initiated an on-street EV charging pilot project over a 12-month trial period. The pilot installed 17 EV charging devices on nine select streets, including two downtown on-street locations and seven residential on-street locations[14]. The downtown on-street locations installed in-ground charging stations, while the residential on-street locations installed chargers on existing utility poles to save costs and to minimize disruption to pedestrians and the community. The following is a high-level summary of the City of Toronto's EV charging pilot project:

- Toronto City Council approved the installation of EV charging stations in the downtown core in 2012. However, certain provisions in the Ontario Energy Board (OEB) Act prevented Toronto Hydro from owning and operating EV charging stations because the charges could not be used for the sole purpose of distributing electricity.
- The OEB rules forced the pilot to be delayed until they were amended in 2016.

[12] https://www.wri.org/research/pole-mounted-electric-vehicle-charging-preliminary-guidance

[13] On-street EV Charging from Light poles – feasibility study identifying possibilities for light-pole charging in Vancouver, source: https://sustain.ubc.ca/sites/default/files/2019-60_On-Street%20Electric%20Vehicle%20Charging_Puentes.pdf

[14] On-Street EV Charging Stations – Pilot Updatehttps://www.toronto.ca/legdocs/mmis/2022/ie/bgrd/backgroundfile-174598.pdf

- EV charging rates for the Downtown On-Street pilot were $2 per hour. For the Residential On-Street pilot, EV charging rates were $3 per hour between 8:00 am and 7:59 pm, and a $3 flat rate between 8:00 pm and 7:59 am
- An equivalent of 55 metric tonnes of CO2 of emissions was reduced from EV usage.
- The Downtown On-Street pilot generated $3,521 (exclusive of taxes in revenue for an average of $5.34 per charging session). The Residential On-Street pilot (EV charging streetlights) collected $9,589 (exclusive of taxes in revenue for an average of $4.78 per charging session.
- Installation of pole-mounted devices were $15,000 each, while pedestal (in-ground) mounted stations were $50,000 each.
- Costs for electricity and transaction fees amounted to $2,470 for the Downtown On-Street pilot and $8,307 for the Residential On-Street pilot. This averages to $6.61 and $4.89 per session, respectively. This does not reflect the full cost of operating on-street charging stations, which would include additional costs for monitoring, data analysis, management, maintenance, capitalization expenses, and depreciation.

The City of Toronto EV charging station pilot project has shown that there may be policy barriers affecting the implementation of EV charging stations. In addition, this pilot project has shown that cities, utility companies, and other governing agencies need to coordinate/collaborate to successfully implement EV charging stations. In terms of EV charging rates, Toronto's pilot project has shown that other cities will need to determine their charging rates to cover the full cost of implementing EV charging stations. This is because every city has unique policies, structures, and processes, which results in varying indirect costs. EV charging rates will need to be determined through a similar pilot project.

Coordinated with Vaughan's streetlight upgrade program, streetlights with EV charging can be installed in residential areas where residences do not have access to off-street home charging. The VMC and other Secondary Plan areas in the City may be potential candidates with anticipated increases in population density. EV charging streetlights can also be installed along streets with on-street parking. Consequently, dedicated on-street parking spaces will be required for spots that offer EV charging. Other considerations in implementing EV charging streetlights are the compatibility of charging ports with various EV manufacturers, public education, integration of parking laws with EV charging spots, payment methods, and wayfinding for EV charging locations.

3.6 Shared and Micro-Mobility and Mobility-as-a-Service

Mobility-as-a-Service (MaaS) is the integration of various forms of transportation services into a single mobility service that is accessible on demand[15]. MaaS offers commuters value with a central application to provide access to mobility, with a single payment channel instead of multiple ticketing and payment operations[16]. Shared mobility refers to the shared use of a vehicle, motorcycle, scooter, bicycle, or other travel modes that provide the user with short-term

[15] What is MaaS? (A brief introduction into Mobility-as-a-Service) - evozon - Custom software development, customized IT solutions. Cluj Napoca, Romania
[16] What is Mobility as a Service?. The transport sector is at the… | by Transit Protocol | Medium

access to one of these modes of travel as they are needed. Micro-mobility refers to a vehicle that is low speed (under 50 km/h), lightweight (less than 45 kilograms), and can be personally owned or part of a shared fleet. Shared and micro-mobility offer multi-modal solutions for users and form part of a larger integrated transportation network, particularly as first and last-mile solutions for public transit. These emerging technologies are being reviewed as part of the VTP in the Future Mobility White Paper.

Emerging forms of shared and micro-mobility increasingly require additional space within the right-of-way for use and storage. Municipalities could offer permits, either by spatial requirements (e.g., square footage of the bike share station) or by a device (e.g., the number of vehicles in the car-share system), to shared, micro-mobility, and MaaS operators to utilize certain parts of the right-of-way (boulevard space, parking spaces) for storage of devices like bikes and scooters. Permits sometimes are priced at a premium due to their impact on the right-of-way. For example, in 2022, the City of Toronto charges $1602.39 per free-floating car-share vehicle per year [17], compared to $206.52 per vehicle for residential on-street parking.

In terms of implementation, it is important to ensure a free and clear pedestrian path and proper storage of devices. Permits to use the right-of-way for storage could cause competition with traditional modes (such as auto/transit/cycle). These challenges could be addressed through a comprehensive complete street design and zoning process with consideration of shared and micro-mobility. Residents, businesses, and BIAs should be consulted during the implementation.

3.7 Flex Streets and Temporary Street Closures

Flexible (“Flex”) streets are streets designed to easily transform from primarily travel/transport uses to economic and community uses. Flex streets can be designed with no curb or grade separation or quickly redesigned through signage, paint, flexible or movable bollards, and temporary closures. Seasonal, time-of-day, and day of the week closures or flexible uses can be determined by the municipality or in partnership with BIAs, neighbourhood groups, and local businesses. Typical flexible uses include play streets, pedestrian and cycling streets, markets, and open streets.

An example of temporary street closures on a large scale is the Ciclovia (Cycleway) Bogota, in Bogota, Columbia. Ciclovia Bogota is a mega cycling network that temporarily opens on the streets of Bogota from 7:00 am to 2:00 pm (local time) every Sunday and on holidays throughout the year. During this time period, vehicular uses are restricted (partially or fully) on a 128-kilometre network of roads (shown in **Figure 6)** in Bogota, Columbia[18]. Although Ciclovia Bogota is targeted toward cyclists, other forms of active transportation (walking, running, rollerblades, skateboards, etc.) are also allowed to use the network.

[17] https://www.toronto.ca/services-payments/streets-parking-transportation/applying-for-a-parking-permit/car-share-vehicle-parking/free-floating-car-share-pilot/
[18] https://www.idrd.gov.co/en/ciclovia-bogotana

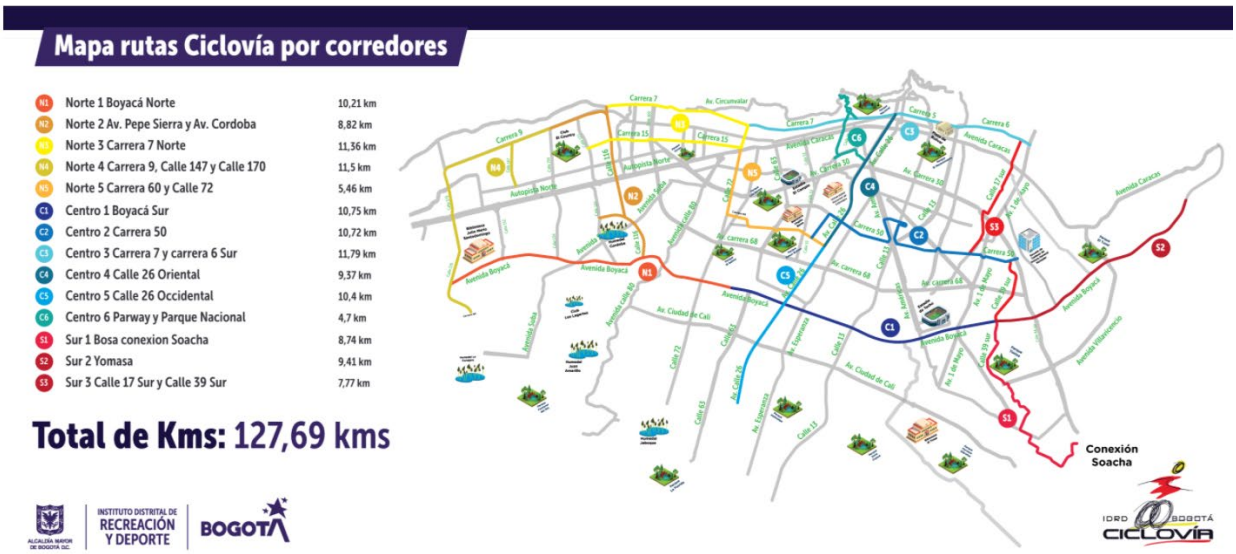

Figure 6: Network Map of Ciclovia Bogota ("Bogota Cycleway")
Source: https://www.idrd.gov.co/en/ciclovia-bogotana

