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Research & Analysis

The Transportation Impacts of Vehicle-for-Hire in the City of Toronto

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TORONTO

Table of Contents

Appendices

Table of figures

Executive Summary

This Executive Summary is also found as Attachment 4, the Transportation Impacts of Vehicle-for-Hire in the City of Toronto, Review of the City of Toronto Municipal Code Chapter 546, Licensing of Vehicles-for-Hire, General Government and Licensing Committee (GL6.31).

Introduction

The purpose of this report is to describe how the introduction of Private Transportation Companies (PTCs) in Toronto has changed travel patterns and behaviour in the City, and to understand its impact on the operation of the City's street networks. Specifically, the report responds to the City Council Recommendation 92 in Item LS10.3 "A New Vehicle-for-Hire Bylaw to Regulate Toronto's Ground Transportation Industry" adopted by City Council on May 3 2016, to report on "*the outcome of a study that assesses and measures the impacts of the volume of PTC vehicles and drivers*". This report will answer the following questions:

1. What are the trends and patterns in vehicle-for-hire travel in the City?

2. How has this travel impacted the transportation network?

3. How have travel choices evolved in Toronto?

These questions are answered primarily using detailed trip data that has been submitted to the City by licensed PTCs covering the period of September 2016 to September 2018.

This study has been completed by the Transportation Services Division's Big Data Innovation team in collaboration with a research team at the University of Toronto Transportation Research Institute (UTTRI).

The complete study is posted on the Transportation Services Big Data Innovation Team website.

Data Sources

This study was based primarily around PTC trip records provided by PTCs as a requirement of the Vehicle-for-Hire (VFH) Bylaw. These records detail the trip origin and destination (to the nearest intersection) of each trip made by a licensed PTC in the City and the times that trips were made. Prior to April 2017, PTCs also provided wait time information for each trip. Trip data used for this study covers the period from September 2016 to September 2018, while summarized aggregate trip totals have been provided up to March 2019.

Taxi brokerages declined participation in the study, and equivalent data on taxi and limousine trip patterns is not available as a form of comparison to the trends and patterns observed with PTC travel. As a result, the content of this report is primarily focused on PTC travel in the City.

This data has been supplemented by a few additional data sources:

- **PTC pick-up and drop-off locations**: Pick-up and drop-off counts at a 10m resolution were acquired using SharedStreets as a broker in partnership with Uber and Lyft.
- **Supplementary aggregate PTC statistics**: On request from the City, Uber provided additional information including the number of PTC vehicles fulfilling trips for selected days, additional aggregated wait time data (after April 2017). Lyft declined to provide additional data.
- **Bluetooth Sensor Travel Speed Data**: Transportation Services monitors travel times on a number of downtown arterial streets using Bluetooth readers, originally deployed for monitoring the King Street Transit Pilot and other downtown transportation initiatives.
- **PTC Travel Behaviour Survey**: UTTRI commissioned a survey as part of this study to understand the trade-offs and choices that travellers make when choosing to take PTCs.

Methodology

The study has been organized into three main sections. A more detailed backgrounder on the technical methodology and data sources used is included in the full report and accompanying technical appendices.

1. Understanding PTC trip-making trends and patterns

PTC trip records were aggregated and filtered by location to study overall trends in PTC trip making since the VFH bylaw was enacted. The data was used to answer questions on the types of trips made, how far people travel, where they travel and at what times of day. This analysis also considers equity and demographic indicators, and the relationship with transit services in Toronto.

2. Studying the travel demand and travel choice impacts of PTC travel

The second stage of the study relied on market research undertaken by UTTRI to understand the travel choice trade-offs made by PTC travelers.

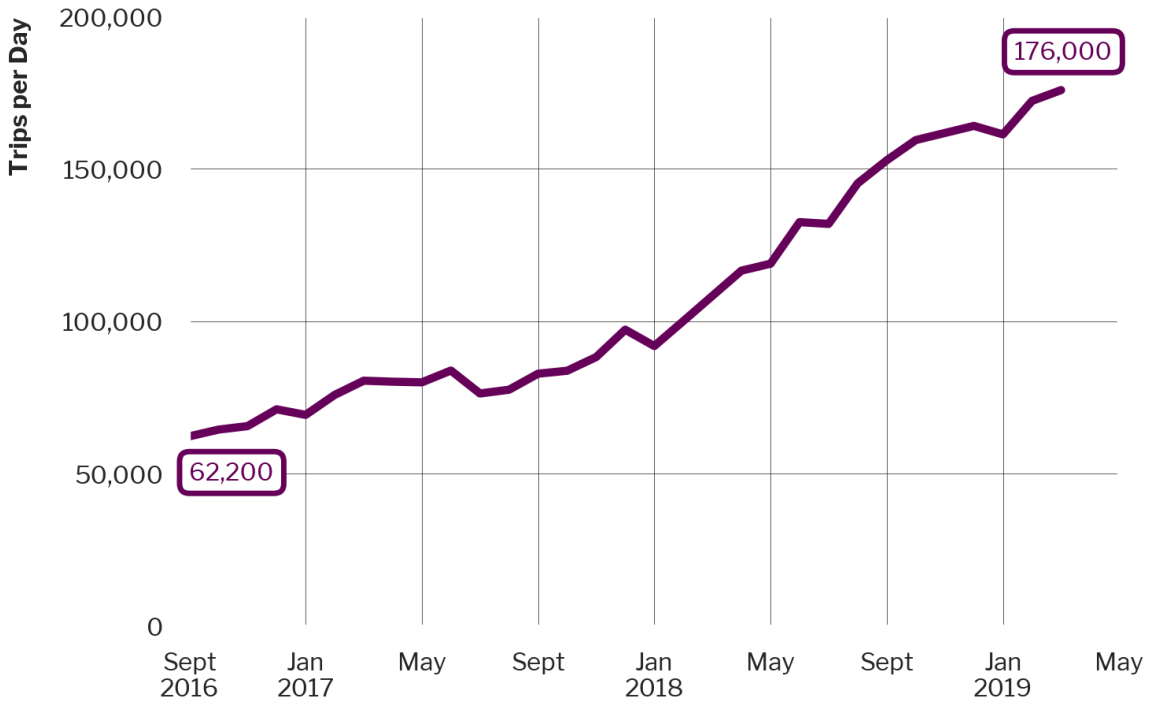
3. Analyzing the impacts of the growth in PTC travel on the transportation network

This part of the study used the PTC trip data to develop estimates of the total amount of PTC travel in the City, the volumes of PTC vehicles by neighbourhood at key times and studied the relationships with changes in travel times on Downtown streets.

PTC trips have grown by 180% in 2.5 years

PTC trips have grown rapidly since September 2016, when the service was first licensed by the City. 176,000 trips were made daily in March 2019, an increase of over 180% since September 2016. As of March 2019, 105 million trips have been completed in the City of Toronto using PTCs.

Exhibit ES-1: Average Daily PTC Trips, September 2016 - March 2019



Trends in comparable North America cities point towards rapid growth in PTC trips

The City of Toronto is still in the early stages of PTC adoption relative to other comparable cities in North America. For context, Chicago, a city of comparable population, experiences approximately 330,400 PTC trips daily, almost twice that of Toronto. While it is impossible to know whether Toronto will reach this same number of daily trips, Chicago has had PTCs operating for 3 years longer than Toronto, and has witnessed consistent growth over the period. While cities can differ greatly in their regulatory context, demographic makeup, and the size and population density of their urban cores, trends in PTC growth and the experience in other jurisdictions suggests that the PTC trip market in the City of Toronto is not saturated and that growth in trips will likely continue for the foreseeable future.

PTC Trips are concentrated downtown and at major transportation hubs

60% of all PTC trips were conducted within Toronto and East York. The vast majority of trip hotspots are located within the downtown core and surrounding areas, including:

- **Within the Downtown Core**: Significant trip hotspots include the major bar and restaurant districts of King West, Ossington Ave, Little Italy, Yorkville and Cherry St (Polson Pier), as well as the Financial and Entertainment Districts surrounding Bay and Wellington.
- **Outside the Downtown Core:** Trips are concentrated around major transit stations, shopping destinations, postsecondary institutions (e.g. York University, Humber College, University of Toronto

Scarborough) and residential developments (e.g. Humber Bay Shores, Liberty Village).

Exhibit ES-2: Average Daily PTC Trips by District, October 2016 vs. September 2018

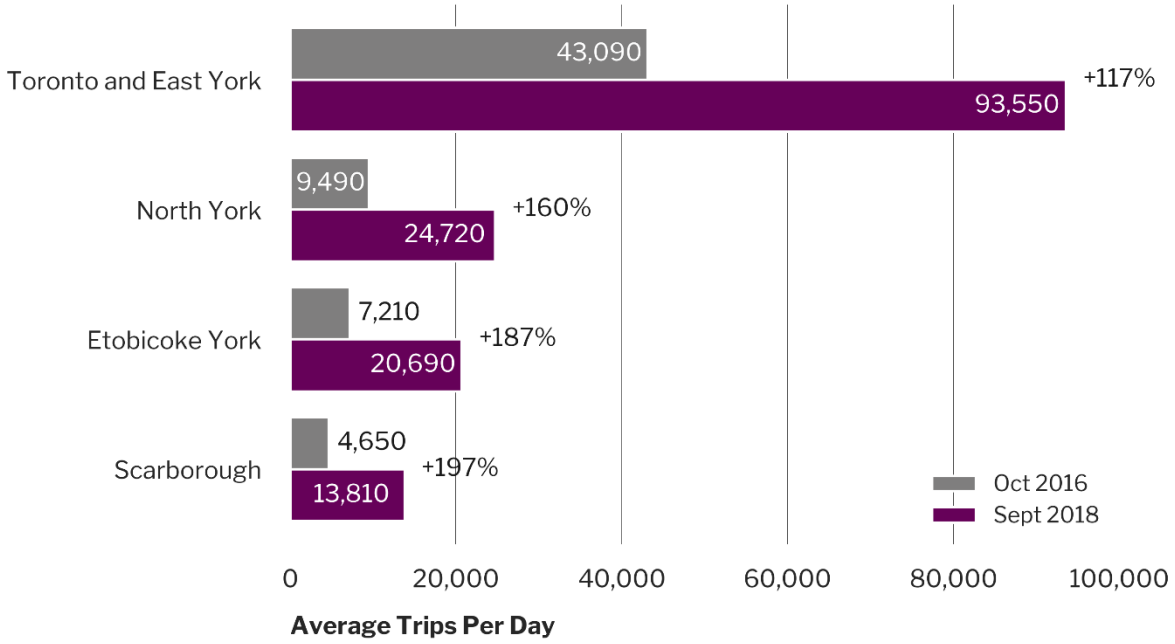


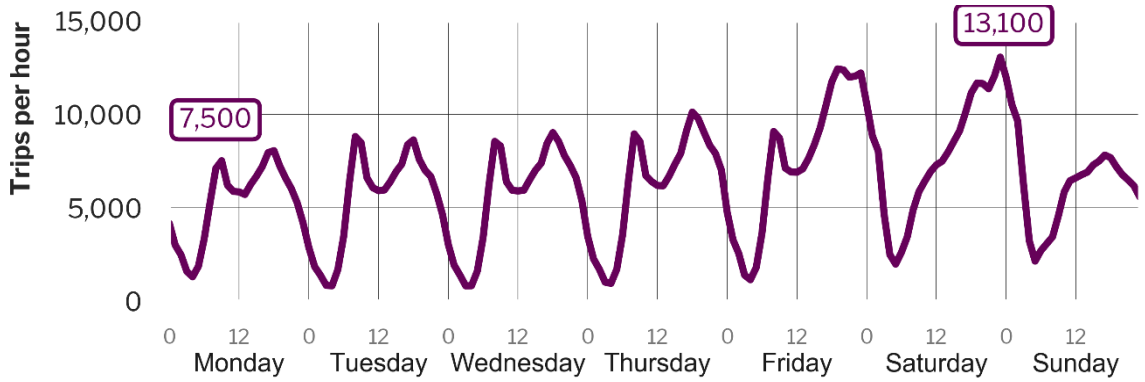
Exhibit ES-3: Daily PTC Drop-Offs by nearest Intersection in Downtown, September 2018

Nighttime economy and commuter travel are the largest trip markets

PTC trip-making peaks are observed in two distinct time periods:

- **Friday and Saturday Nights**: the busiest period by far for PTC travel is Friday and Saturday nights, peaking at an average 13,100 trips per hour at midnight on Sunday morning. This time period is typically associated with nightlife activity, which is reflected in the dominance of trips in the downtown Entertainment District during this time.
- **Weekday Commuting Periods:** PTCs are heavily used in the morning and afternoon peak periods, typically associated with the times during which the road network experiences the most traffic. This trip market has increased over the past two years.

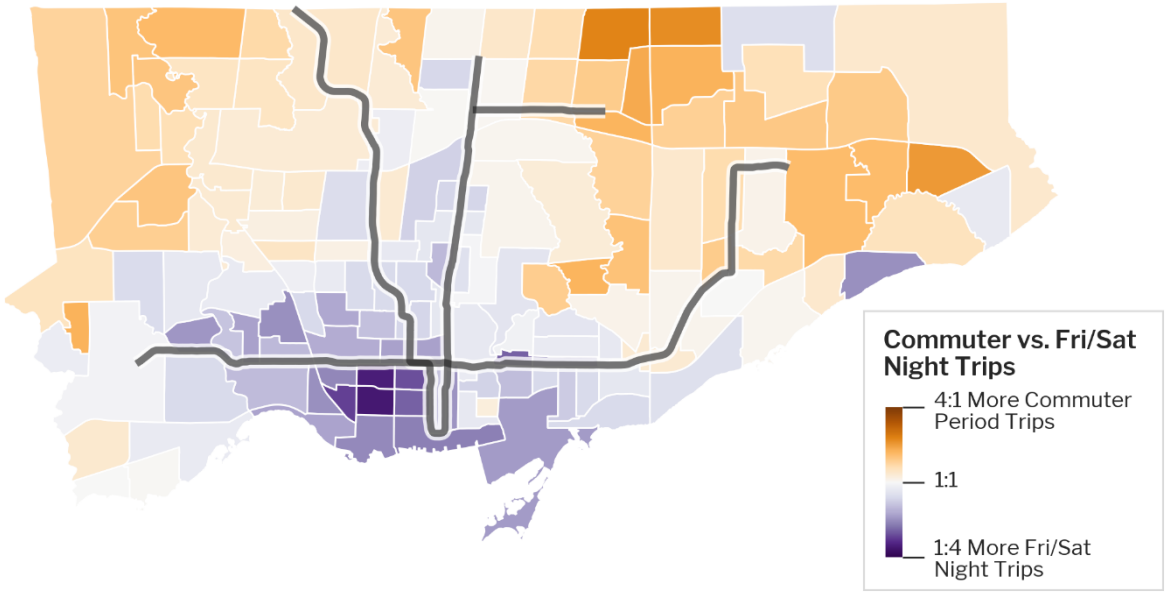
Exhibit ES-4: Trips by Time of Day and Day of Week, September 2018



PTCs are more commuter-focused outside of Downtown

Commuter trips are emerging as a major trip market that are being increasingly captured by PTCs. This is illustrated in Exhibit ES-5, which shows a landscape with two distinct geographies. Downtown neighbourhoods generally see more than two Friday and Saturday night trips for every weekday commuter period trip while the opposite is true in the suburbs where trips are much more commuter-focused.