The Ciclovia Bogota program began in 1974 and has inspired cities around the world to implement their version of it. Some of these cities include Philadelphia; San Antonia, Texas; and Ottawa, Ontario to name a few. The City of Toronto has implemented its version (ActiveTO) during the COVID-19 pandemic. The ActiveTO program closes major streets adjacent to highly utilized trails to provide more space for walking and cycling[19]. These closures reoccur short-term over the weekends and holidays. These programs will likely generate limited direct revenues for the City but may increase local economic activity through increased tourists or recreational visits to the area. Cycling tours are often offered on the cycling network and include stops for sightseeing, food and shopping. These stops present opportunities for tourists and locals to take a break and refuel throughout their journey on the cycling network[20]. A study conducted in 2004 found that the number of staff involved in the program was approximately 2,500 employees[21]. In addition, 1,517 kiosks with approximately 2,000 employees were surveyed along the cycling network. About 75% of these kiosks are related to food and beverage, while the remaining were related to bicycle repair, bicycle accessory, consumer goods, antiques, and others[21]. The Ciclovia Bogota program also offers social and environmental benefits such as an increase in public physical activity, and a reduction in greenhouse gas emissions from vehicles.

Examples of a Flex Street can be found at Dundas Place in London, Ontario (shown in **Figure 7**) and Argyle Street in Halifax, Nova Scotia (shown in **Figure 8**).

[19] https://www.toronto.ca/explore-enjoy/recreation/covid-19-activeto/covid-19-activeto-closing-major-roads/

[20] https://www.velonews.com/culture/when-bogota-belongs-to-the-bicycles-how-ciclovia-has-shaped-colombias-capital-city/, and https://torontosun.com/life/homes/streets-for-people-and-not-just-cars

[21] https://discovery.ucl.ac.uk/id/eprint/110

Figure 7: Dundas Place in London, Ontario
Source: **https://london.ca/dundasplace**

Figure 8: Argyle Street in Halifax, Nova Scotia
Source: https://www.halifax.ca/about-halifax/regional-community-planning/construction-projects/argyle-grafton-shared-streetscape

Another example of a Flex Street design is the City of Toronto's CurbTO program implemented during the COVID-19 pandemic. The CurbTO program aims to provide additional space for customer lineups/queues to promote physical distancing. Extra spaces were provided by using private property (i.e., parking lots) and sidewalk furnishing zones (between trees, bike rings, benches). The use of private property and furnishing zones for CurbTO are shown in **Figure 9**. In addition, Temporary Parking Pick-up Zones were set up near businesses that offer curbside

pick-up services. Any motorists are permitted to park in these zones for 10 minutes or less for a quick curbside pick-up or delivery.

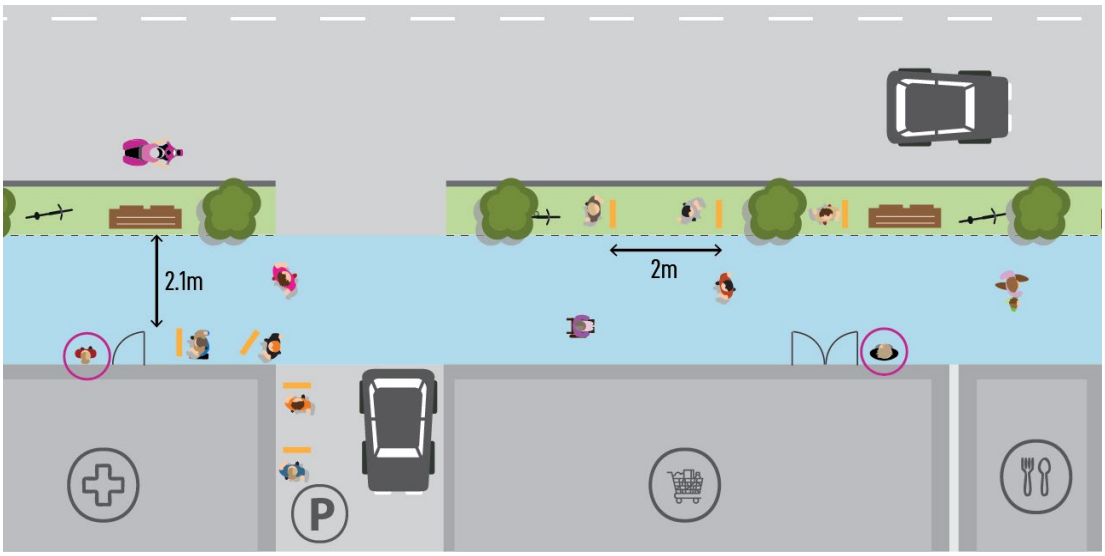

Figure 9: Sample Use of Private Property and Furnishing Zone for CurbTO
Source: https://www.toronto.ca/business-economy/business-operation-growth/covid-19-economic-support-recovery-for-businesses/covid-19-curbto/

The City of Vaughan can use Flex Streets or temporary closures to activate streets, encourage active transportation, and spur economic activities. Examples of road closures to spur economic activities include Taste of Asia in Markham (closure of Kennedy Road north of Steeles), and Taste of the Danforth in Toronto (closure of Danforth Avenue in the Danforth BIA). Permits can be applied to temporary closures proposed by community groups like BIAs, neighbourhood groups, and local businesses to recover costs such as administrative and law enforcement fees.

For example, in the City of Toronto, Street Event Permits ranges from approximately $100 to $500 for application fees and $100 to $11,000 permit fees per event. Furthermore, the design and implementation of street furniture and appropriate lighting assist in the success of temporary uses like fairs, markets, and other programming. Implementation of street closures requires traffic rerouting, street cleaning, and traffic barrier controls. In addition, accessibility for the needs of all users should be considered.

3.8 Speed Enforcement Cameras

Automated traffic enforcement captures the speed of vehicles and assigns fines or fees to vehicles surpassing defined speed thresholds. Speed cameras enable automated traffic enforcement and generally require speed measurement, data processing/storage, and image capturing technology. Fines or fees are assigned to motorists by cross-referencing license plates to households. Based on a study completed by the Police Research Group in the UK, Automated Speed Enforcement (ASE) units cost approximately $21,000 (CAD) for installation

(including planning and procurement) and about $15,000 (CAD) in annual operation and maintenance fees[22].

Examples of the use of ASE cameras can be found in the City of Toronto. The City of Toronto implemented the ASE program on July 6, 2020, with 50 locations. An individual caught speeding could receive a set fine between $5 and 12 per km/h [23], with an additional victim surcharge ranging from $10 - $125[24]. In the first year of enforcement, the City of Toronto issued 227,322 speeding tickets[25] which resulted in a minimum of $4.5 million in fines. More importantly, the City of Toronto has seen lower speeds on streets with ASE implemented. The number of speeding tickets issued to vehicles speeding on streets with a 40 km/h limit dropped to 28 percent in 2020 from 49 percent in 2019.