Exhibit ES-5: Comparison of Commuter Trips vs Friday/Saturday Night Trips, September 2018

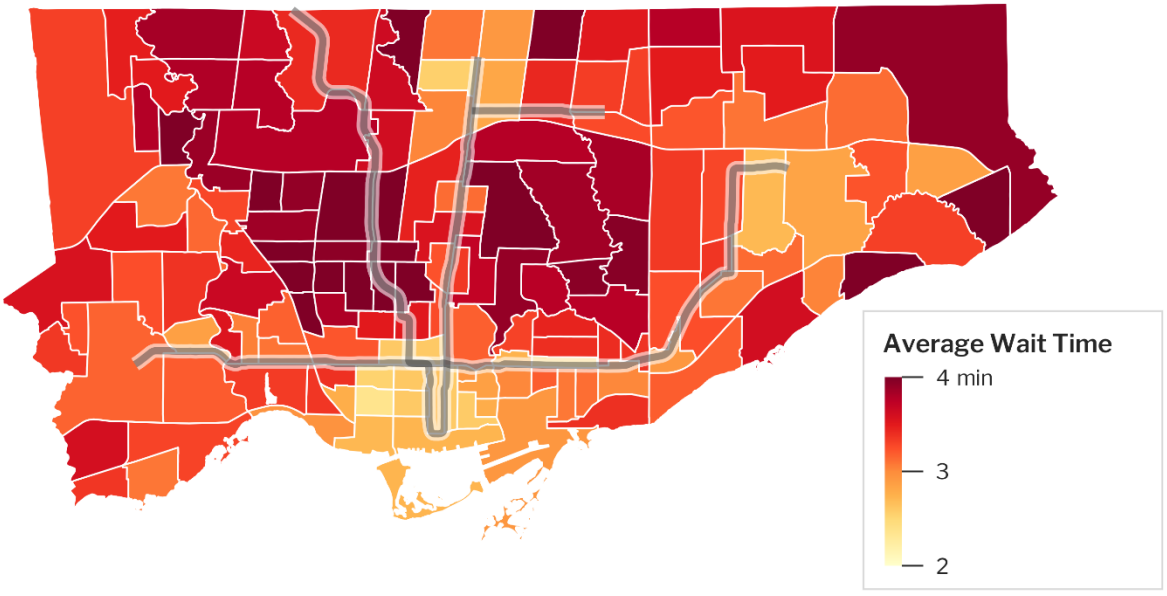


Average wait times are under 4 minutes City-wide

Understanding the wait times for PTC users is key to understanding how PTC service levels have evolved, both over time and across the city. Average wait times provide important context for understanding spatial inequities and the competitiveness of PTCs with public transit.

The average wait time for completed trips in the City of Toronto has dropped from 4.2 minutes in September 2016 to 3.1 minutes in September 2018. Wait times are quite consistent across the City with wait times ranging from 2.8 min in Toronto and East York up to 3.5 minutes in North York.

Exhibit ES-6: Wait Times by Neighbourhood, September 2018

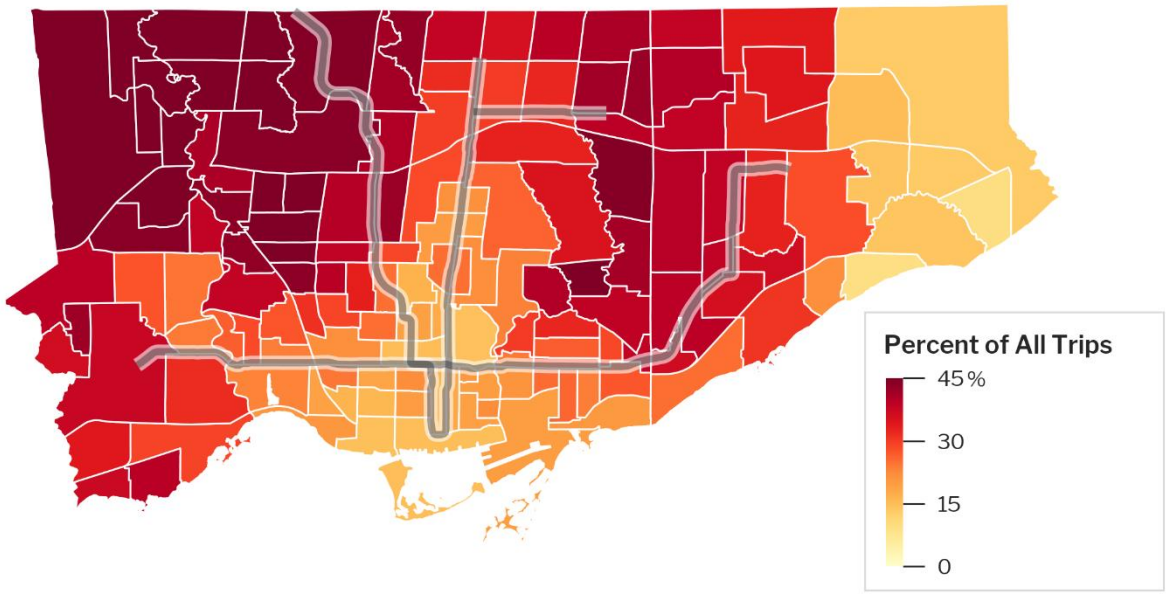


A quarter of overall PTC trips use shared ride services

Shared ride services, such as Lyft Line and Uber Pool, are unique offerings that make up a portion of the overall PTC trip market. These services work by matching passengers with others heading on similar paths. Shared trip requests have grown from about 6,900 trips/day in September 2016 to 28,400 in September 2018 and now account for 26% of all PTC trips. Outside the core, in particular in large sections of Etobicoke and North York, users are much more likely (up to 45% of all trips) to order shared ride services.

While shared trip services are increasingly popular with PTC users, 82% of these trips are being completed without matching riders with additional passengers. In September 2018, only 5,200 of the total 28,400 daily shared ride trips made more than one distinct pick-up.

Exhibit ES-7: Proportion of Shared Ride Trips Requested by Neighbourhood, September 2018



PTC users' second choice of mode is most often transit or taxi

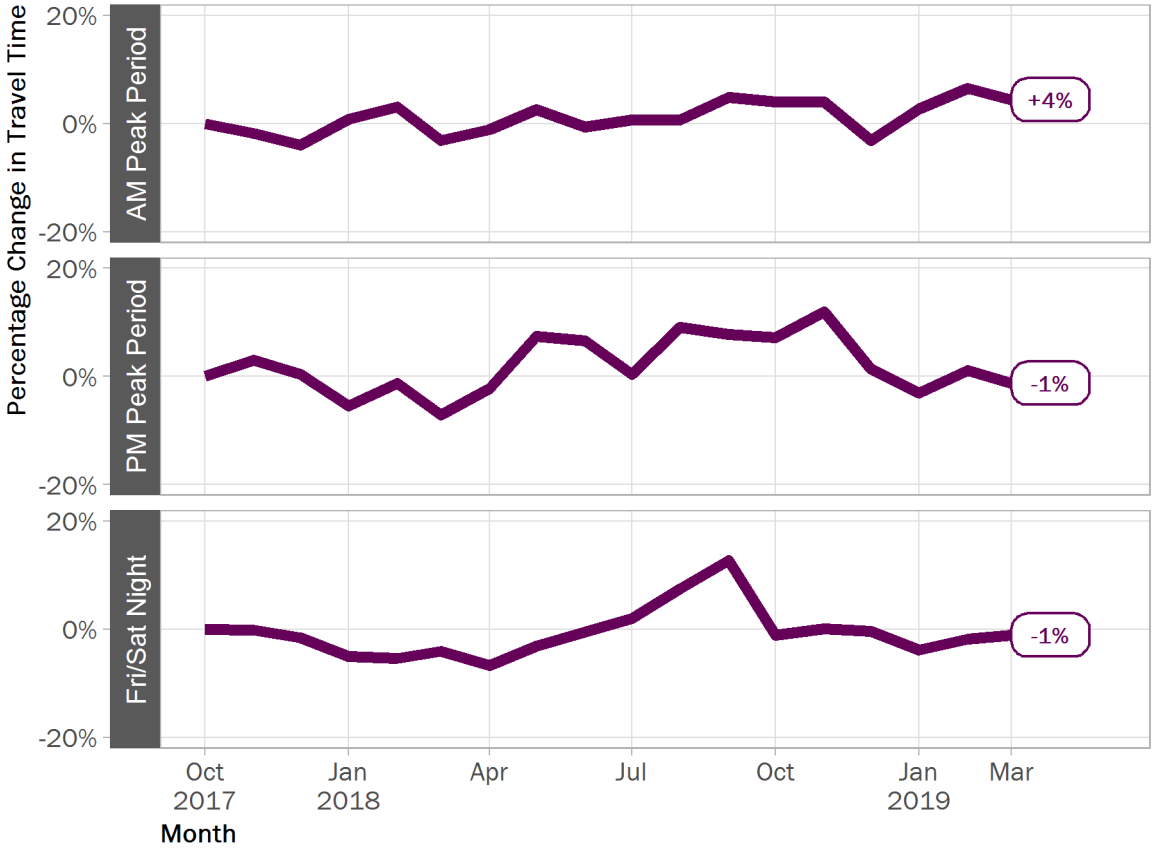
UTTRI conducted a survey of City of Toronto residents in May 2019 to determine the factors that influence residents' choices of when they use PTC services in the City. Survey participants were asked a series of questions that reflected real or hypothetical decisions to identify, in part, which modes were directly competing with PTCs.

49% of the respondents stated that they would have taken public transit in the absence of PTCs for their most recent PTC trip, while 33% would have taken a taxi. The remaining 18% would have driven, been driven by someone, walked, biked, or would have not made the trip at all. When looking only at commuting trips, 58% of respondents would have taken transit in the absence of PTCs and 20% would have taken a taxi.

Downtown travel times have been stable over 18 months while PTC trips increased by 96%

The City of Toronto collects car travel time data on most major streets in the downtown core, the area of the City where PTC trip concentrations are highest. This data shows marginal changes in travel times over the last 18 months in the downtown core. Between October 2017 and March 2019, downtown travel times on major streets has increased by 4% in the morning peak hour (7 to 10 a.m.), and decreased by 1% in both the afternoon peak period (4 to 7 p.m.) and Friday and Saturday nights (10 p.m. to 1 a.m.). This same period is associated with a 96% increase in PTC trips city-wide, from 83,800 to 164,000 daily trips. These findings are consistent with the recently-completed evaluation of the impacts of the King Street Transit Pilot which showed no significant changes in travel times on downtown streets over the Pilot period.

Exhibit ES-8: Changes in Travel Time in the Downtown Core, October 2017 to March 2019



PTCs in Downtown Toronto make up 5-8% of total traffic

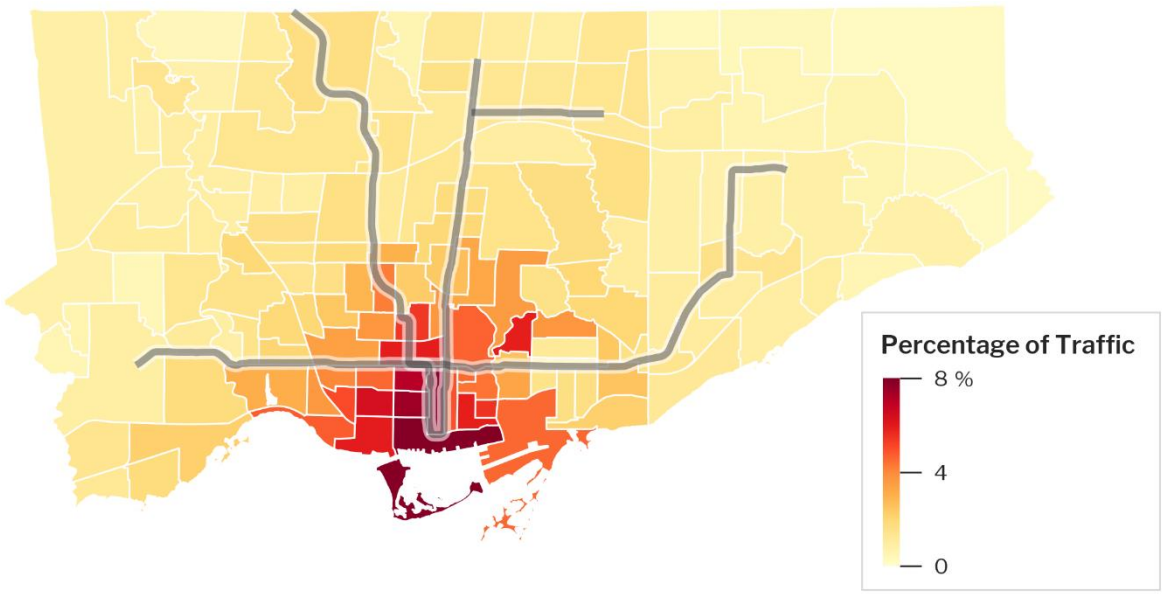
The impact of PTCs on the transportation network is largely a function of the amount of driving its vehicles are adding on to the City's road network, measured in vehicle-kilometers travelled (VKT). Outside of any potential impacts on traffic congestion, additional VKT can also directly affect the City's ability to meet its climate change goals under the TransformTO Climate Action Strategy. Increased VKT has also been found to have adverse impacts

on air quality, health, safety, and noise. PTC vehicles contribute to total VKT on City streets in two distinct ways:

- **In-Service Trips**: Distances travelled by vehicles carrying passengers; and,
- **Deadheading:** Distances travelled by vehicles either cruising for passengers or en route to pick-up a passenger

The largest volumes of PTCs are concentrated downtown where a conservative estimate of PTC volumes shows that PTCs now account for between 5 and 8% of overall daily traffic in Downtown Neighbourhoods. The busiest neighbourhood is Waterfront Communities-The Island, bordered by Bathurst St, Queen St/Front St, the Don River, and Lake Ontario.

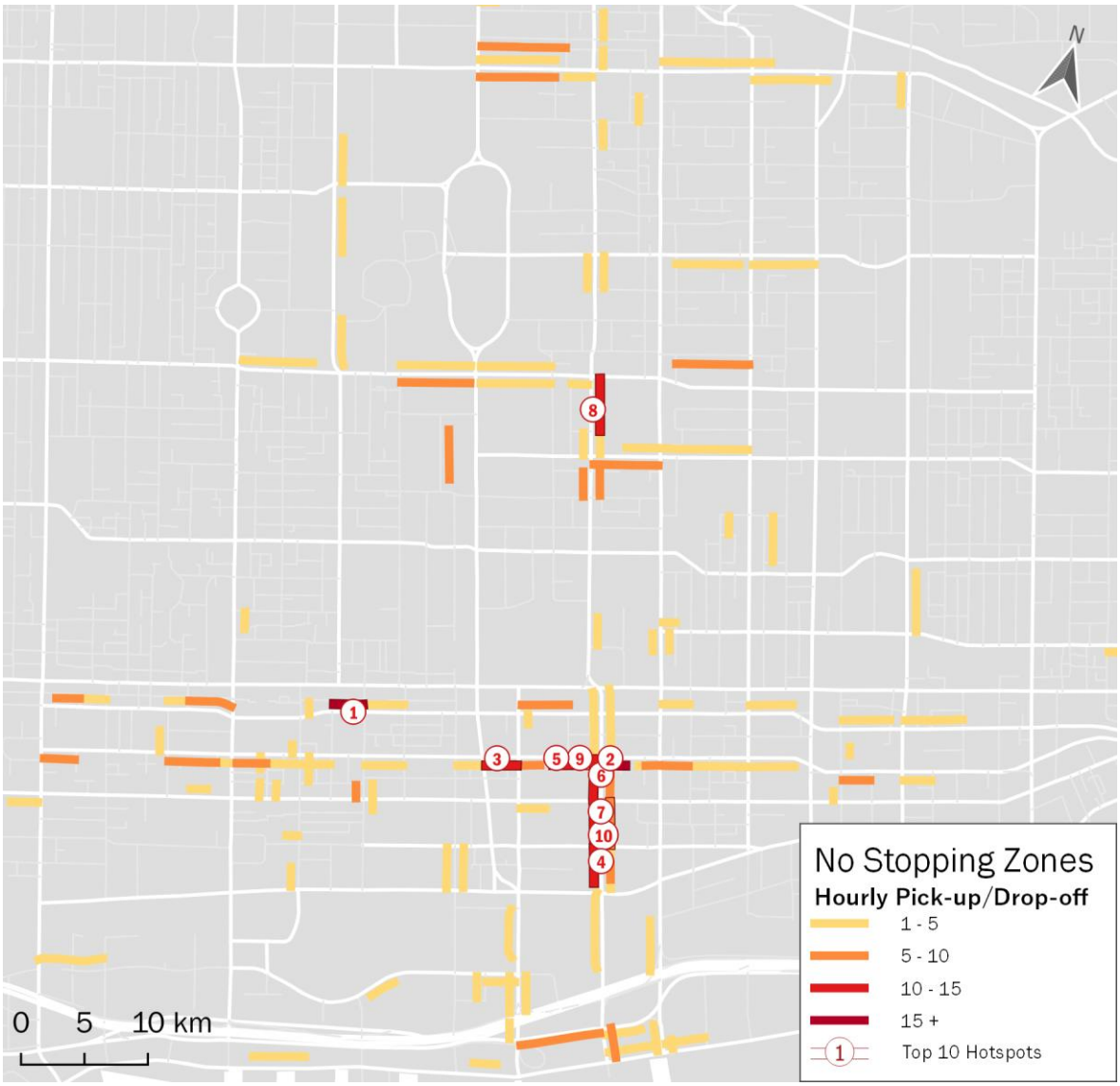
Exhibit ES-9: Proportion of PTC VKT by Neighbourhood, September 2018



Pick-up and drop-off data highlight conflicts with no-stopping zones and bike lanes

The introduction of PTCs, a mode of transportation heavily dependent on access to the curbside, raises important questions on the continued effectiveness of the City's curbside traffic and parking regulations. A detailed look at pick-up/drop-off data has shown hotspots during the morning commute period where pick-up and drop-off activity is occurring in no-stopping zones. The largest hotpots are found on Bay St and Adelaide St in the Financial District. A similar analysis of pick-ups and drop-offs along bike lanes is also included in the full report to highlight areas that could benefit from additional separation between bike lanes and vehicular traffic.

Exhibit ES-10: Hotspots of Pick-up/Drop-off Activity in No-stopping Areas (7 to 10 a.m.), September 2018



Next Steps & Recommendations

This study has looked at what is most-likely the first wave of disruptions from new mobility-as-a-service (MaaS) businesses. Trip growth is not anticipated to slow in the upcoming years, and whether these trips have resulted in increased travel times on City streets to date or not, these services will likely create traffic and operational changes throughout the City in the future. In addition, increased VKT can negatively impact the City reaching its climate goals and provide other impacts. However, PTC services have been immensely popular with Toronto residents as evidenced by the rapid growth in trips. PTC services now play an important role in many residents' daily travel patterns including an increasing role in daily commuter travel.

The goal of the Transportation Impact Study has been to build a deeper understanding of these new services and to pave the way for future work and studies to keep in front of these rapidly changing trends. This will allow

the City to define policy to support the benefits of PTC services while minimizing adverse impacts to traffic, to the environment and to the equity of mobility services.

As a result of the work to date, it is recommended that:

1. Transportation Services to build a monitoring program as part of the Congestion Management Plan to monitor the impacts of Vehicles-for-Hire on VKT, traffic congestion and GHG emissions and to better-understand the relationship with traffic congestion trends in the city
2. Transportation Services to continue to study the impact of Vehicles-for-Hire on the Curbside Management plan and related policies.
3. Transportation Services to investigate whether there is a road safety impact of Vehicles-for-Hire and to collaborate with MLS and the Toronto Police Service to collect appropriate data.
4. In order to be able to continuously monitor and evaluate the impact of vehicles-for-hire on the transportation network, changes are required to the data currently being collected to include information on PTC volumes, wait times, trip cancelations, deadheading and curbside activity.

1 Introduction

The City of Toronto's Vehicle-for-Hire (VFH) Bylaw was approved by City Council on July 15, 2016 to regulate taxicabs, limousines and private transportation companies providing personal transportation services (like Uber and Lyft). Municipal Licensing and Standards (MLS) is currently undertaking a comprehensive review of the VFH bylaw. One key element of this review is the need to report to City Council on the impact that the ground transportation industry, particularly Private Transportation Companies (PTCs), has had on transportation within the City.

Transportation patterns mostly change and evolve in pace with development and changes made to transportation infrastructure and policies, whether public transit operations, street infrastructure, bicycle lanes or traffic signals. The introduction of PTCs in 2014 - when Uber first started operating its UberX service on City streets - has resulted in a significant change in travel behaviour in the City over the period of only a couple of years.

The purpose of this report is to describe how the introduction of PTCs in Toronto has changed travel patterns and behaviour in the City, and to understand its impact on the operation of the City's street networks. The report responds to the council directive to report on "*the outcome of a study that assesses and measures the impacts of the volume of PTC vehicles and drivers*".

The report will answer the following questions about the ground transportation industry in Toronto:

1. What are the trends and patterns in vehicle-for-hire travel in the City?

2. How has this travel impacted the transportation network?

3. How have travel choices evolved in Toronto?

These questions are answered primarily using detailed trip data that has been submitted to the City by licensed PTCs covering the period of September 2016 to September 2018. Taxi brokerages declined participation in the study, and equivalent data on taxi and limousine trip patterns is not available as a form of comparison to the trends and patterns observed with PTC travel. As a result, the content of this report is primarily focused on PTC travel in the City.

This study has been completed by the Transportation Services Division's Big Data Innovation team in collaboration with a research team at the University of Toronto Transportation Research Institute (UTTRI).

2 Data & Methodology

2.1 Data Sources

The methodology of the study has been structured around five primary datasets:

- **PTC Trip Records**: The VFH bylaw requires PTC companies to submit trip records to the City of Toronto Municipal Licensing & Standards Division. These records detail the trip origin and destination (to the nearest intersection) and time of each trip made by a licensed PTC in the City. Individual trip data used for this study covers the period from September 2016 to September 2018, while summarized aggregate trip totals have been provided up to March 2019. This data has been fundamental to building an understanding of trip patterns, flows and trends.
- **PTC Pick-up and Drop-off Data**: Pick-up and drop-off counts at a 10m resolution were acquired using SharedStreets as a broker in partnership with Uber and Lyft. This data is used to study potential conflict points, hotspots and understand the implications for curbside regulations in the City.
- **Supplementary aggregate PTC statistics**: On request from the City, Uber provided additional information including the number of PTC vehicles fulfilling trips for selected days, additional aggregated wait time data (after April 2017). Lyft declined to provide additional data.
- **Bluetooth Sensor Travel Speed Data**: Transportation Services monitors travel times on a number of downtown arterial streets using Bluetooth readers. This data provides traffic speeds at a block level and 5-minute resolution, where data is available and is used to measure congestion trends.
- **Transportation Tomorrow Survey (TTS)**: The TTS is a cooperative effort by local and provincial government agencies to collect information about urban travel in southern Ontario. The data collected helps local and regional governments, as well as the province and its agencies make transportation planning and investment decisions. The most recent survey was conducted in the fall of 2016 and is used to understand the characteristics of PTC and taxi travelers.
- **PTC Travel Behaviour Survey**: As part of this study UTTRI commissioned a survey to understand the trade-offs and choices that travellers make when choosing to take PTCs. This survey helps to answer questions on how PTCs compete with existing transportation options in the City.

2.2 Methodology

The methodology was based on new approaches and best-practices from the academic literature developed in cooperation with the University of Toronto Transportation Research Institute. The methodology has been designed to build credible and conservative assessments of the volume of PTC vehicles

on City streets in the absence of data about the volume of PTC vehicles on city streets and on deadheading activity. A more detailed backgrounder on the technical methodology and data sources used is included in Appendix A. Profiles of PTC travel in each of the City's 25 wards is included in Appendix B.

The study has been organized into three main themes:

1. Understanding PTC trip making trends and patterns

PTC trip records were aggregated and filtered to study overall trends in PTC trip making since the VFH bylaw was enacted. This data was used to answer questions on the types of trips made, how far people travel, where they travel and at what times of day. This analysis also considers equity and demographic indicators, and the relationship with transit services in Toronto.

2. Analyzing the impacts of the growth in PTC travel on the transportation network

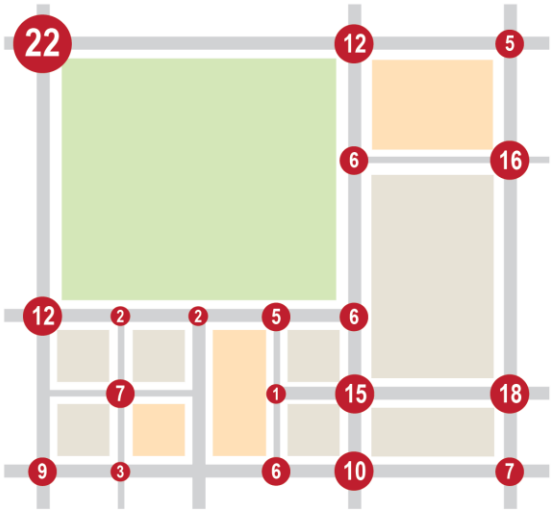
This part of the study used PTC trip data to develop estimates of the total amount of PTC travel in the City, the volumes of PTC vehicles on City streets at key times and studies the relationships with changes in traffic congestion patterns. A methodology was developed to route trips across City streets and simulate the chains that drivers complete between in-service PTC trips. This enabled the study to build estimates of the amount of travel of empty PTCs while estimating the total Vehicle Kilometres Travelled of PTC vehicles and linkages with traffic congestion. Exhibit 2-1 provides a high level overview of the methodology used for estimating PTC volumes, while a more detailed description is provided in Appendix A.

3. Studying the travel demand and travel choice impacts of PTC travel

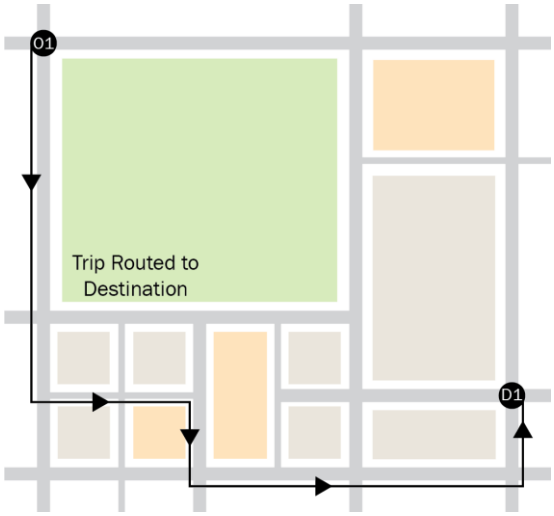
The final stage of the study relies on market research undertaken by UTTRI to understand the travel choice trade-offs made by PTC travelers in order to determine where these new trips have been created from, whether diverting from other modes or whether they are new trips altogether.

Exhibit 2-1: Methodology for Estimating Total PTC Trip Volumes

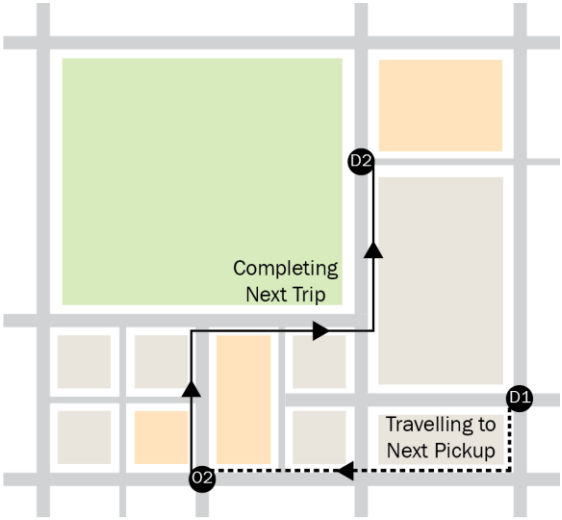
1) PTCs submit trip origins and destinations to the nearest intersection



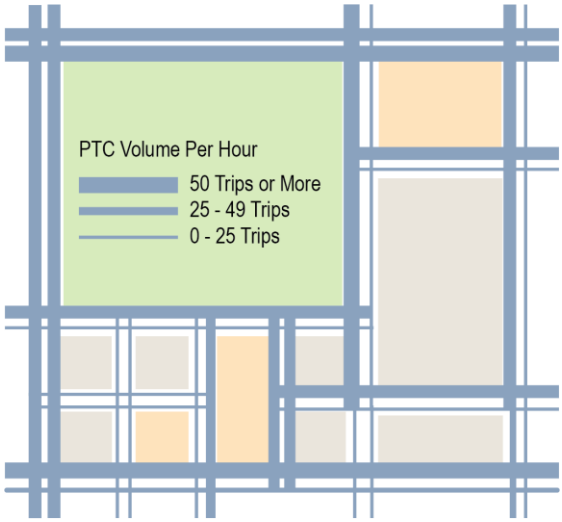
2) Trips are routed through streets based on historical speeds at the time of the trips (speed data from HERE Technologies)



3) Trips are linked using a simulation to estimate the distance traveled without passengers (deadheading time)



4) Total PTC volumes are estimated by adding up all of the routed trips on each street



3 Overall Trip-Making Trends and Patterns

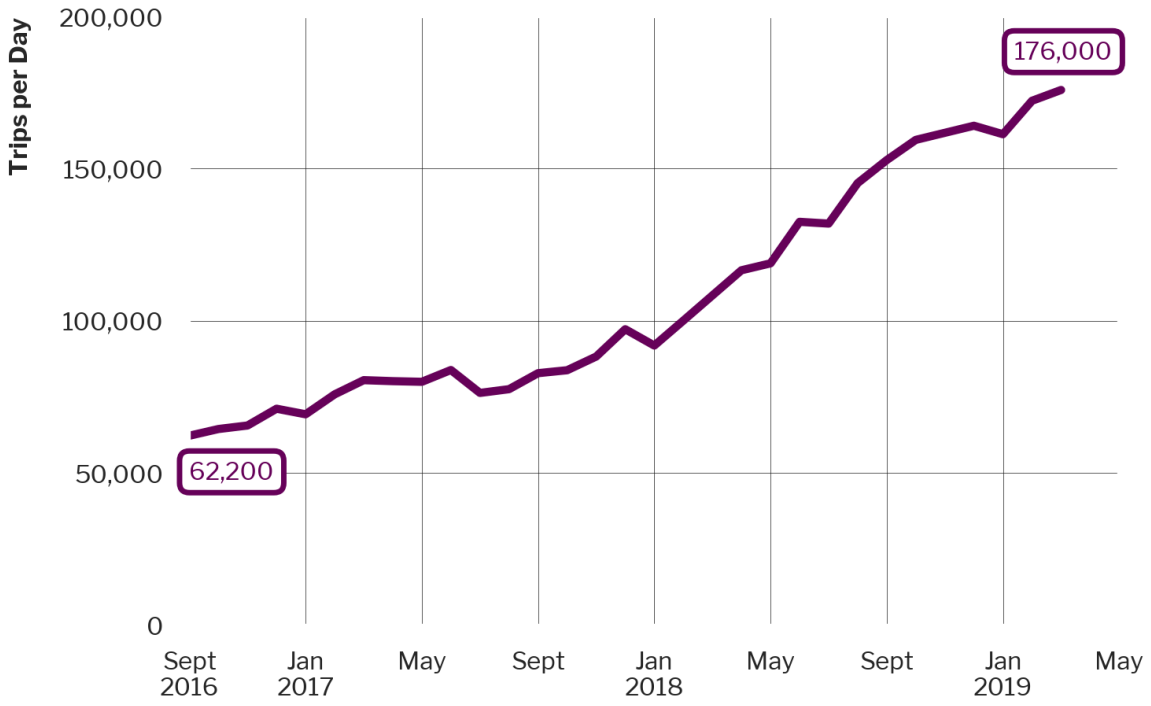
3.1 PTC trips have grown by 180%

Exhibit 3-1 shows the overall timeline of when Uber and Lyft launched in Toronto. Uber started offering its UberX service in September 2014. Almost two years later, the City passed its Vehicle-for-Hire Bylaw in June of 2016. Lyft entered the Toronto market at the end of 2017.