York Region has implemented a two-year automated speed enforcement pilot program throughout the region. In addition to automated speed enforcement employed by York Region, the City of Vaughan could identify candidate roads for speed cameras and apply fees using a similar structure to York Region. The City of Vaughan should review the results of York Region's pilot program upon completion in 2022 and identify candidate zones for applicability.

4 Opportunities

Based on the review in **Section 3**, the most implementable opportunities to maximize transportation infrastructure value include curbside management options such as time-of-day restrictions and parklets, automated speed enforcement cameras, EV charging streetlights, and shared and micro-mobility permits, and Flex Streets and Temporary road closures. These opportunities are relatively easy to implement due to minimal capital investments, minimally invasive policies, and intensive analyses that are typically not required. Furthermore, these opportunities can be implemented within local jurisdiction and may not require approval from a higher-tier municipality.

The locations to implement these opportunities will need to be examined in more detail. The local and surrounding context must be taken into consideration, such as existing/future traffic demands, pedestrian and cyclist activities, parking supply/demand, synergies between land-use types, and public and stakeholder inputs. Furthermore, opportunities can be implemented individually or through combinations depending on the location. For example, the curbside management options can be implemented with EV charging streetlights in high-demand areas like major intensification areas, trip-generating areas such as the VMC, or popular retail destinations. These measures can also be implemented alongside Flex Streets due to heavy pedestrian activities. A few specific examples of where opportunities can be implemented are listed in **Table 3**. Detail analyses should be conducted to identify the impact and other locations for opportunities.

[22] Cost benefit analysis of traffic light and speed cameras, Police Research Group, UK

[23] https://www.toronto.ca/news/automated-speed-enforcement-program-to-begin-issuing-speeding-tickets-on-july-6/

[24] https://www.ontario.ca/laws/regulation/000161

[25] https://globalnews.ca/news/8137352/traffic-toronto-speed-cameras-tickets/

Table 3: Examples of Opportunities in the City of Vaughan

Opportunity	Potential Areas for Consideration	Justification
Curbside Management – dynamic parking pricing	• VMC and other intensification areas • Islington Avenue within Kleinburg Village • Thornhill Village • Woodbridge Avenue • Cortellucci Vaughan Hospital	Popular areas with high curbside activities
Curbside Management – parklets	• Islington Avenue within Kleinburg Village • Thornhill Village • Woodbridge Avenue	Areas with front-facing retail/commercial stores
Curbside Management – time-of-day restrictions	• VMC and other intensification areas • Cortellucci Vaughan Hospital	Areas with high traffic demand and on-street parking
Curbside Management – freight-zone pricing	• VMC and other intensification areas • Islington Avenue within Kleinburg Village • Woodbridge Avenue • Thornhill Village	Popular areas with high curbside activities
EV Charging Streetlights	• VMC and other intensification areas • Residential areas such as Kleinburg Village, Thornhill neighbourhood • Local streets near City parks	Presence of existing on-street parking and streetlights, popular destinations (e.g., major centres, recreational activities)
Shared and Micro-mobility	• Streets near VMC subway, GO Rail stops, and other transit hubs • Kleinburg Village • Retail destinations such as Promenade Centre and Vaughan Mills Mall • Community areas with developed separated cycling networks	Popular destinations where people may seek alternative modes to access
Flex Streets and Temporary Road Closures	• VMC and other intensification areas	Locations with existing social activities. Existing transit hubs can provide greater convenience for public events
Automated Speed Enforcement	• School zones, senior zones, and community centres with a high proportion of vehicles exceeding the speed limit	Locations with high active transportation activities. Enforcing speed can greatly benefit the safety of vulnerable users.

Another opportunity for the City is to integrate curbside management practices as supporting background information for the City's RFP in establishing a Parking Authority.

5 Business Case Overview

To support the City of Vaughan's direction to maximize value of transportation infrastructure assets, this section of the whitepaper provides additional details on how other jurisdictions have optimized existing transportation asset infrastructure through pilot projects, initiatives, and programing. Using a business case approach, the purpose of this section is to present a collection of case studies that demonstrate how an investment in optimizing existing infrastructure can realize strategic and economic benefits for a municipality.

The case studies will focus on projects that fall under these categories:

- Curbside Management – Time of Day / Specific Use, Dynamic Parking Prices, Parklets
- EV Charging Streetlights
- Shared/Micromobility & Mobility as a Service (MaaS)
- Flex Streets / Temporary Street Closures

5.1 Approach

Using the *Metrolinx Business Case Manual Volume 2: Guidance* document as a framework, a high-level overview of how each project performed under the four cases, and how it may align with the VTP. The following considerations should be noted:

- Within a Business Case context, any project, initiative, or program is broadly referred to as an 'investment'.
- The level of detail provided for each case is dependent on publicly available reports or post-in-service business cases. Where no information is available, lessons learned from the case study will be inferred.

See Table 4 below for a summary of the Metrolinx Business Case Benefits Framework.

- **Strategic Case** – a detailed review of how the investment achieved strategic goals and objectives. The Strategic Case typically aims to articulate the value of a proposed investment based on city goals, plans, and policies in a traceable and logical manner. The investment is typically evaluated based on measurable outputs that are linked to desired outcomes (see Table 4 for examples).

- **Economic Case** – an appraisal of the economic value of the investment to society. Generally, this refers to the monetization of societal benefits and spans the entire investment's lifecycle (i.e., carbon emission savings, travel time savings). This case requires economic analysis resources, tools, and techniques to be applied and may be subject to significant scrutiny. See Key Considerations at the end of the chapter.

- **Financial Case** – appraisal of the investment's costs, and direct financial impacts. Generally, refers to the hard costs attributed to the project and reflected in the final budget (i.e., construction, operations and maintenance, property costs, etc.).

- **Deliverability and Operations Case** – appraisal of high-level risks and implementation requirements, and typically refers to risks related to construction and implementation, budget, and schedule.

Table 4 Metrolinx Business Case Benefits Framework

	Outcomes	Outputs	Actions	Inputs
Description	• Outcomes represent the value that an investment can realize for the City	• The direct measurable results from delivering the investment	• The core changes to the transportation network	• Resources required to deliver the investment
Role in Business Case	• Used to communicate the high-level positive changes the investment can realize • To quantify and qualify the benefits of an investment in the Strategic Case and the Economic Case	• Outputs are used to estimate benefits throughout the business case	• Actions are defined as a set of investments and how they change the transport network	• Used in the Economic Case to determine the benefit-cost ratio • Used in the Financial Case, and Deliverability and Operations Case to determine the costs and requirements to deliver an investment
Example	• Improve Public Transit	• Change in automobile vehicle kilometres travelled (VKT) • Ridership change • Average wait times • Positive customer satisfaction survey results	• Add new service • Make services faster • Provide new stations • Provide more capacity • Changes to customer experience	• Capital Costs • Operating Costs • Full-time equivalents are required over the course of the project

5.2 Curbside Management

5.2.1 Time of Day and Specific Use Restrictions

As demand for curbside space increases, a few Canadian cities (specifically Toronto and Vancouver), have developed strategies to manage and permit these spaces on a time-of-day and specific use basis. Notably, Vancouver's policy is generally focused on ride-hailing drop-offs and pick-ups, whereas Toronto approved several tactics for different uses, including ride-hailing, but also delivery vehicles, motorcycles, and accessible loading designations. The following is additional detail on these strategies for time-of-day and specific use restrictions of curbside space:

- **Congestion and Curbside Management Permit (CCMP), City of Vancouver (2018 – On-going):** intended to manage streets and congestion resulting from ride-hailing services. Ride-hailing vehicles are required to have a CCMP to access any curbside within the Metro Core of Vancouver for passenger pick-up and drop-offs between 7 AM and 7 PM.
- **Curbside Management Strategy, City of Toronto (2018 – On-going):** Toronto City Council approved several 'Quick Win' tactics to improve curbside usage. These tactics were briefly discussed in **Section 3.1.1**. Non-delegated traffic and parking by-law amendments were made to:
    - Allow taxicab operators to park or stand at specifically designated hydrant locations,
    - Convert existing 'advisory' courier loading zones to designated delivery vehicle parking zones,
    - Install on-street designated motorcycle parking zones in specific designated pay-and-display areas, and
    - Allow designation of accessible loading zones.