Exhibit 3-1: Timeline of PTCs in the City of Toronto

PTC trips have grown rapidly since September 2016, when the service was first licensed by the City. As shown in Exhibit 3-2, an average of 176,000 trips were made daily in March 2019, an increase of over 180% since September 2016. The PTC trip volume represents nearly 3% of the 6.5 million trips average daily trips made to or from the City of Toronto in 2016[1].

Exhibit 3-2: Average Daily PTC Trips, September 2016 - March 2019



[1] 2016 Transportation Tomorrow Survey, Data Management Group, University of Toronto Transportation Research Institute

3.2 Trends in comparable North American cities point towards rapid growth in PTC trips

The City of Toronto is still in the early stages of PTC adoption relative to other comparable cities in North America. Exhibit 3-3 details the size of the PTC trip markets in other large cities across North America, along with their population and the year that PTCs first started operating. Chicago, a city of comparable population, hosts approximately 330,400 PTC trips daily, more than double that of Toronto. While it is impossible to know whether Toronto will reach this number of daily trips, it is noted that Chicago has had PTCs operating for 3 years longer than Toronto, and has witnessed consistent annual growth. While cities can differ greatly in their regulatory context, demographic makeup, and the size and population density of their urban cores, recent growth suggests that the PTC trip market in the City of Toronto is not as saturated as other cities and that growth in trips will likely continue for the foreseeable future.

Exhibit 3-3: Size of PTC Trip Markets in Other Jurisdictions

Jurisdiction	Daily PTC Trips	Dates	Population	First PTC Trip
New York City[2]	769,700	March 2019 Daily Average	8,400,000 (2018)	2011
Chicago[3]	330,400	March 2019 Daily Average	2,716,000 (2017)	2011
San Francisco[4]	170,000	Nov-Dec 2016 Typical Weekday	864,000 (2017)	2011
Toronto	**176,000**	**March 2019 Daily Average**	**2,956,000 (2018)**	**2014**
Boston[5]	95,600	2017 Daily Average	618,000 (2017)	2012
Seattle (King County)[6]	91,000	Q2 2018 Daily Average	1,931,000 (2017)	2011

[2] Schneider, Todd W. Taxi and Ridehailing Usage in New York City. Retrieved from: https://toddwschneider.com/dashboards/nyc-taxi-ridehailing-uber-lyft-data/

[3] City of Chicago. (2019). Transportation Network Providers – Trips | City of Chicago | Data Portal. Retrieved from: https://data.cityofchicago.org/Transportation/Transportation-Network-Providers-Trips/m6dm-c72p

[4] San Francisco County Transportation Authority. (2018). TNCs & Congestion. Retrieved from: https://www.sfcta.org/sites/default/files/2019-02/TNCs_Congestion_Report_181015_Final.pdf

[5] Commonwealth of Massachusetts. 2017 Data Report: Rideshare in Massachusetts. Retrieved from: https://tnc.sites.digital.mass.gov/

[6] The Seattle Times. (2018). How popular are Uber and Lyft in Seattle? Ridership numbers kept secret until recently give us a clue. Retrieved from: https://www.seattletimes.com/seattle-news/transportation/how-popular-are-uber-and-lyft-in-seattle-ridership-numbers-kept-secret-until-recently-give-us-a-clue/

3.3 PTC riders are younger and more likely to own a transit pass

This section summarizes the demographics of PTC users and how they compare to the general population of the City of Toronto as well as those that use taxis. This work relies heavily on the Transportation Tomorrow Survey (TTS), a large-scale travel demand survey that is conducted in the Greater Toronto and Hamilton Area (GTHA) every five years. The 2016 TTS was conducted in the fall of 2016 and was the first TTS to collect information on PTC trips as an explicit mode of travel. Uber was the main company operating in the GTHA at the time.

Exhibit 3-4 shows that the PTC user base is significantly younger than that of the general population and those that use taxis. A contributing factor is that younger users tend to be more digitally inclined, whereas smartphone-based applications can be a barrier to adoption for older adults. Taxis, on the other hand, were found to have a user base that is generally older than the general population. This is also reflected in Exhibit 3-5 which shows that taxi users are more likely to be without a driver's licence.

Exhibit 3-4: Age Distribution of Users, 2016 TTS

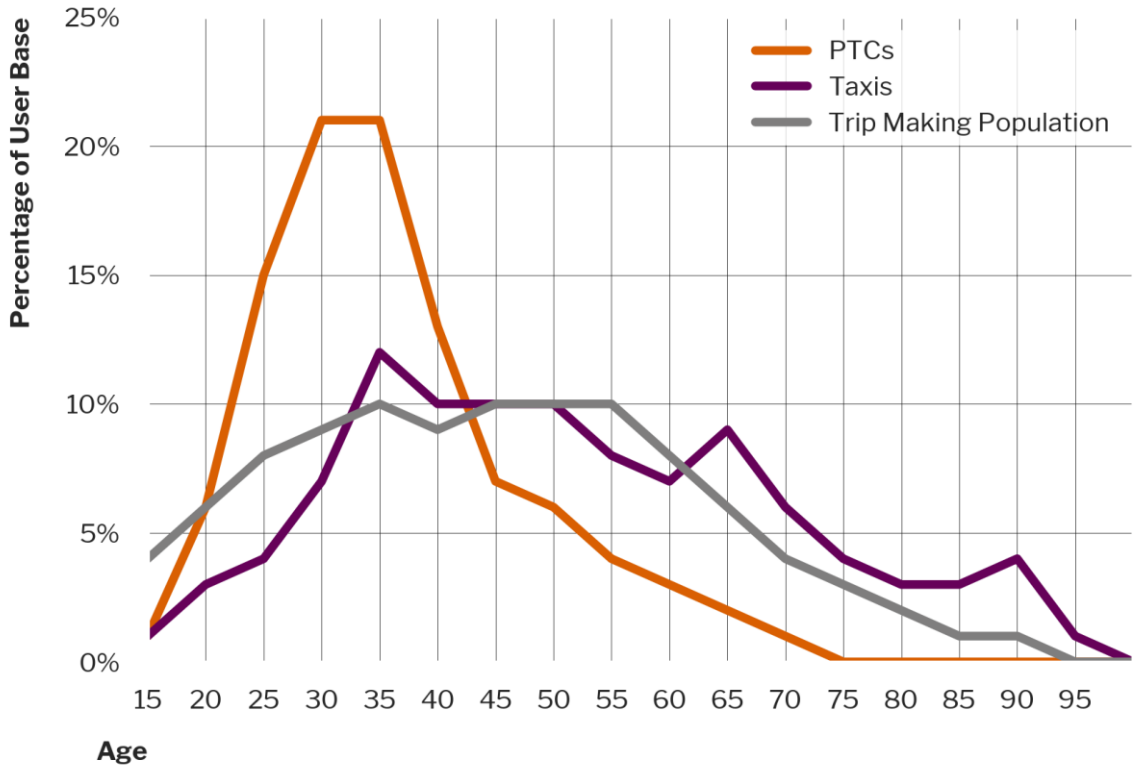
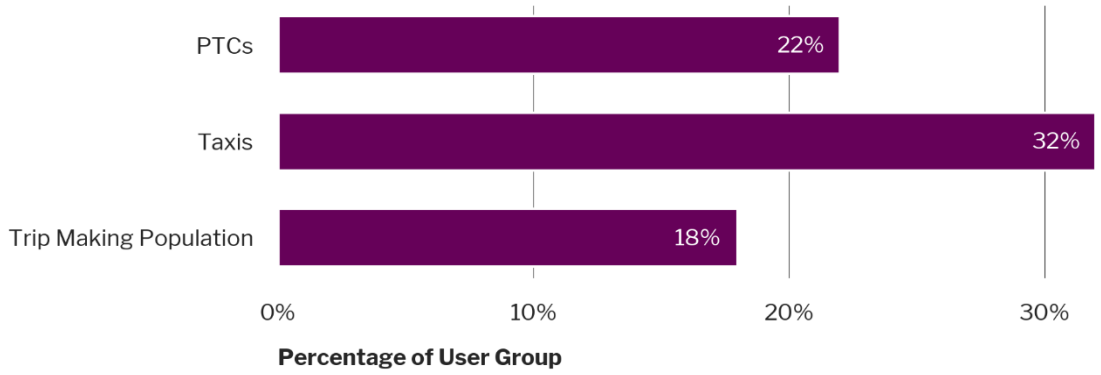
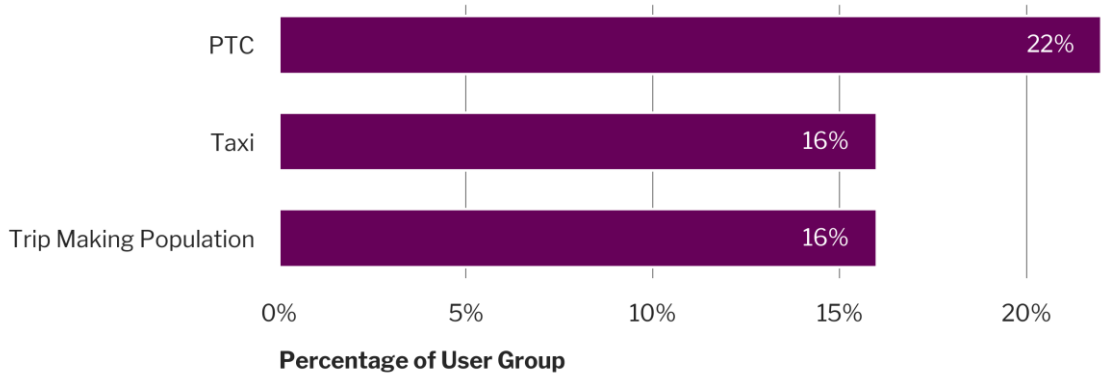


Exhibit 3-5: Users without Driver's Licences, 2016 TTS



About 20% of PTC Users own a transit pass as shown in Exhibit 3-6. Compared to taxi users, PTC users are nearly 40% more likely to have a transit pass. This suggests that more PTC riders are regular transit users overall.

Exhibit 3-6: Transit Pass Ownership Distribution, 2016 TTS

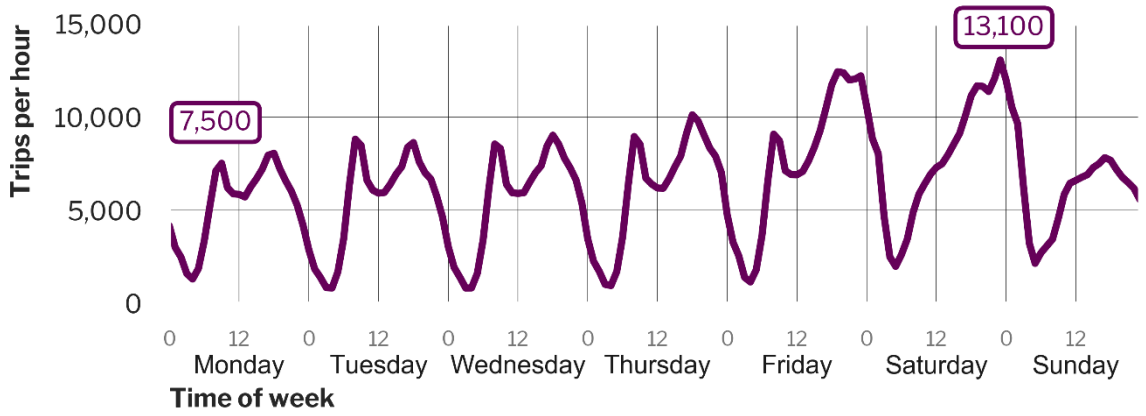


3.4 Nighttime economy and commuter travel are the largest trip markets

Exhibit 3-7 shows the average hourly trips completed over an average week in September 2018. Trips increase throughout the week from Monday through to Saturday. Generally, PTC trip-making peaks are observed in two distinct time periods:

- **Friday and Saturday Nights**: the busiest period by far for PTC travel is Friday and Saturday nights, peaking at an average 13,100 trips per hour at midnight on Sunday morning. This time period is typically associated with nightlife activity, which is reflected in the dominance of trips in the downtown Entertainment District during this time (see Section 3.10).
- **Weekday Commuting Periods:** PTCs are also heavily used in the traditional morning and afternoon peak periods, typically associated with the times during which the road network experiences the most traffic.

Exhibit 3-7: Trips by Time of Day and Day of Week, September 2018



3.5 PTC trips are concentrated downtown and at major transportation hubs

Exhibit 3-8 summarizes the growth in daily PTC trips in each of the four districts within the City between October 2016 and September 2018. While Toronto and East York experienced the lowest percentage growth of the four districts, it accounts for over 65% of all new trips since October 2016. Within Toronto and East York, the majority of activity is happening within the much smaller area bounded by Jarvis St in the East, Liberty Village in the West and Bloor St in the North.

Exhibit 3-8: Average Daily PTC Trips by District, October 2016 vs September 2018

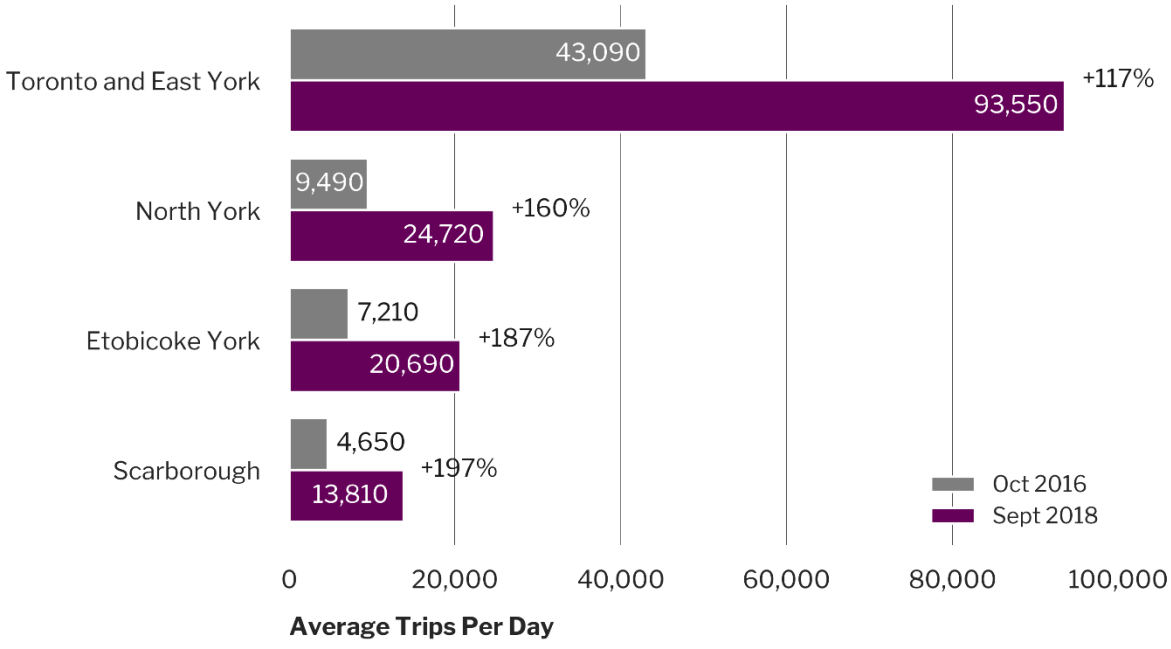


Exhibit 3-10 and Exhibit 3-11 show the areas of the City experiencing the heaviest concentration of pick-ups and drop-offs, respectively, over a two-year period. The vast majority of major trip concentration hotspots are

located within the downtown core, but there are discernable patterns in the surrounding neighborhoods as well:

- **Within the Downtown Core**: Significant trip hotspots include the major bar and restaurant districts of King Street West, Ossington Avenue, Little Italy, Yorkville and Cherry Street (Polson Pier), as well as the Financial District surrounding Bay Street and Wellington Street.
- **Outside the Downtown Core:** Trips are concentrated around major transit stations, shopping destinations (e.g. Yorkdale Mall, Sherway Gardens, Scarborough Town Centre), postsecondary institutions (e.g. York University, Humber College, University of Toronto Scarborough) and residential developments (e.g. Humber Bay Shores, Liberty Village).

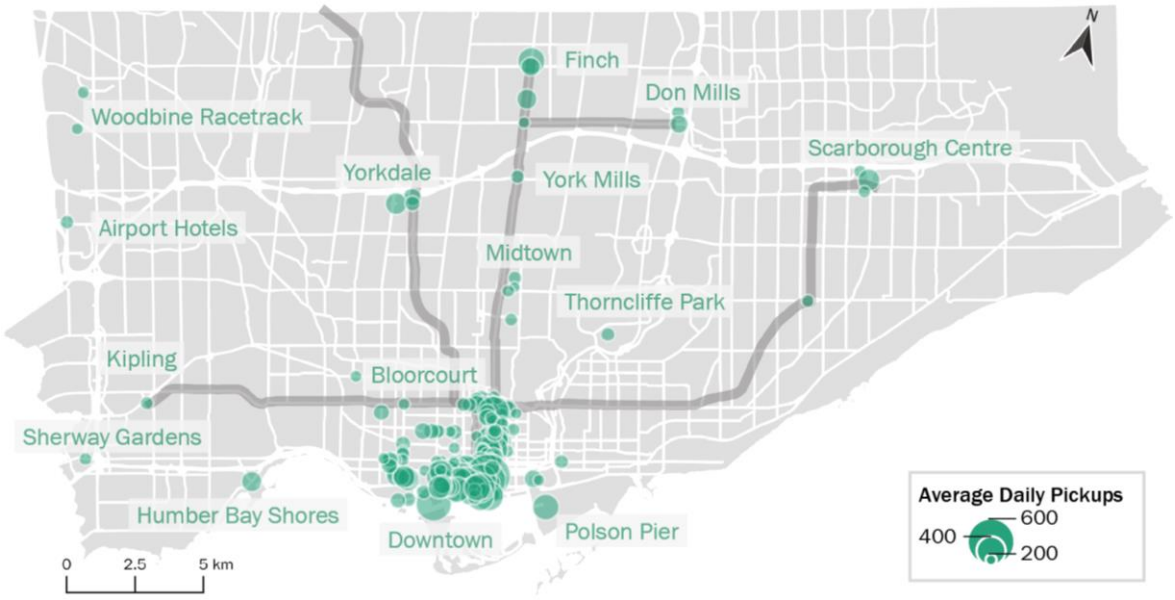
Exhibit 3-9 summarizes the ten most frequent pick-up and drop-off locations in the City of Toronto in September 2018. The most popular intersections are largely concentrated around the Financial District and Union Station, as well as Billy Bishop Airport. Appendix B maps the most popular intersections for each ward.

Exhibit 3-9: Top 10 PTC Pick-up/Drop-off Intersections in the City of Toronto, September 2018

Intersection	Location	Total Trips/Day
Bay and Wellington	Financial District	1,010
Stadium and Little Norway	Billy Bishop Airport	790
Bay and Front	Financial District	780
Yonge and St. Mary	Yorkville	710
University and Front	Financial District, Entertainment District	700
Bay and Queens Quay	Harbourfront	630
Yonge and Dundas	Eaton Centre	630
York and Bremner	Entertainment District	630
Bay and Dundas	Eaton Centre	600
Gerrard and O'Keefe Lane	Ryerson University	580

Exhibit 3-10: Average PTC Pick-ups, September 2018

A. City of Toronto



B. Downtown Toronto

Exhibit 3-11: Average PTC Drop-offs, – September 2018

A. City of Toronto

B. Downtown Toronto

3.6 The majority of PTC trips are less than six kilometres

As summarized in Exhibit 3-12, travel by PTCs is made up of mostly short distance trips, with almost 50% of trips being less than five kilometres and over 70% less than ten kilometers. Using average fare data published by Uber and Lyft, this corresponds to a cost of 10 to 15 dollars for most non-shared trips. This distribution is consistent with a trip market that is dominated by the downtown core.

Exhibit 3-12: Distribution of City-wide PTC Trip Distances, September 2018

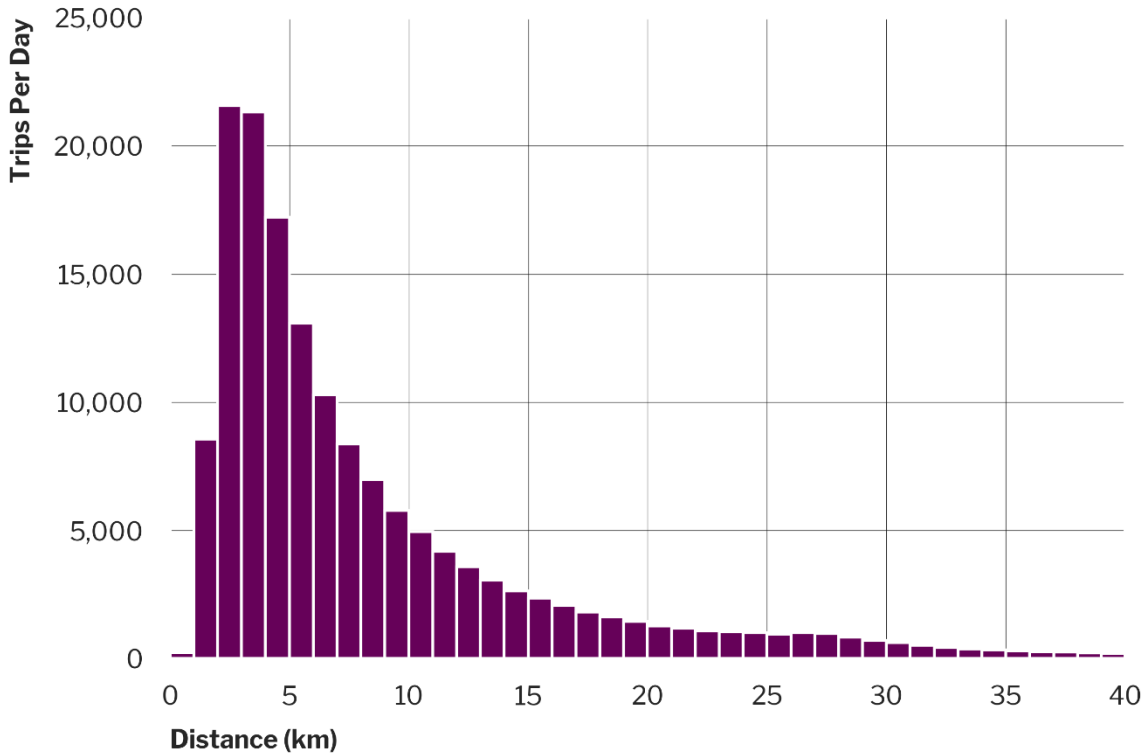
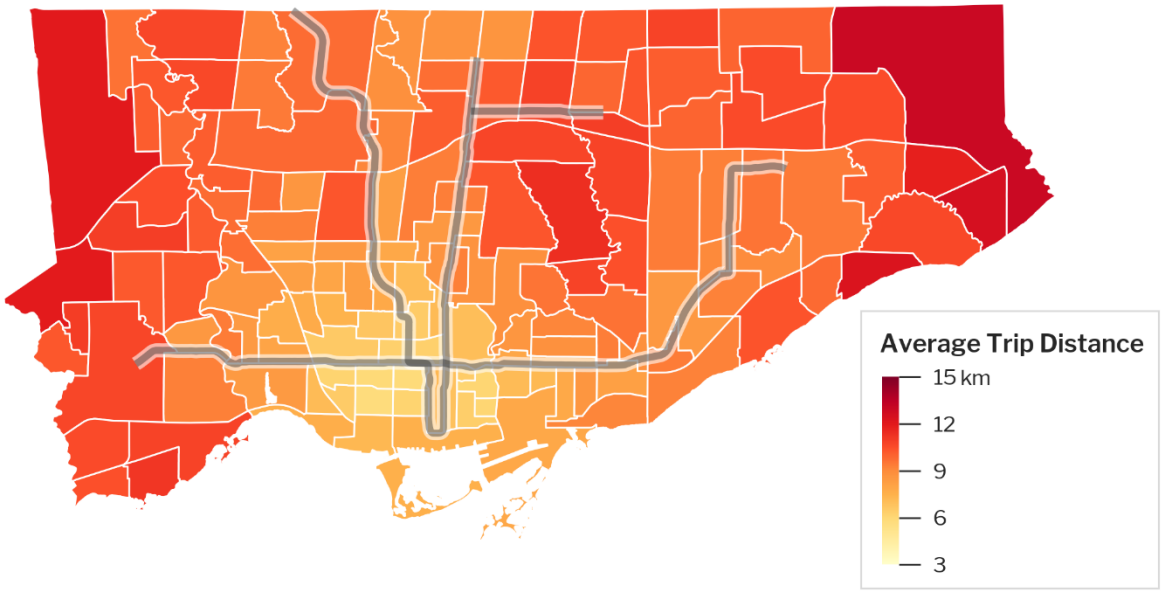


Exhibit 3-13 shows that median trip distances increase as the pick-up locations move farther out from the core. Average trip distances within downtown Toronto are less than five kilometres, increasing to ten kilometres or higher in parts of Etobicoke, Scarborough and North York.

Exhibit 3-13: Average PTC Trip Distance by Neighbourhood, September 2018



3.7 The busiest days are on celebration weekends

Exhibit 3-14 and Exhibit 3-15 highlight the days on which PTC usage was significantly higher or lower, respectively, relative to the daily averages observed on comparative days across a 5-week period. In general, these days are linked with some of the largest celebration dates in the City, with the Saturday before Halloween consistently being the busiest day of the year.

Exhibit 3-14: Busiest Days for PTC Trips

Date	PTC Trips	% Change from 5 Week Average	Potential Reason
Dec 31, 2018	199,200	44%	New Year's Eve
Jan 1, 2018	110,400	38%	New Year's Day
Dec 31, 2017	134,800	35%	New Year's Eve
May 25, 2017	93,400	35%	Heavy Rain
Oct 27, 2016	72,700	31%	Halloween
Dec 14, 2017	107,400	30%	Holidays
Dec 22, 2017	77,100	30%	Holidays
Apr 6, 2017	89,700	28%	Unknown
Dec 21, 2017	106,800	28%	Holidays
Oct 27, 2018	251,100	27%	Halloween

Over 250,000 PTC trips were taken on the Saturday prior to Halloween in 2018, 27% higher than Saturdays in October and November. Other peak days include New Year's Eve, St Patrick's Day, and the Pride Parade and Victoria Day weekends. Conversely, the slowest days of the year are mostly found on public holidays such as Christmas, New Year's Day, Thanksgiving,

March Break and Family Day. Appendix B shows the busiest hour of activity in each ward.

Exhibit 3-15: Lightest Days for PTC Trips

Date	PTC Trips	% Change from 5 Week Average	Potential Reason
Dec 25, 2016	41,500	-40%	Christmas
Dec 25, 2018	87,300	-39%	Christmas
Dec 26, 2018	96,200	-32%	Boxing Day
Oct 8, 2018	95,900	-32%	Thanksgiving
Jan 2, 2017	38,900	-32%	Post New Years
Dec 25, 2017	57,000	-30%	Christmas
Dec 24, 2016	64,900	-29%	Christmas Eve
Dec 28, 2018	136,600	-23%	Holidays
Apr 17, 2017	54,700	-22%	Good Friday
Feb 20, 2017	50,800	-22%	Family Day

3.8 Average wait times are under 4 minutes city-wide

Understanding the wait times for PTC users is key to understanding how PTC service levels have evolved, both over time and across the city. Average wait times provide important context for understanding spatial inequities and the competitiveness of PTCs with public transit.

The average wait time for completed trips in the City of Toronto has dropped from 4.2 minutes in September 2016 to 3.1 minutes in September 2018. As shown in Exhibit 3-17, wait times are comparable across the City with times ranging from 2.8 min in Toronto and East York up to 3.5 minutes in North York. Wait times have decreased up to two minutes on average in the past two years in most areas of the City (Exhibit 3-18).