The financial impacts observed in these case studies are relatively low and were able to be accommodated in the cities' budgets according to the reports addressed to their respective councils/committees.

Table 5 summarizes the business case for Time of Day and Specific Use Restrictions.

Table 5: Business Case Summary for Time of Day and Specific Use Restrictions

Case	Summary

Strategic Case	**Strategic Benefits**
	• City of Toronto Case:
	  ○ Permits for ride-hailing and courier/delivery companies reduced vehicle demands in the city core
	  ○ Improved curbside management for local businesses (i.e., curbside loading activities
	  ○ Increased capacity for accessible vehicles
	• City of Vancouver
	  ○ Decreasing GHG emissions by incentivizing EV/accessible vehicles through discounted permit fees for ride-hailing vehicles
	
	Strategic Alignment with VTP
	• Supports the objectives of providing safe and equitable modes of transportation by incentivizing accessible ride-hailing vehicles, supporting road safety with greater street use coordination
	• Supports goals of reducing traffic congestion and improving sustainable goods movement

Economic Case	• No formal economic analyses were found. • Potential economic benefits that can be measured include travel time savings for passenger and delivery vehicles and a reduction in GHG emissions.
Financial Case	**Capital Costs** • Typically included start-up costs such as policy adjustments, stakeholder meetings, signage adjustments, traffic planning studies, and consultant services; a specific amount is not available.

Case	Summary
	• Cost of regulatory parking signs for designation of delivery vehicle parking zones, taxi stands at fire hydrants, and motorcycling parking zones were accommodated within Toronto's Transportation Services 2018 Operating Budget. Cost estimates of required parking signs were not provided. **Revenue** • Collected solely from license/permit fees • City of Vancouver's Engineering Services estimates the CCMP will generate $500,000 in revenue for the city[26] • The City of Toronto estimates a revenue loss approximating $400,000 from a decrease in parking violation tickets from previously illegally stopped/parked delivery/courier vehicles[27]. • City of Toronto's Transportation Infrastructure Management estimates the Courier/Delivery permits will generate approximately $500,000 in revenue for the city[27] **Operating Costs** • Operating costs include salaries from hiring additional staff (administrative, analysts, enforcement) • In the case of Vancouver's CCMP, their operating budget included $100,000 for a Data Analyst Specialist to analyze data collected from ride-hailing companies participating in the program[26]
Deliverability & Operations Case	**Implementation Requirements:** • Consultation with stakeholders (businesses, ride-hailing companies, courier/delivery companies) to discuss changes and establish fair permit fees. • Coordination with other municipalities to establish inter-municipal permits. • Creation of additional parking zones for passenger pick-up and drop-offs, and delivery. • Geofencing to establish boundaries where permits are applicable. • Additional enforcement is required in the early implementation stages for changes to curbside operations. • Data collection and monitoring requirements were established through consultation with ride-hailing companies. **High-Level Risks** • Non-courier and non-delivery vehicles stopping/parking in designated loading zones. • Parking and stopping violations may still occur. • Parking enforcement may not catch all parking violators.

5.2.2 Dynamic Parking Prices

There is limited information on dynamic parking price projects in Canada due to a lack of precedent pilot projects. However, the City of Mississauga's and the City of Hamilton's parking master plans, as well as the City of Ottawa's 2019 Municipal Parking Management Strategy have indicated the need for detailed analyses/studies on dynamic parking pricing. The Sustainable Mobility Agency (SMA) in the City of Montreal implemented dynamic parking pricing in 2018 but has published limited data online. **Table 6** summarizes the business case for dynamic parking prices.

[26] https://council.vancouver.ca/20191002/documents/cfsc1.pdf
[27] https://www.toronto.ca/legdocs/mmis/2018/te/bgrd/backgroundfile-110832.pdf

Table 6: Business Case Summary for Dynamic Parking Prices

Case	Summary
Strategic Case	**Strategic Benefits** • Improving parking utilization of off-street and on-street facilities. • Distributing parking demand throughout the day to reduce congestion during peak hours. • Improving urban mobility and improving customer experience. **Strategic Alignment with VTP** • Supports the objective of reducing traffic congestion in urban areas.
Economic Case	• No formal economic analyses were found. • Potential economic benefits to measure include travel time savings through reduction in vehicle congestion, reduction in "cruising" time to find parking and more efficient parking utilization, and reduction of noise.
Financial Case	**Capital Costs** • Development of mobile application (no data available). • Installation of new smart parking meters (no data available. **Revenue** • Approximately net zero change in revenues since the goal of dynamic parking pricing is to distribute parking rather than to generate profit. In Montreal, dynamic parking prices were established such that parking revenue remained about the same as pre-dynamic pricing ($70 million, from SMA annual report)[28]. **Operating Costs** • Mobile application maintenance (no data available). • Other operating costs such managing, coordination, marketing, and administrative staff (no data available).
Deliverability & Operations Case	**Implementation Requirements:** • Consultation and coordination with publicly and privately owned parking garages to establish information sharing. • Introduce new payment plans such as a pay-by-license system. • Improve parking enforcement across the city. • Marketing and educating drivers. In Montreal, in the first year (2012) of launching P$ Service Mobile, 10% of revenue was collected through the app. This number increased to 66% within 5 years through marketing efforts. **High-Level Risks** • Easy to underestimate the scope, magnitude, and technological sophistications necessary to offer real-time parking data and provide dynamic parking pricing • Incomplete data sharing between on-street and off-street facilities and parking information systems may result in inaccurate/inappropriate parking rates • Lack of staff, consultants, and contractor expertise to operate and maintain new parking technologies and parking information systems. • Due to dynamic pricing being a relatively new practice, technologies and processes are constantly evolving and adapting. For example, parking technology and data management systems are typically custom made, and parking sensor accuracy and reliability are variable.

[28] https://www.agencemobilitedurable.ca/en/annual-reports-scsm.html

5.2.3 Parklets

In response to COVID-19 pandemic restrictions imposed in 2020, many cities across Canada proposed, accelerated, and/or extended their parklet programs to support businesses facing challenges. Parklet programs were observed in cities or towns such as Lethbridge, Alberta; Saskatoon, Saskatchewan; Barrie, Sudbury, Windsor, Ottawa, and Toronto, Ontario; and Vancouver, British Columbia. Parklets allowed restaurants and bars to stay open for businesses while providing physical distancing of patrons by expanding their dining spaces into sidewalk cafes, curb lane cafes or patios on private properties. The parklet programs received positive feedback from both business owners and the public. The success of parklets encouraged cities such as Lethbridge, Saskatoon, Windsor, Ottawa, Toronto, and Vancouver to extend the program or make them permanent. **Table 7** summarizes the business case for parklets.

Table 7: Business Case Summary for Parklets

Case	Summary
Strategic Case	**Strategic Benefits Observed** • Increased in the vibrancy of streets and social activity. • Support for the local economy. • Created a safe space for people to gather and socialize. • Increased of pedestrian and cyclist traffic in parklet areas. **Strategic Alignment with VTP** • Aligns with goals in the Pedestrian and Bicycle Master Plan in providing safe and accessible walking and cycling facilities. • Supports goals of reducing car dependency and reducing traffic congestion. • Supports the goal to move people safely, efficiently, and sustainably.
Economic Benefits	• Generally, local businesses with or near parklets reported an increase in the number of customers (no detailed data available). • Intended to improve land values and support economic development. • Revenue of participating businesses could be recorded before and after parklet installation to determine localized economic impacts in terms of increased business revenues or additional jobs.
Financial Case	**Capital Costs** • City of Toronto's Transportation Services estimates spending $712,000 on Consultants and Contractors and $840,000 on equipment (planter boxes, barriers, accessible picnic tables, traffic control materials) for their parklet program in 2022 and beyond[29]. • Public communication costs are estimated to be $10,000 in Toronto's 2022 parklet program[29]. • Supporting businesses in creating patios ($270,000 grant in Toronto[30], 50% match up to $5,000 for design and construction of major patio or parklets and/or a variety of street furniture infrastructure in Lethbridge[31]). • Replacing and maintaining plants ($16,500 grant in Toronto, 50% match up to $1,000 for costs including plants, planters, furnishings, barriers, and other needs for any patio or parklet in Lethbridge). **Revenue** • Administrative fee: about $400 in Barrie and Sudbury[32]