Exhibit 3-16: Average Wait Times by District, September 2018

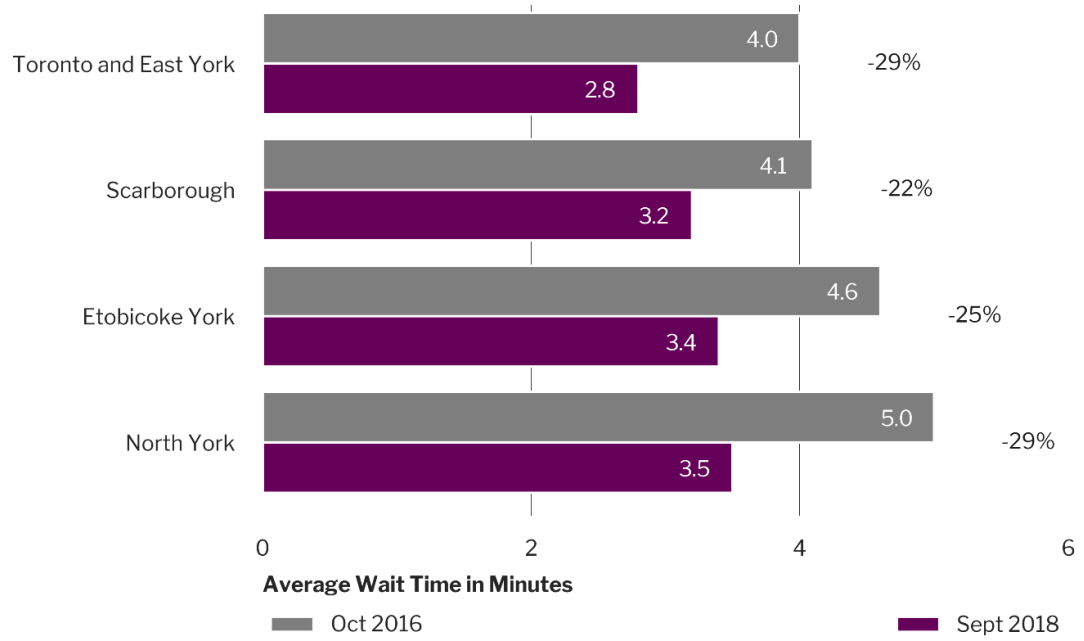


Exhibit 3-17: Wait Times by Neighbourhood, September 2018

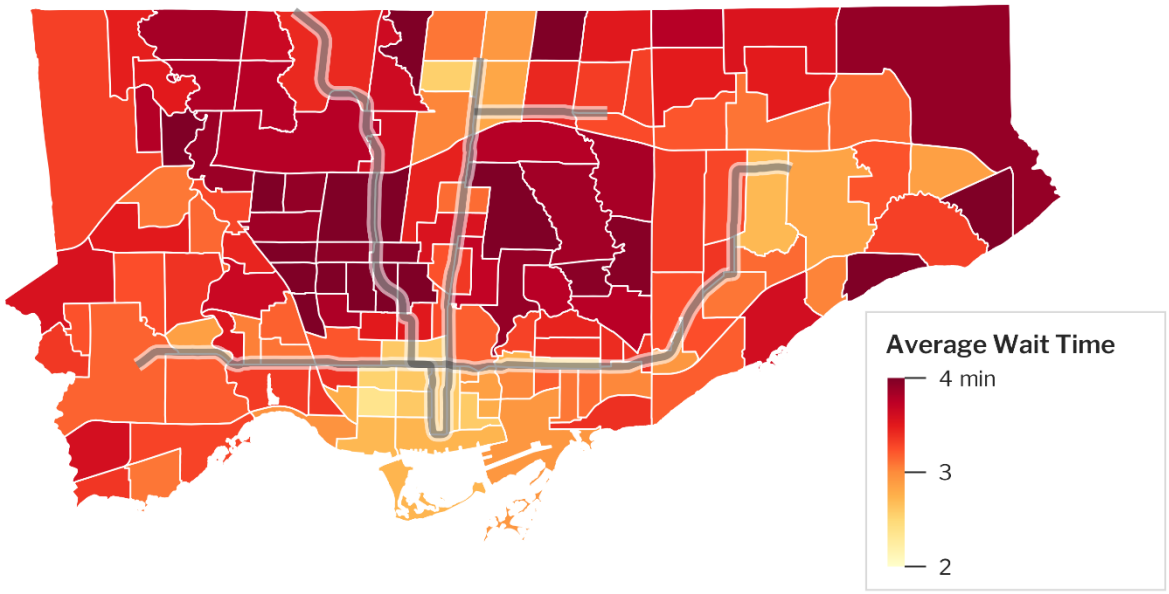
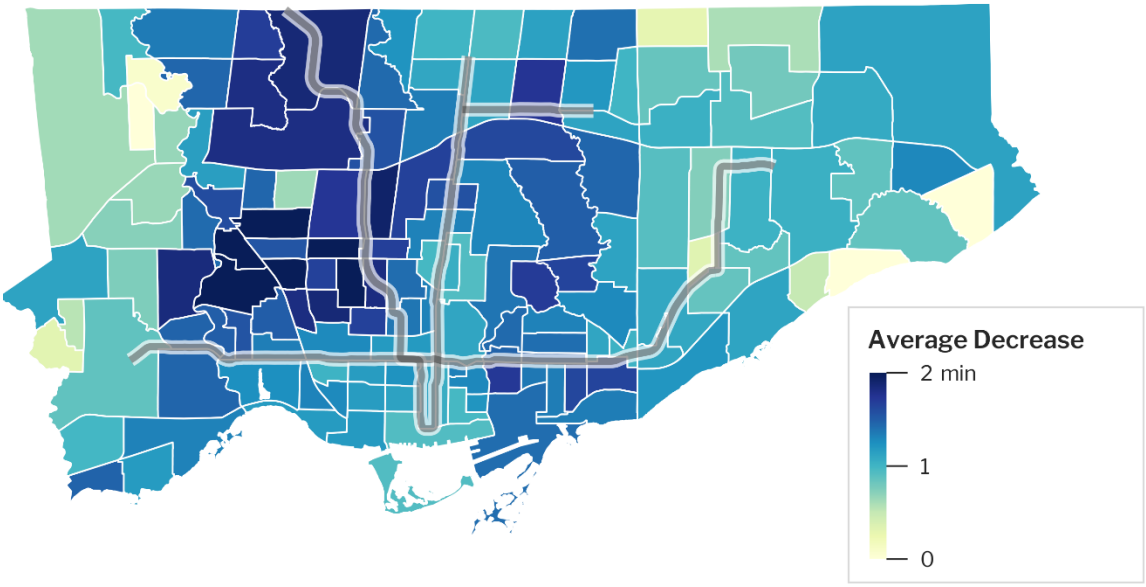


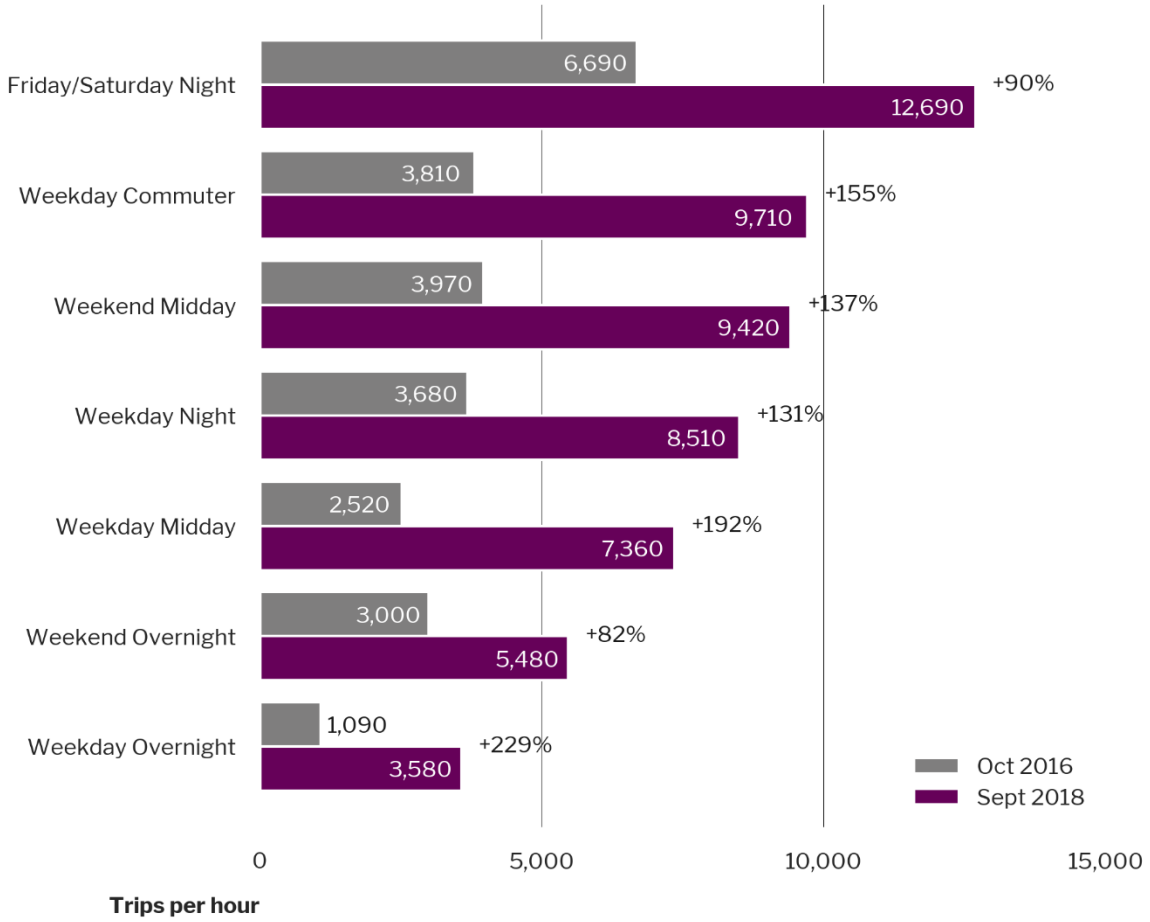
Exhibit 3-18: Wait Time Changes by Neighbourhood, September 2016 vs. September 2018



3.9 The commuter trip market is growing rapidly

Over a two-year period starting in September 2016, the nature of PTC travel demand has evolved from being primarily nighttime entertainment focused to an increasingly popular commuter travel option. As shown in Exhibit 3-19, Friday and Saturday night trips over these two years have grown by only 90% compared to overall growth of 155% in the commuter peak periods. Similar rapid growth has been observed in in the weekday midday, night and overnight periods.

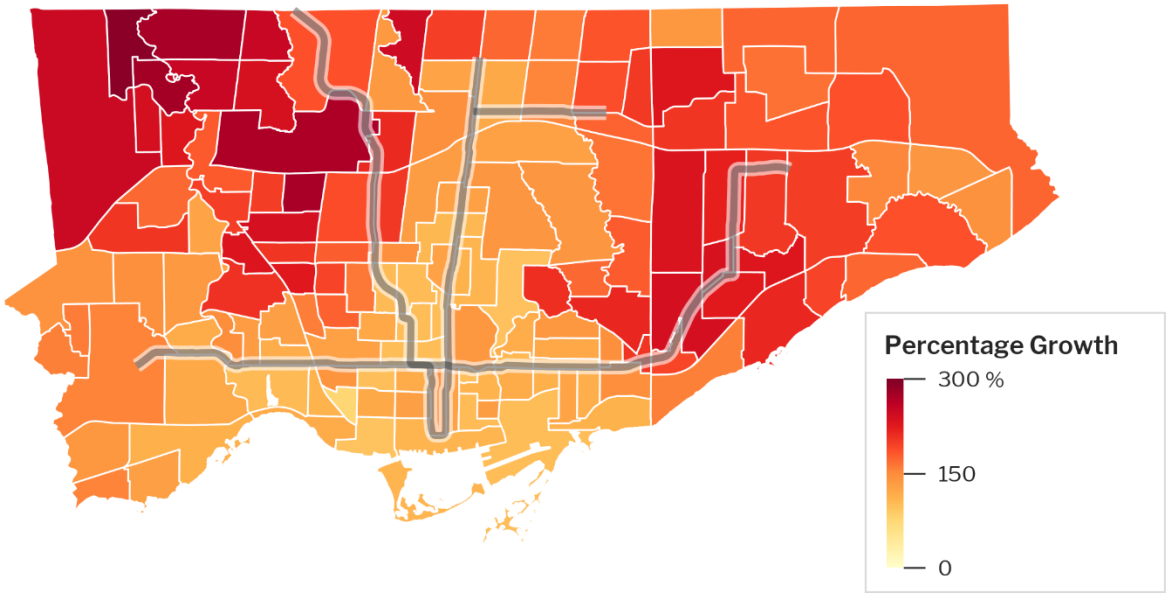
Exhibit 3-19: PTC Trip Growth by Time Period, October 2016 vs. September 2018



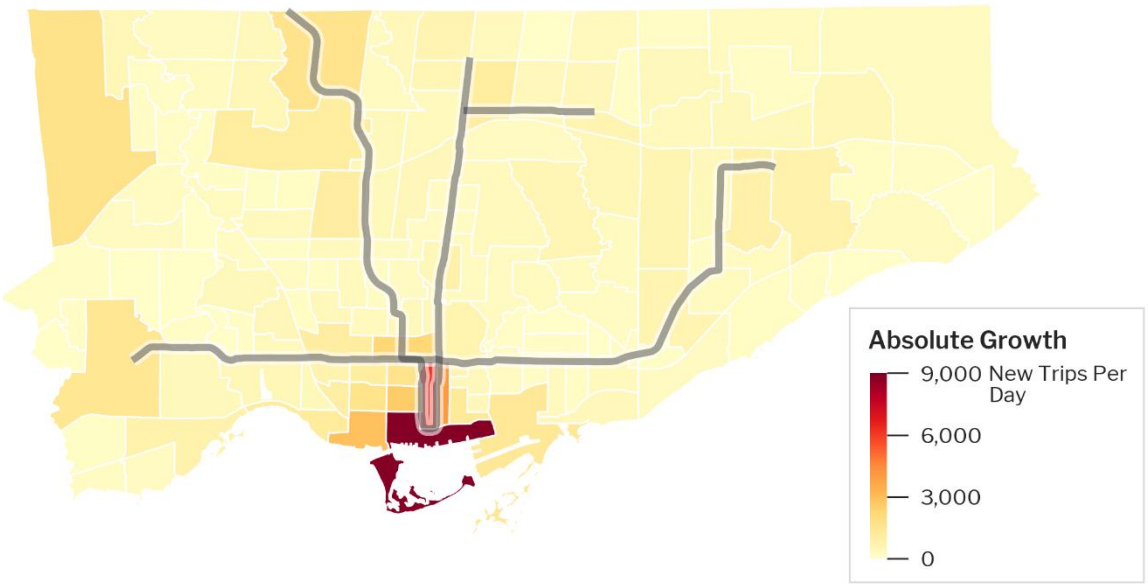
As shown previously in Section 3.5, PTC trips have grown fastest in the suburban areas of the city, with two-year growth of 197% in Scarborough, 160% in North York and 187% in Etobicoke, compared to only 117% in Toronto and East York. PTC service, however, is still largely concentrated downtown, with 61% of all pick-ups in September 2018 occurring within Toronto and East York. Exhibit 3-20 shows that the rate of growth in PTC trips tends to increase with distance away from Downtown Toronto, with the most rapid percentage growth being seen in North-West Etobicoke.

Exhibit 3-20: Growth in PTC Trips by Neighbourhood, October 2016 to September 2018

A. Percentage Growth



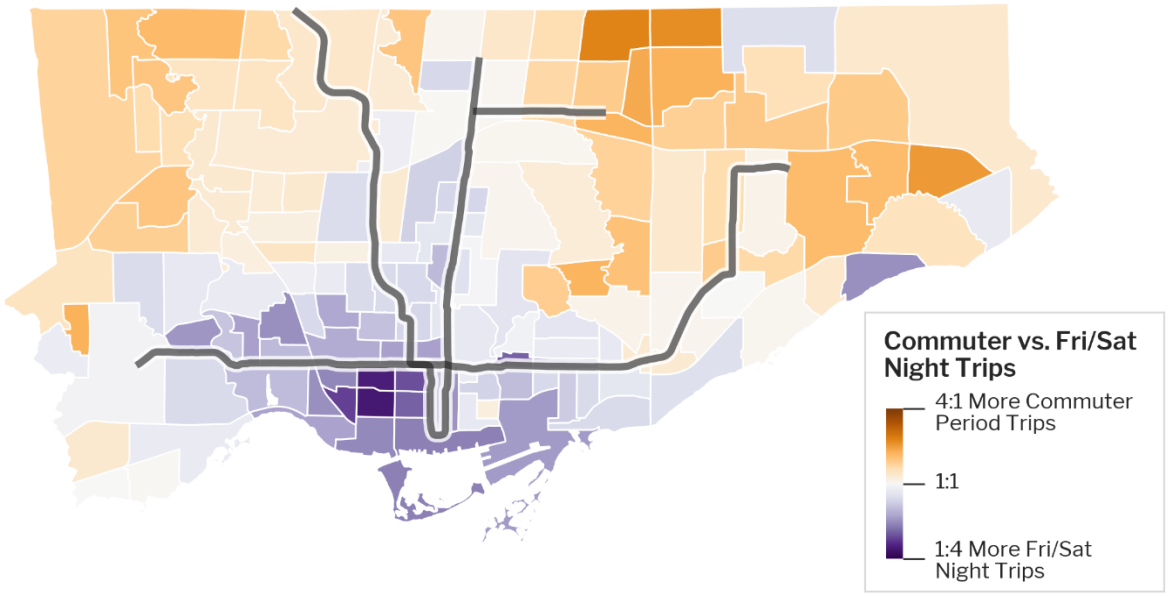
B. Absolute Growth



3.10 PTCs are more commuter-focused outside of Downtown

As detailed in the previous section, commuter trips are emerging as an important trip market that are being increasingly captured by PTCs. This is illustrated by Exhibit 3-21, which shows a landscape with two distinct geographies. Downtown neighbourhoods generally see more than two Friday and Saturday night trips for every weekday commuter period trip while the opposite is true in the suburbs where trips are much more commuter-focused.

Exhibit 3-21: Comparison of Commuter Trips vs Friday/Saturday Night Trips, September 2018



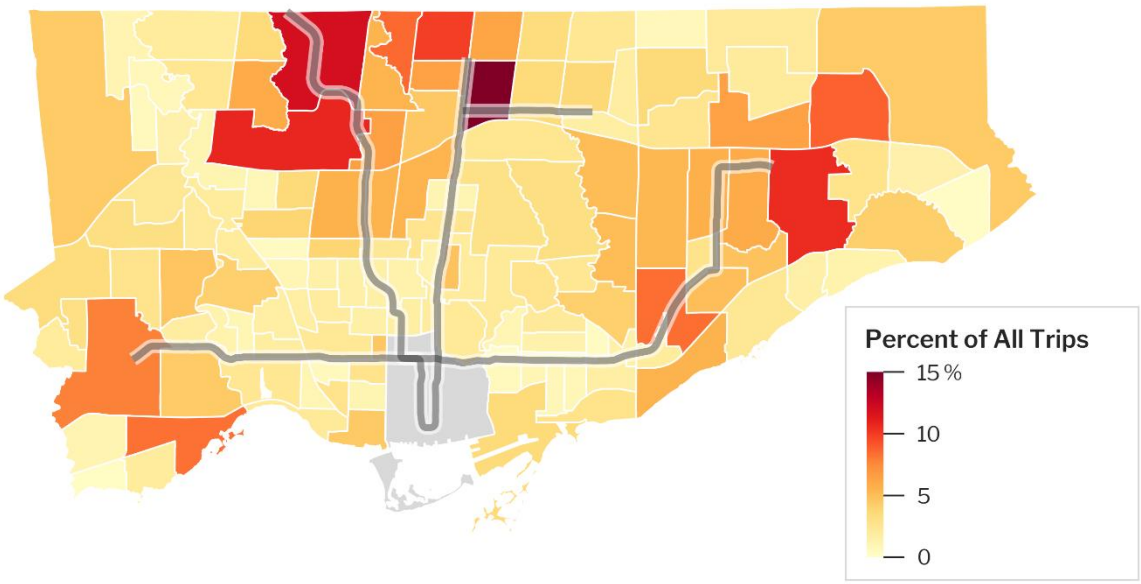
The distribution of trip destinations is critical to understanding the underlying trends driving the growth in suburban commute trips. Exhibit 3-22 summarizes the distribution of trip destinations for the weekday morning peak hour (8 to 9 a.m.) for PTC trips originating in Etobicoke, North York and Scarborough. The large majority of these trips are not destined for downtown, with many staying within the same neighbourhood or district.

Exhibit 3-22: Destination of AM Peak Period Trips

Pick-up District	Subway (%)	Within District (%)	Downtown (%)	Other Districts (%)
Etobicoke	7	41	12	41
North York	9	43	14	33
Scarborough	10	50	8	32

Exhibit 3-23 shows in further detail the proportion of trips by neighbourhood that are being taken by PTC users to access TTC subway stations. In general, trips to non-downtown subway stations make up approximately 3 to 12% of all trips outside of downtown, but the absolute trip volumes are still small overall. The busiest suburban subway station is Finch Station, which attracted an average of 27 PTC trips in the morning peak hour, approximately half the capacity of a standard TTC bus.

Exhibit 3-23: Proportion of AM Peak Hour Trips to Subway Stations



3.11 A quarter of overall PTC trips use shared ride services

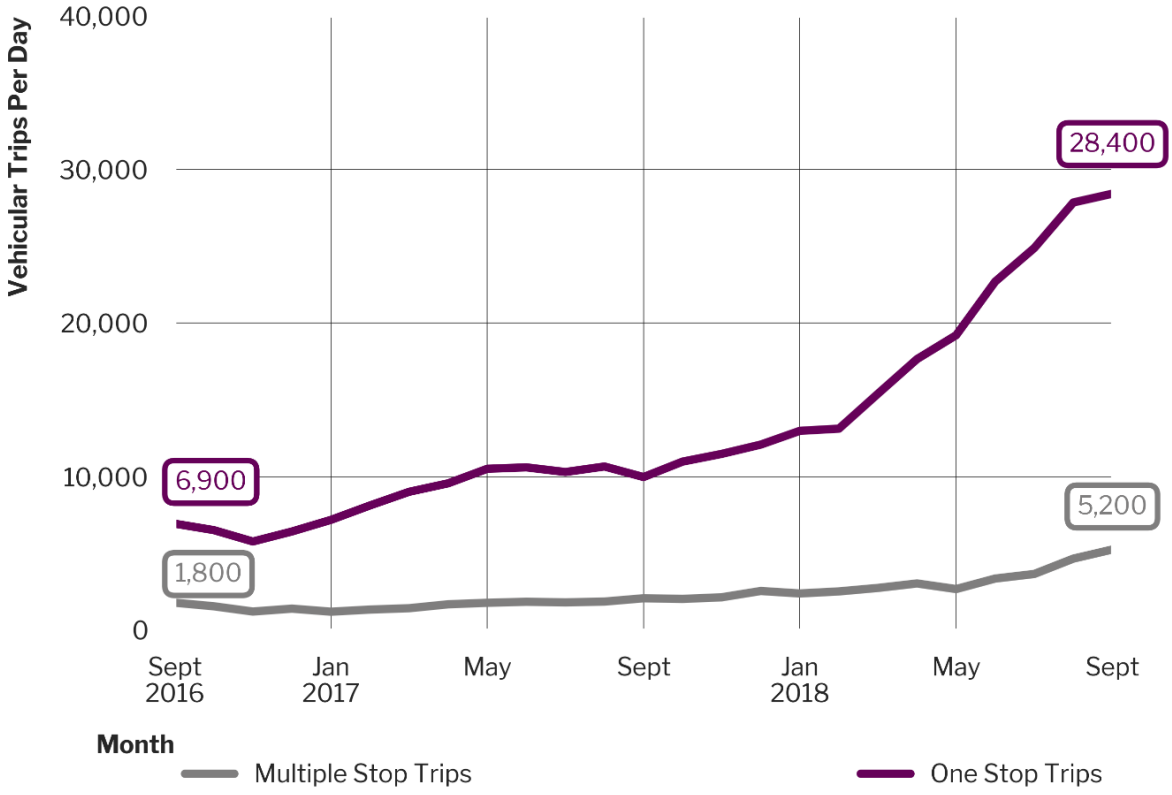
Shared ride services, such as Lyft Line and Uber Pool, are unique offerings that form a subset of the overall PTC trip market. These services chain together pick-ups and drop-offs and allow the driver to operate as a shared ride for multiple distinct customers, while providing passengers with a reduced fare. Exhibit 3-24 illustrates the growth in shared trips from about 6,900 trips/day in September 2016 to 28,400 in September 2018; this 140% growth is significant as shared trip requests have increased from 17% to 26% of all PTC trips (Exhibit 3-25).

While shared trip services are increasingly popular with PTC users, it appears that the large majority of these trips are being completed with no additional passengers. These services work by matching passengers with others heading on similar paths, but most trips result in passengers not being matched up with other users; in September 2018, only 5,200 (18%) of the total 28,400 daily shared ride trips made more than one distinct pick-up.

Exhibit 3-25 demonstrates that in the suburbs, especially in large sections of Etobicoke and North York, users are much more likely to order shared ride services. Up to 45% of trips in these areas are shared ride requests. In addition, shared ride trips in these neighbourhoods make fewer pick-ups on average than the city as a whole. As a result, passengers in these neighbourhoods are likely to receive a service identical to private PTC services while still benefiting from the lower price point of a shared ride.