[29] https://www.toronto.ca/legdocs/mmis/2021/ex/bgrd/backgroundfile-171963.pdf
[30] https://www.toronto.ca/legdocs/mmis/2021/ex/bgrd/backgroundfile-159875.pdf
[31] https://calgary.ctvnews.ca/lethbridge-patio-and-parklet-program-back-for-another-summer-season-1.5871088
[32] https://pub-saskatoon.escribemeetings.com/filestream.ashx?DocumentId=53318

Case	Summary

	• Permit fee: $165 (Ottawa), $210 (Windsor), $500 (Vancouver)[32].
	• Application fee: $325 (Ottawa)[32].
	• One-time program cost recovery: $1000 (Vancouver)[32].
	• Inspection fee: $200 (Vancouver)[32].
	• Parklet fee: $596 per month or $935 per month in Toronto based on geography[32].
	• Parking meter removal charged to businesses: $125 per meter (Vancouver)[32].
	• Size fee: $1.50 per m^2 sidewalk occupied (Sudbury), $6.50 per parking space per day (Sudbury), $0.40 per ft^2 per month (Barrie), $3.00 per ft^2 per parklet (Windsor)[32]
	• Revenue loss for waiving existing outdoor dining permits: estimated to be $775,000 in Toronto[30].
	• The City of Toronto's parking authority reported a $2,500,000 revenue loss from the reduction of on-street pay-and-display parking[30].
	
	Operating Costs
	• Full-time equivalents (FTEs) to manage, process, and coordinate permit applications.
	• The City of Toronto estimates a total of $2 million in salaries will be dedicated to their parklet program (CaféTO). The breakdown is as follows[29]:
	  ○ $895,000 for Transportation Services – Operations and Maintenance
	  ○ $330,000 for Transportation Services – CaféTO Program staff
	  ○ $398,000 for Transportation Services – Enforcement
	  ○ $412,000 for Municipal Licensing and Standards - Licensing

Deliverability & Operations Case	**Implementation Requirements:** • Consultation with internal stakeholders (transportation management, parking, etc.) and local businesses. • Setting requirements such as minimum widths on sidewalks, proper drainage, preventing parklets from blocking fire hydrants and driveways, and clearing outdoor patio spaces for winter maintenance. • Consider a fee structure that starts discounted and then gradually increases to incentivize businesses to participate in parklet programs. • Conduct transportation analyses to ensure adequate parking supply and/or access to parklets via transit, walking, or cycling. **High-Level Risks** • Since parklets are public spaces, the municipality is liable for health and safety incidents within parklets. • Due to limited city funding and staff capacity, the City of Vancouver was not able to keep up with growing demands from restaurants and cafes.

5.3 EV Charging Streetlights

The following pilot projects/feasibility studies were conducted and reviewed in detail: Toronto, Vancouver, and New Westminster, British Columbia. These projects were conducted to understand the impacts and challenges of implementing EV charging streetlights. Cities were interested in implementing EV charging streetlights because they could help increase the market share of EVs, increase adoption rates, and thereby reduce GHG emissions from automobiles. A summary of the abovementioned studies is presented in the following:

- **Residential and Downtown On-Street Electric Vehicle Charging Station Pilot, City of Toronto (2020-2021):** This 12-month pilot project was done in collaboration with Toronto

Hydro. It installed 17 on-street EV charging stations in various residential and high traffic areas. Locations of charging stations are shown in **Figure 10**. This pilot was conducted to obtain data on utilization, GHG impacts, costs, and revenues. A $2 per hour fee was charged to use EV charging streetlights. Users were still charged this rate when their vehicle batteries are full to encourage EV owners to move their cars and allow other EV vehicles to charge. A $3 flat fee was charged between 8:00 pm to 7:59 am in residential areas.

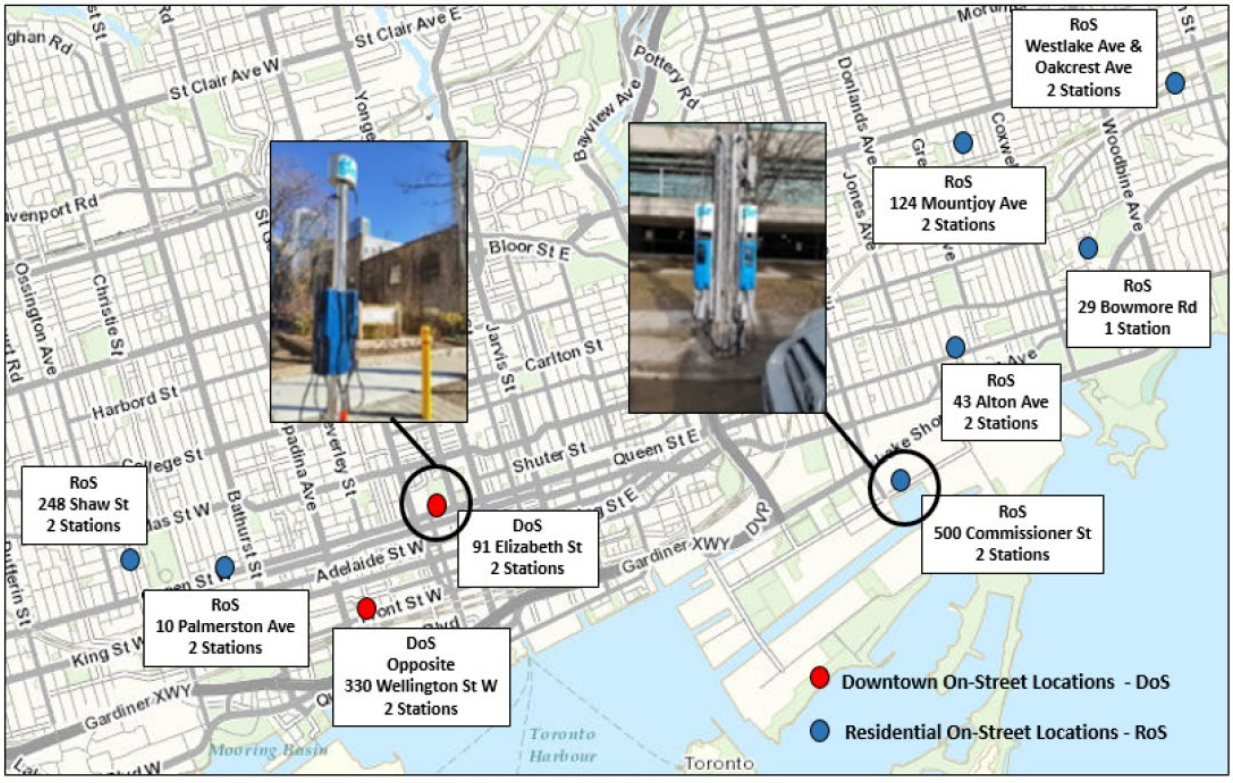

Figure 10: Locations of Charging Stations in the City of Toronto's EV Charging Pilot Project
Source: https://www.toronto.ca/legdocs/mmis/2022/ie/bgrd/backgroundfile-174598.pdf

- **On-Street Electric Vehicle Charging from Light Poles, Vancouver (2019):** This feasibility study was conducted to determine possible locations to install EV charging stations on municipal streetlight poles. The goal of the study was to review best practices in cities around the world, analyze the existing status of their electrical/streetlight infrastructure, and identify possible pilot project locations for installing EV streetlight charging stations.
- **New Westminster, British Columbia (2017):** This pilot project was done in collaboration with the City of New Westminster and the BC Institute of Technology (BCIT). The project installed 15 EV charging stations using streetlight infrastructure and was specifically catered to residents that do not have access to off-street EV charging. A $2 per hour parking fee was charged to use EV charging streetlights.

Table 8: High-Level Business Case Summary for EV Charging Streetlights

Case	Summary
Strategic Case	**Strategic Benefits Observed** • Increases accessibility to charging stations to consumers without access to off-street home charging. • Increases adoption rate of EVs and reduces dependence on fossil fuels. • Reduction in GHG emissions. Toronto's pilot project saw an energy consumption totalling 54,774 kWh, which equates to a reduction of approximately 55 metric tonnes of CO_2[33]. **Strategic Alignment with VTP** • Supports the goal of addressing climate change through reduction in GHG emissions and air pollutants.
Economic Case	• No formal economic appraisal was conducted as part of the pilot projects. • Reduction in GHG emissions can be estimated by monitoring the amount of electricity used for charging EVs, increased rate of EV adoption and reduction in fossil fuel use.
Financial Case	**Capital Costs** • Installation of each charging station ranged from $15,000 to $50,000 in Toronto's pilot project depending on above-ground versus in-ground installations[33]. • Toronto's pilot project had no impact on Transportation Services Division Capital Budget. The project was funded entirely by the Toronto Atmospheric Fund ($65,000), a city agency that finances and supports initiatives relating to energy efficiency, global climate stabilization, and air quality improvement. • In Vancouver's feasibility study, they estimate that investment costs of their ideal scenario (minimal adjustments to existing infrastructure) range from $21,000 to $32,000 in direct costs (lighting fixture replacement, service panels, labour, equipment, etc.), and $6,000 to $8,000 in indirect costs (city overhead charges, permit fees, contingency funds) per station[34]. **Revenue** • $13,110 total revenue collected from Toronto's pilot project[33]. • $20,760 in parking violation tickets were issued to vehicles parked and not using the charging stations in Toronto's pilot project[33]. **Operating Costs** • Revenues generated by charging stations in Toronto's pilot project were insufficient in recovering transaction fees and electricity costs. The remaining balance was covered by the Toronto Atmospheric Fund. • Parking enforcement to ensure proper use of charging stations. • Data on other operating costs such as management, coordination, administration, and maintenance are not available.
Deliverability & Operations Case	**Implementation Requirements:** • Location of EV charging streetlights should be installed in high-demand clusters (residents without access to chargers), and high-density areas such as community centres. Location typically should not have daytime parking restrictions or alternate side of street parking. • EV charging streetlights should be installed in parking areas with permit requirements and available parking (where parking utilization rates are lower than 90%).

[33] https://www.toronto.ca/legdocs/mmis/2022/ie/bgrd/backgroundfile-174598.pdf
[34] https://sustain.ubc.ca/sites/default/files/2019-60_On-Street%20Electric%20Vehicle%20Charging_Puentes.pdf

Case	Summary
	• EV charging streetlights should be installed on a street that allows for two parking spaces ideally end-to-end without encroaching on driveways, intersections, and fire hydrants. • Location/light poles should have sufficient power to support EV charging stations. • The light pole is required to be energized 24 hours a day 7 days a week to be effective. **High-Level Risks** • Most charging products in the market are not Measurement Canada and CSA certified. Products may need to be retrofitted/inspected to ensure accurate metering to satisfy Measurement Canada standards and will need to meet safety, performance, and compliance requirements of CSA[34, 35, 36]. • Ownership structures and existing regulations/acts may result in complexities and delays in implementing pilot projects. For example, the City of Toronto's 2012 EV Charging Station pilot project was delayed four years. The delay resulted from certain provisions in the Ontario Energy Board (OEB) Act that prevented Toronto Hydro from owning and operating EV charge stations because the chargers could not be used for the sole purpose of distributing electricity. The pilot project was delayed until the provisions were amended in 2016.

5.4 Shared/Micromobility & Mobility as a Service (MaaS)

The use of micromobility and MaaS by municipalities as alternatives to conventional transit systems has increased dramatically in recent years. The performance of micromobility and MaaS programs from a business case perspective is also highly variable due to a wide range of implementation models. The success of micromobility systems is also dependent on the availability of supporting infrastructure (i.e., cycling facilities).

From a strategic case perspective, the benefits of micromobility and MaaS services are similar, including:

- Increased access to low-cost options beyond the private automobile
- Increased options for first- and last-mile trips

One of the key differences between micromobility and MaaS can be seen in the financial case, which can be highly variable depending on how an initiative is implemented. Key considerations include:

- **Third-Party/Vendor Owned and Managed:** Financial impacts tend to be low if a municipality procures a third-party contractor to operate and manage a system. User fees, operating costs, and risks associated with using the system are transferred to the user and the contractor. Example: Lime Scooter, Zipcar.
- **Municipally Owned and Managed:** Financial impacts tend to be high if the municipality owns the system. Costs and risks associated with using the system are owned by the municipality. User fees are typically subsidized by the municipality.

[35] https://www.ic.gc.ca/eic/site/mc-mc.nsf/eng/lm04949.html
[36] https://www.csagroup.org/testing-certification/product-areas/power-generation-energy-storage/vehicle-power-fueling/electric-charging/

  - Example: Bike Share Toronto – formerly operated by PBCS Urban Solutions under the BIXI brand and was taken over by the Toronto Parking Authority in 2014, with Shift Transit acting as the system's operator (i.e., servicing, rebalancing, marketing).
- **Hybrid:** assets are owned and managed by a third-party vendor. User fees are typically subsidized by the municipality. Other cost and risk-sharing agreements vary depending on contract agreements. Example: SoBi Hamilton.

Three micromobility and MaaS projects and/or programs were examined in detail:

- **E-Scooter & e-Bike Pilot, City of Calgary (October 2018 – October 2020)**: The pilot was proposed to support the City's mobility and sustainability goals and provide direction and clarity, and regulations around new shared mobility technologies. The project observed a total of 1,874,000 trips. The pilot was operated and funded by three shared micro-mobility companies.
- **Lime Scooter Pilot, City of Waterloo (May 2018 to October 2018, and April 2019 to September 2019):** The City of Waterloo held a pilot project using Lime scooters. The pilot project was privately operated by Lime. The project observed approximately 6,000 unique riders making a total of 18,000 trips and travelled a total of 19,000 km. The median trip time observed was 6 minutes with a median trip length of 0.75 km.
- **SoBi / Hamilton Bike Share Hamilton (2013 – On-going):** Hamilton's bike share system is 100% funded by user revenues, sponsorship, donations, and Hamilton Bike Share – a local non-profit. The system has over 800 smart bikes in a network over 25 square kilometers of Hamilton[37]. In February 2022, the City announced that it will invest $302,400 per year to operate the program.

Table 9 below provides a high-level summary of benefits and costs associated with these projects.

Table 9: High-Level Business Case Summary for Shared/Micromobility & Mobility as a Service

Case	Summary
Strategic Case	**Strategic Benefits Realized** • E-Scooter & e-Bike Pilot, City of Calgary - 2% of survey respondents used an e-scooter to connect to Calgary Transit[35]. • Supported tourism and economic development objectives: ○ E-Scooter & e-Bike Pilot, City of Calgary: approximately 55% of shared e-Scooter and e-Bike trips ended in BIA areas[35]. **Strategic Alignment with VTP** • Supports accessibility and connectivity objectives by increasing access to transportation options for commuting and discretionary trips. • Supports environmental stewardship objectives by providing first- and last-mile option

[37] https://www.hamilton.ca/home-neighbourhood/getting-around/biking-cyclists/hamilton-bike-share

Case	Summary
	• Supports equity objectives by providing a low-cost and "on-demand" transportation option

Economic Case	• Economic outcomes are difficult to quantify as a monetized value and are generally not evaluated using standard economic appraisal tools. Typical economic benefits include:
	  ○ Monetary value of auto operating costs savings based on reduced VKT.
	  ○ Monetary value of GHG impacts (i.e., GHG emissions avoided).
	  ○ Monetary value of travel time savings.
	• Strong potential to reduce vehicle kilometers traveled (VKTs). Note that VKT reduction is typically estimated using post-in-service user surveys and the number of trips taken using the service.
	  ○ **Lime Scooter Pilot, City of Waterloo** - City of Waterloo estimated that 12,877 km of automobile traveled was avoided, saving 1,260 litres of gas and preventing 880 kg of CO_2 from being emitted[37].
	  ○ **E-Scooter & e-Bike Pilot, City of Calgary –** Based on survey data, approximately one-third of e-scooter trips replaced car trips (personal, taxi or rideshare)[35].
	  ○ **SoBi Hamilton –** As of May 2020, 1.6 million trips were logged, with a total of 2.3 million kilometres travelled[38]. Compared to average car travel, this represents a reduction in 1,000 tons of CO_2 equivalent.

Financial Case	**Scooter & e-Bike Pilot, City of Calgary[39]** • Capital: None – all capital assets owned by the vendor • Operating: $163,000 (staff time, infrastructure (parking zones), project studies, enforcement and education, data analysis) • Revenue: $177,000 was collected by the City from company permit fees **Lime Scooter Pilot, City of Waterloo** • Capital: $10,000 for temporary signage[40]. The cost of e-scooters was incurred by Lime. • Operating: 1-3 FTEs in the city to manage/coordinate the program. Operating costs related to e-scooters were incurred by Lime. • Revenue: No data available from the City of Waterloo. However, revenues could be generated from permits and/or revenue-sharing agreements. **SoBi Hamilton (2019)** • Capital: $1.6 million obtained through the Metrolinx Quick Wins Fund [41] ○ $16 billion of investment was dedicated to The Big Move, including the Big Move projects including the $740 million in funding for the Quick Wins. The $16 billion in funding was contributed by all orders of government, including more than $13 billion from the Province of Ontario).[42] • Operating: In February 2022, the City announced that it will invest $600,000 per year to operate the program (i.e., $55 per month per bike in maintenance costs for the fleet of 900)[43].

[38] https://pub-hamilton.escribemeetings.com/filestream.ashx?DocumentId=223938
[39] https://www.calgary.ca/content/dam/www/transportation/tp/documents/cycling/cycling-strategy/shared-e-Bike-and-eScooter-final-pilot-report.pdf
[40] https://www.cbc.ca/news/canada/kitchener-waterloo/waterloo-electric-scooter-pilot-project-lime-1.4846765
[41] https://learn.sharedusemobilitycenter.org/wp-content/uploads/policy-documents-2/HamiltonBikeShare-Implementation%20Plab.pdf
[42] https://www.metrolinx.com/en/regionalplanning/funding/IS_Full_Report_EN.pdf
[43] https://globalnews.ca/news/8607452/hamilton-council-bike-share-funding/

Case	Summary
	○ Pre-2022, the system was operated by Hamilton Bike Share Inc., a local non-profit organization that operated the program through donations and user fees (a detailed breakdown of operating costs incurred by the organization is not publicly available, as they are not required to provide a financial audit since they do not receive operational funding from the City)[44] • Revenue: No data available. The operator is not required to provide a financial audit as they do not receive operational funding from the City.
Deliverability & Operations	**Implementation Requirements:** • Develop a public and stakeholder consultation and education strategy on micromobility, existing types of modes, and existing operating requirements, rules, and regulations. • Leverage the Transportation Innovation Program process (as defined in the New Mobility White Paper) as an intake process for interested operators, to guide trials of new services and modes and evaluate alternatives from different operators/providers. • Establish data-sharing practices and methods with the operator to program success, while keeping residents' privacy in mind. • Develop a program structure that covers administrative costs to regulate and manage the program and establish a partnership with an operator, negotiating start-up costs, revenue sharing models, and liability risks. • Review and amendments to the existing operating requirements, rules, and regulations that are currently defined for the City of Vaughan, as needed. • A monitoring program to evaluate economic and transportation impact (i.e., VKT, mode shift) and make informed changes to policy and design. **High-Level Risk:** • Moderate risk of equity challenges as these would come at a cost to providing a first-/last-mile connection that may add to existing trip costs. • Moderate risk of accessibility as elderly or disabled populations may find difficulty accessing these services due to physical or digital barriers. The City of Oakland piloted an adaptive bike share for people with disabilities in 2019 (specifically wheelchair users)[45]. • High risks relating to safety and liability, as many users may be inexperienced or recreational and unaware of regulations. Managing joint and several risks is necessary when partnering with operators. • High risks relating to vendor performance and availability, as many micromobility devices lack regulation and industrial standards (lead to variations in speed between vehicles of the same class). Additionally, shared operation of these modes is a fairly new service concept, and reputable vendors may be lacking in the market and may require greater oversight and monitoring from the City.

[44] https://globalnews.ca/news/3353765/sobi-hamilton-draws-ire-of-councillors-after-refusing-to-provide-financial-statements/
[45] https://www.oaklandca.gov/news/2019/adaptive-bike-share

5.5 Flexible Streets and Temporary Street Closures

Flexible street and temporary street closures generally deliver strong strategic benefits that support local policy and plans for encouraging more active and sustainable communities. Flexible street and temporary street closures are typically implemented on a smaller scale within a local neighborhood and are usually implemented by local Business Improvement Areas (BIAs) or municipalities.

Flexible and temporary street closures typically operate within defined timelines. Projects can be delivered on an annual seasonal basis (usually during the summer season), as well as a pilot project with a fixed project start and end date. Depending on the success of a pilot project and available funding, projects may be eligible to become part of a city's regular programming.

Due to the temporary and local nature of flexible and temporary street closures, the financial impact is typically low. However, the temporary nature of projects also means that quantitative data supporting the economic and financial case is limited.

Three flexible street and temporary street closure projects were examined as part of this white paper:

- **King Street Transit Priority Corridor, City of Toronto (2017 – 2019):** aimed to give priority to streetcars by prohibiting through movements for vehicles at most intersections, expanding space for streetcar stops, and re-purposing segments of the curb lane for public space areas, cafés, loading zones, and taxi stands. The corridor was tested as a pilot project in 2017 and was made permanent in 2019.
- **CaféTO (2019 – On-going):** the CaféTO program was created to facilitate the expeditious rollout of sidewalk and curb lane café extensions, which assisted with increasing space for dining opportunities for Toronto restaurant and bar operators in the public right-of-way. In 2021, City staff recommended that the program become permanent. An economic benefits study was undertaken by TABIA, the umbrella organization of Toronto's 85 BIAs, to better understand the project's impact throughout the summer of 2021.
- **Pedestrian and Shared Street Program, City of Montreal (2017 – On-going)**: designed to test different road-sharing configurations to reduce the right-of-way for automobiles to 60% of the street's surface area. The program includes transitional installations in the first and second years followed by permanent installations in the third year the approach includes a tactical urban planning component, i.e., the installations can be adjusted along the way, depending on the results of the participatory process[46].
- **Argyle & Grafton Streetscape Project, Halifax (2017):** this streetscape project was undertaken by the City of Halifax to enhance connections between major destinations while prioritizing the pedestrian experience and support local economy and tourism. Argyle Street remained a one-way street while Grafton Street remained a two-way street. Both streets have marked drop-off and loading zones, as well as accessible

[46] https://fcm.ca/sites/default/files/documents/resources/case-studies/2018scawards-transportation-city-montreal-pedestrian-shared-streets-program-gmf.pdf

parking, but without standard on-street parking on the streetscape. The street includes "pedestrian zones" and "shared zones". Vehicles are not permitted to drive in the pedestrian zones and must stay between the tactile warning strips[47]. This allows pedestrians, cyclists, and motor vehicles to mix within the "shared zone" but uses visual cues to get motor vehicles to proceed at slower speeds.

- The first sidewalk patios in Downtown Halifax appeared in 1995 as temporary enhancements for the G7 Economic Summit. In 1997, the Downtown Halifax Business Commission (DHBC) lobbied the city to enhance the annual patios that were appearing and to invest in high-quality streets.
- Argyle Street was identified as a top streetscaping priority in 2013, and a new vision for a shared street was developed by the community.
- In 2015, Halifax Regional Municipality (HRM) and DHBC piloted a shared street project to success, further reinforcing the business case. Halifax Council approved the budget for this new streetscaping project in 2016[48].
- Streetscape construction began June 1, 2017, and concluded November 4, 2017. Capital costs were estimated to be approximately $16.6 million[49].

Table 10 below provides a high-level summary of benefits and costs realized through these projects. Note that the Argyle & Grafton Streetscape Project in Halifax is not included in the business case summary, as it is a large-scale streetscape project rather than a flexible street/temporary street closure initiative.

Table 10: High-Level Business Case Summary for Flexible Street and Temporary Street Closures

Case	Summary
Strategic Case	**Strategic Benefits** • Significant opportunity to support employment creation and economic impact, supporting and increasing access to vibrant public spaces. • Transit Priority corridors present significant opportunities in supporting improved transit experience for users. **Strategic Alignment with VTP** • Strong alignment with local plans related to active and sustainable communities.

Economic Case	• Economic outcomes can be difficult to quantify and are not evaluated in depth. For purely sharing streets or streetscaping, benefits can be difficult to capture as monetizing improvements to the pedestrian realm is a challenge. However, benefits from other aspects can be observed.
	• Strong potential to increase travel time savings through establishing a transit priority corridor and improve travel time reliability.
	  ○ City of Toronto staff reported that the King Street Transit Priority Corridor saved approximately 30,000 minutes of travel time are saved by King streetcar customers on an average weekday, and daily weekday ridership grew by 16% from 72,000 to 84,000 boardings per day[50].
	  ○ Additionally, transit journeys were made more reliable as a result of the transit priority corridor, where travel times rarely exceed 20 minutes

[47] https://www.halifax.ca/about-halifax/regional-community-planning/construction-projects/argyle-grafton-shared-streetscape
[48] https://downtown.org/wp-content/uploads/2019/03/2018_DowntownHalifax_ArgyleGrafton_Summary.pdf
[49] https://cdn.halifax.ca/sites/default/files/documents/city-hall/regional-council/160426rc1413.pdf
[50] https://www.toronto.ca/legdocs/mmis/2019/cc/bgrd/backgroundfile-132032.pdf

Case	Summary

	compared to prior to the pilot, where travel times were regularly above 25 minutes.
	• Strong potential to improve revenues through sidewalk and curb lane café extensions during the summer season.
	  ○ For the CaféTO program, TABIA estimates that total sales from patios was $181 million over the 13-week study period and expenditures from restaurants to upgrade and maintain patios was estimated at $25 million. A total of 4.9 customers were served through CaféTO.
	  ○ On average, CaféTO participating restaurants spent $26,000 on upgrades and maintenance of patios, signage, menus, mobile apps and training. These participating restaurants experienced $15,000 in weekly CaféTO-related sales during the study period, serving 400 CaféTO customers.
	  ○ CaféTO sales accounted for 36% of total participating restaurant sales, whereas 26% was from indoor dining, 25% from permanent patios, and 13% from take-out/delivery.

Financial Case	**King Street Transit Priority Corridor[51]:**
	• Capital: $1.5 million (2017) / $1.5 million (2019) for improvements to TTC stops and public realm spaces. Establishments and individuals provided costs related to the construction and maintenance of outdoor cafes and public installations.
	• Operating: $750,000 for traffic signal maintenance, maintenance of public realm spaces and seasonal maintenance and operations.
	• Revenue: $0.9 million (Toronto Parking Authority). Approximately 180 on-street parking spaces were removed from King Street as part of the pilot project which would generate approximately $1.5 million, annually. However, 100 new on-street parking spaces have been added to side streets since the pilot began, with the annual revenue collected from these spaces at approximately $2.4 million, a net revenue increase of $0.9 million.
	• The application fee for applicants for outdoor cafes and public installations on a curb lane were and continue to be waived by the City since the curb lane will be used to expand the public realm. This fee would recoup a total of approximately $16,800 based on the current permit fee and thirty curbside spaces for which it would apply.
	
	CaféTO[52]:
	• Capital costs to the City of Toronto: $2.05 million for consultants and contractors, equipment (i.e., planted boxes, barriers, picnic tables, etc.), public communications, staffing, Queen Street W TTC work (i.e., café removals and reinstallations), planter maintenance grants to BIAs).
	  ○ Restaurants as part of the CaféTO program spent $10.4 million on furniture expenditures, $6.7 million on property expenditures and spent $4.2 million on dining-related expenditures (such as glassware, plants and menus). On average, this totaled $22,300 per restaurant.
	• Operating: $2.03 million for salary of CaféTO dedicated FTEs, for Transportation Services (Operations and Maintenance, CaféTO Program Staff, enforcement), and Municipal Licensing and Standards.
	  ○ Restaurants as part of the CaféTO program spent $3.7 million on operational expenditures such as recruitment, training, advertisement and signage. On average, this was $3,900 per restaurant.
	• Revenue: Loss of $3.04 million from waiver of permit fees and parking fees.
	
	Pedestrian and Shared Street Program, City of Montreal:

[51] https://www.toronto.ca/legdocs/mmis/2019/ex/bgrd/backgroundfile-131188.pdf
[52] https://www.toronto.ca/legdocs/mmis/2021/ex/bgrd/backgroundfile-171963.pdf

Case	Summary

	• Capital: up to $600,000 per project may be granted (up to 5 projects per year).
	  ○ Year 1: selected projects receive funding of 50% of the total budget, up to $100,000.
	  ○ Year 2: additional $100,000 is granted for additional changes and design adaptations, up to a maximum of $100,000
	  ○ Year 3: Maximum of $400,000 is granted to make the project permanent [53] [54].
	• Operating: no data available. As the program has been launched since 2015, it is assumed that all operating costs are included in the City's annual budget.
	• Revenue: revenue data is not collected as part of the Program. Information gathered on the program indicate that revenue generation by the City is not an objective of the program, rather, it is to provide free public amenities.

Deliverability & Operations	**Implementation Requirements:** • Primary departments needed for delivery: Transportation Services, City Planning; Transit Authority, Parking Authority/Parking Operator, Municipal Licensing, Corporate Communications. • Detailed Design and Traffic Mitigation Planning to confirm the potential impacts of flexible streets and street closures, such as locations and design of new public space (including street furniture elements), traffic signal modifications, signage and pavement marking details, and associated by-law amendments. • Monitoring and evaluation. • Public Education & Awareness Communications Strategy. • Enforcement Strategy. **High-Level Risk:** • Significant risk from funding availability and schedules; may require quick turnaround from concept to implementation. • Moderate risk from political opposition; concerns from parking removal. • Low risk from compliance and enforcement and seasonal weather consideration. • Low risk from concerns from local businesses on lack removal of parking.

5.6 Key Considerations for Monitoring

It may be challenging to quantify the impacts of investments such as pilot projects and initiatives without the appropriate staff resources. Since it is an emerging area of interest, a robust business case framework with standardized metrics is recommended to be developed and continued to be monitored. Some potentially quantifiable metrics could include:

- Travel time savings (example: for congestion-reduction related initiatives)
- Travel time savings for delivery vehicles
- Reduction in noise
- Increase in number of pedestrians and cyclists in the area (i.e., mode shift)
- Increase in sales of local businesses
- Willingness to pay from local residents and visitors.

[53] https://www.tac-atc.ca/sites/default/files/conf_papers/tac2017_montreal_complete.pdf
[54] http://ville.montreal.qc.ca/pls/portal/docs/PAGE/ARROND_VSP_FR/MEDIA/DOCUMENTS/PROGRAMME_RUES_PIETONNES_2017.PDF

Furthermore, some quantifiable metrics require high-level government approvals and coordination to be recognized as a viable measure. Examples of this may include congestion pricing and carbon pricing.

6 Conclusion and Next Steps

This paper reviewed different opportunities to maximize transportation infrastructure value and their social and economic benefits. Curbside management, EV charging streetlights, micromobility and MaaS, and flexibility streets were examined in more detail on the strategic and economic benefits, capital and maintenance costs, and implementation considerations. The information presented in this paper provides inputs to policy recommendations for the VTP and the City's Official Plan review, and a starting point for the City to initiate future work to implement these measures.