Exhibit 3-24: Growth in Shared Ride Trips, September 2016 to September 2018

A. Total shared ride trips



B. Shared ride trip proportion of total trips

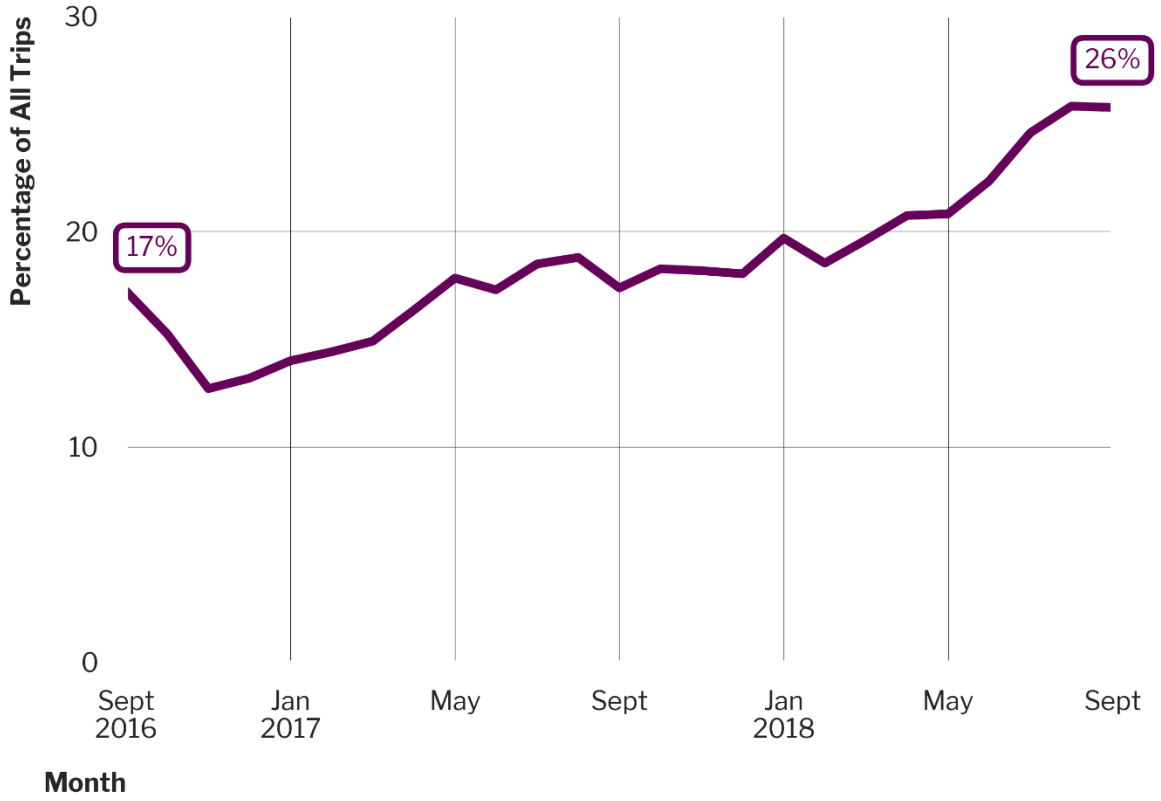


Exhibit 3-25: Proportion of Shared Ride Trips by Neighbourhood, September 2018

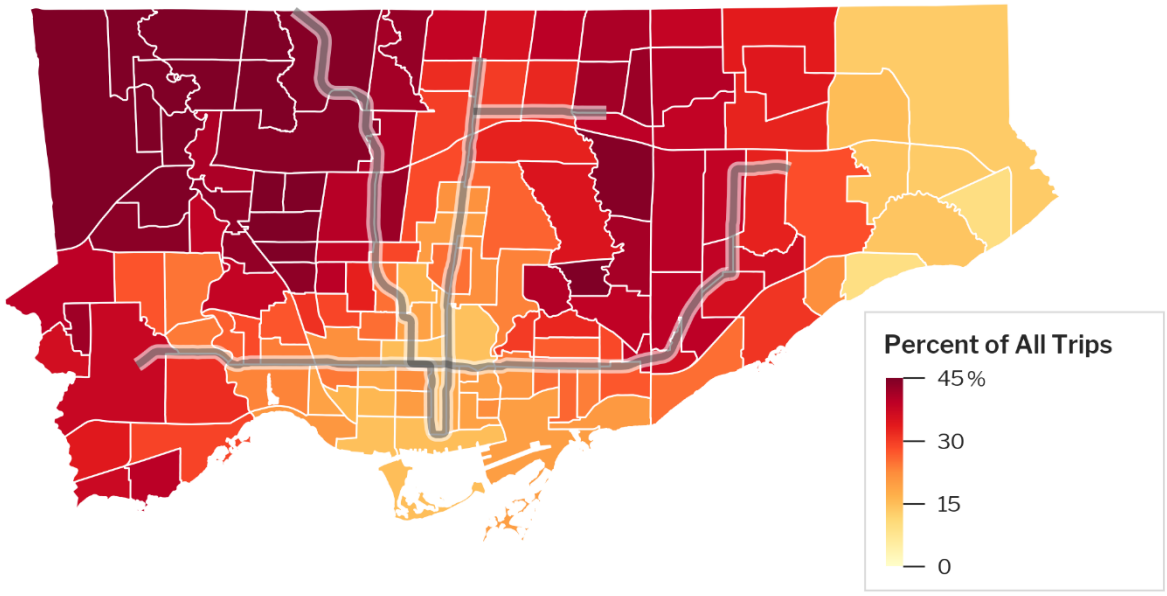
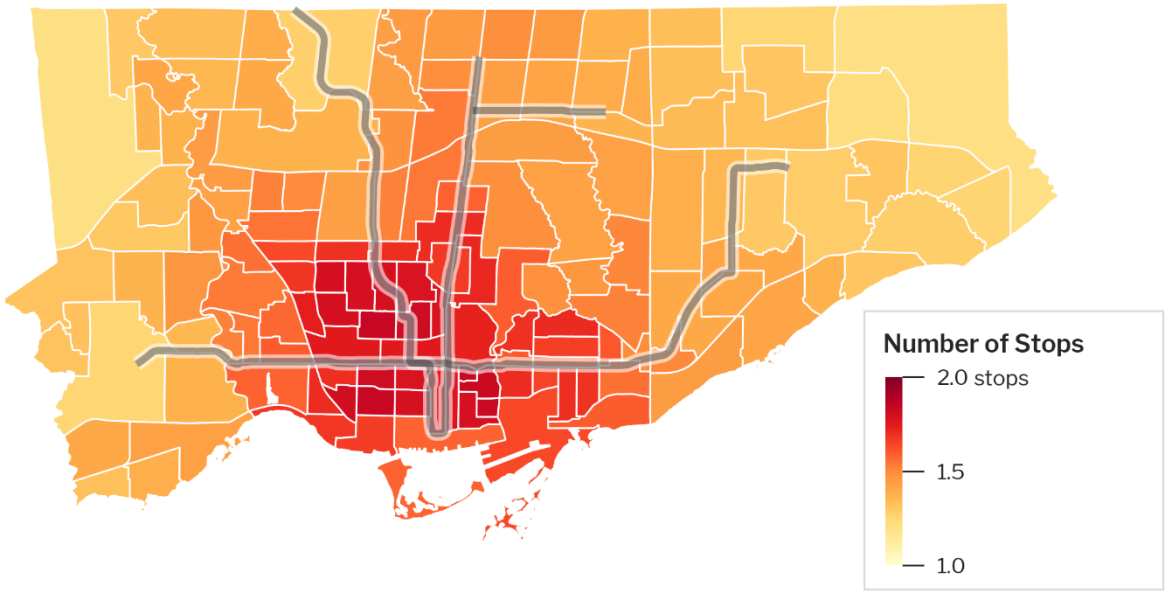


Exhibit 3-26: Average Number of Stops per Completed Shared Ride Trip, September 2018



4 Accessible Service

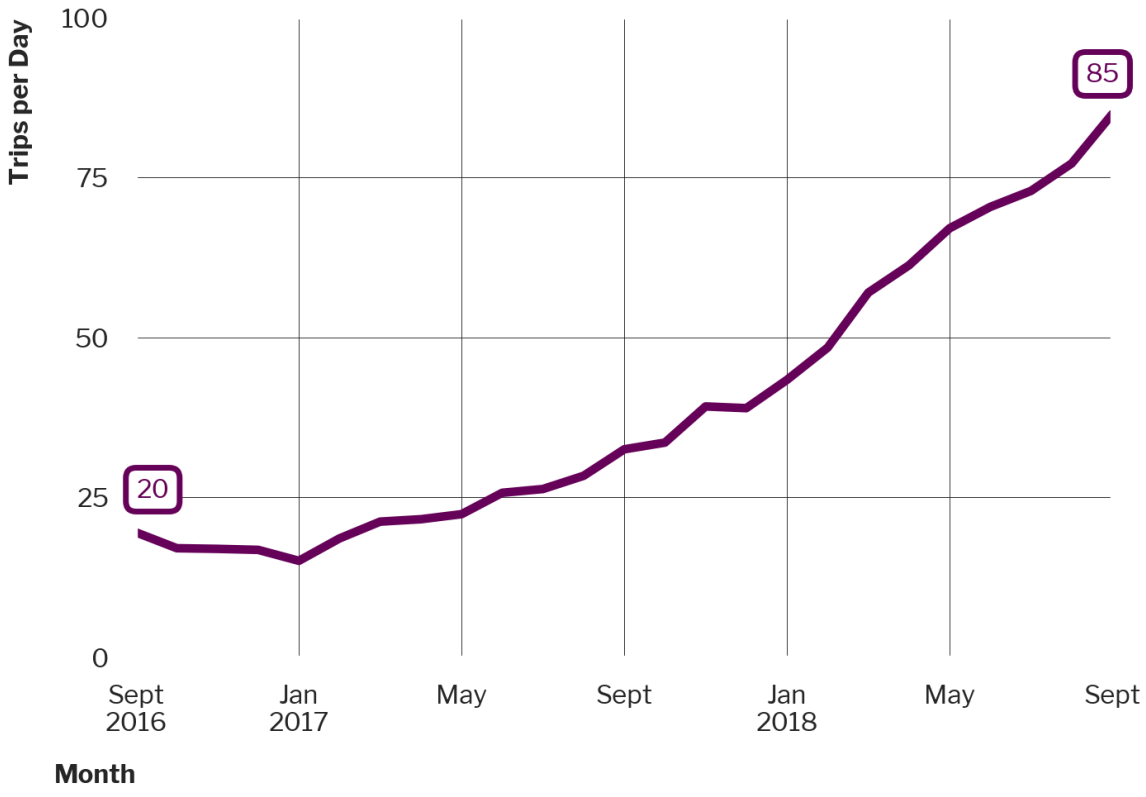
4.1 Fewer than 100 accessible (WAV) trips are made per day

In accordance with the Toronto Municipal Code, Chapter 546-119 Wheelchair Accessible Vehicle (WAV) service must be operated by any PTC in Toronto with more than 500 licensed drivers. The service is required to:

- Ensure wheelchair accessible vehicles are available when requested by a passenger through the PTC's platform within the average wait time for non-accessible taxicab services; and
- Charge fares for accessible vehicles that are the same or less than, the fare charged by that PTC for its lowest cost non-accessible service.

Only Uber currently offers these services under the WAV product category. Lyft is currently not operating in compliance with the bylaw per these requirements. Accessible trips are few but growing rapidly (see Exhibit 4-1): the average of 85 trips per day completed in September 2018 represent less than 0.1% of all PTC trips in Toronto.

Exhibit 4-1: Growth in Daily Wheelchair Accessible Trips, September 2016 – September 2018



As illustrated in Exhibit 4-2, time of week trends for WAV trips are different than those of all PTC trips. WAV trips tend to peak after noon rather than during the commuting periods, with no nocturnal activity peaks on Friday and Saturday. This pattern is likely due to a number of factors, including a larger amount of non-commuter trip purposes (shopping, medical appointments

etc.), people with mobility challenges potentially avoiding peak period travel and a lower availability of accessible options for Friday and Saturday night activities.

Exhibit 4-2: Percentage of Trips by Time of Week, All PTC Trips vs. WAV Trips

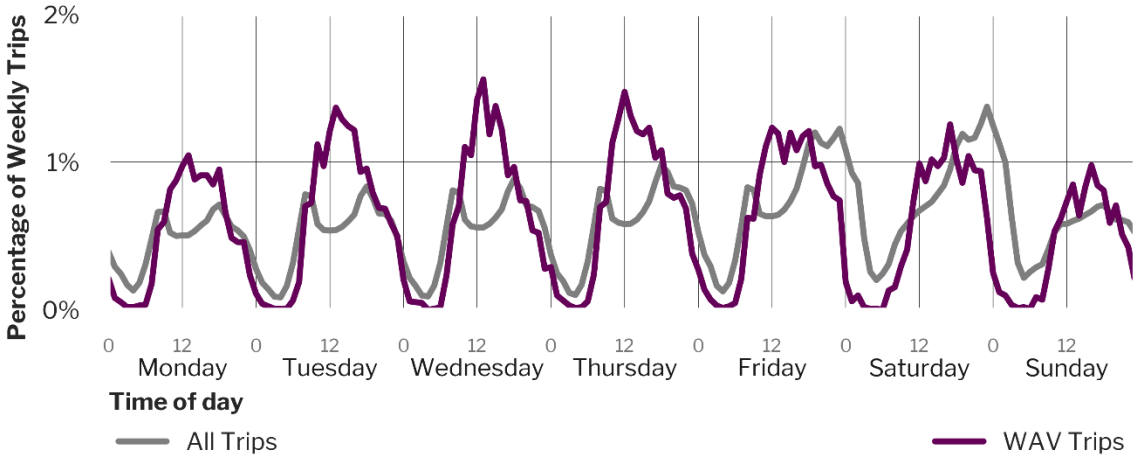
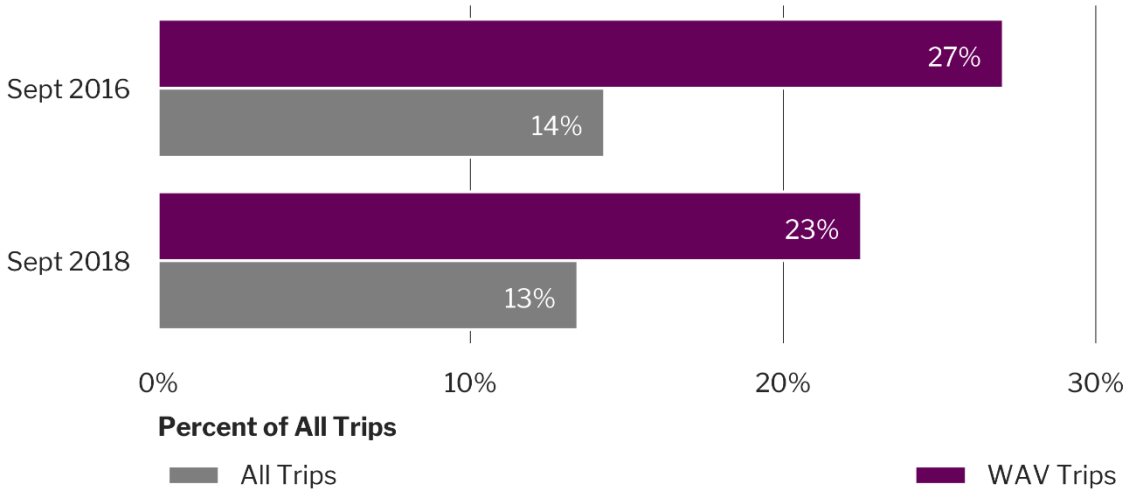


Exhibit 4-3 shows an estimate of the proportion of accessible trips that are made to intersections adjacent to healthcare facilities (defined as hospitals, clinics, long term care homes, retirement homes, disability centres, and labs) compared to the proportion of all PTC trips. In September 2018, 23% of accessible trips are destined to intersections with healthcare facilities compared to only 13% for the full population of PTC trips.

Exhibit 4-3: Percentage of Trips to Intersections Near Health Facilities, All PTC Trips vs. WAV Trips

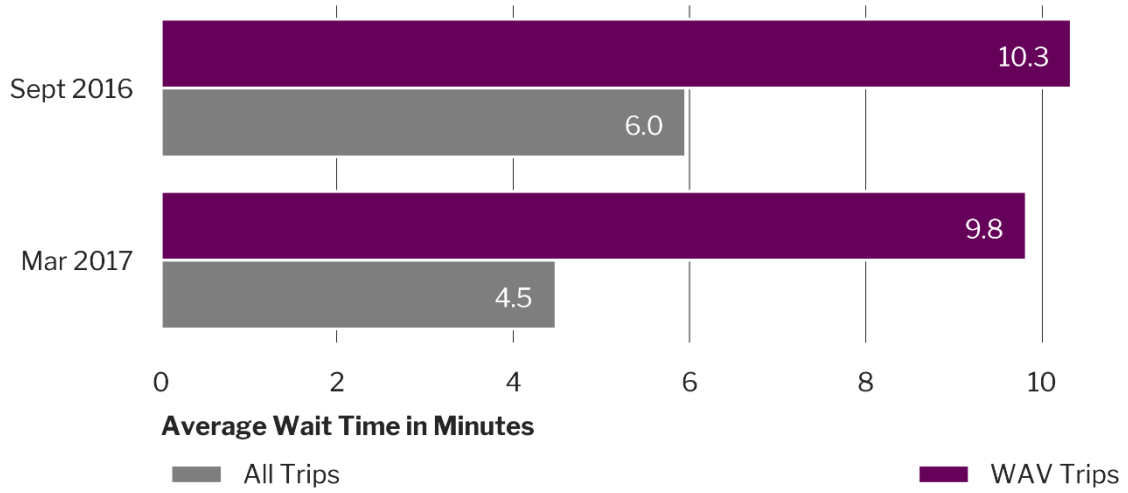


4.2 Wait times for WAV trips are longer than non-WAV trips

The Vehicle-for-Hire bylaw requires that wait times for accessible service is equivalent to that of non-accessible services. As of March 2017, however, passengers using the accessible service were subject to wait times that were

about two times longer than those of the non-accessible service (see Exhibit 4-4). This is not unexpected due to the low overall volume of accessible trips in the city and the small population of registered accessible vehicles (32 as of June 2019).

Exhibit 4-4: Average Wait Times by Month, All PTC Trips vs. WAV Trips



5 Mode Shift & Transit Impacts

The emergence and continued growth of PTCs in the City of Toronto impacts the demand for other modes of transportation, whether taxis, public transit, driving, walking or cycling. This section explores the links between PTCs and other modes, with a focus on its relationship with public transit. In particular, this analysis looks to answer the following questions:

- How have PTCs impacted travel decisions?
- How do transit service levels compare with PTC services for the same locations and times?
- Are PTCs compensating for gaps in transit service?

Further work is needed to understand how the relationships and observations described in this section have impacted transit ridership in the City. This work would require a study of ridership data across the City while building in relationships from market research on travel behaviour patterns as introduced in Section 5.1.

5.1 PTC users' second choice is most often transit or taxi

The University of Toronto Transportation Research Institute (UTTRI) conducted a survey of City of Toronto residents in May 2019 to determine factors that influence residents' choices for if and when they choose to use PTC services in the City. In total, 723 participants completed the survey. See Appendix A for further information on the survey design and results. Survey participants were asked a series of questions that reflect real (revealed-preference) or hypothetical (stated-preference) decisions to identify, in part, which modes were directly competing with PTCs. Revealed preference questions are able to ask details of a recent trip, while the stated preference question is used to look in more detail at trade-offs between time, cost and other attributes of the trip. Of the survey respondents, 65% reported that they had used a PTC service at least once of which half had a PTC app installed on their phone at the time of the survey.

As detailed in Exhibit 5-1, 49% of the 409 respondents stated that they would have taken public transit in the absence of PTCs for their most recent PTC trip, while 33% would have taken a taxi. The remaining 18% would have driven, been driven by someone, walked, biked, or would have not made the trip at all. Of the above respondents, only 60 had taken commuting trips recently. For their most recent commuting trip, as summarized in Exhibit 5-2, 58% of respondents would have taken transit in the absence of PTCs and 20% would have taken a taxi.

Exhibit 5-1: The Second Choice Mode for the Most Recent PTC Trip (Revealed Preference)

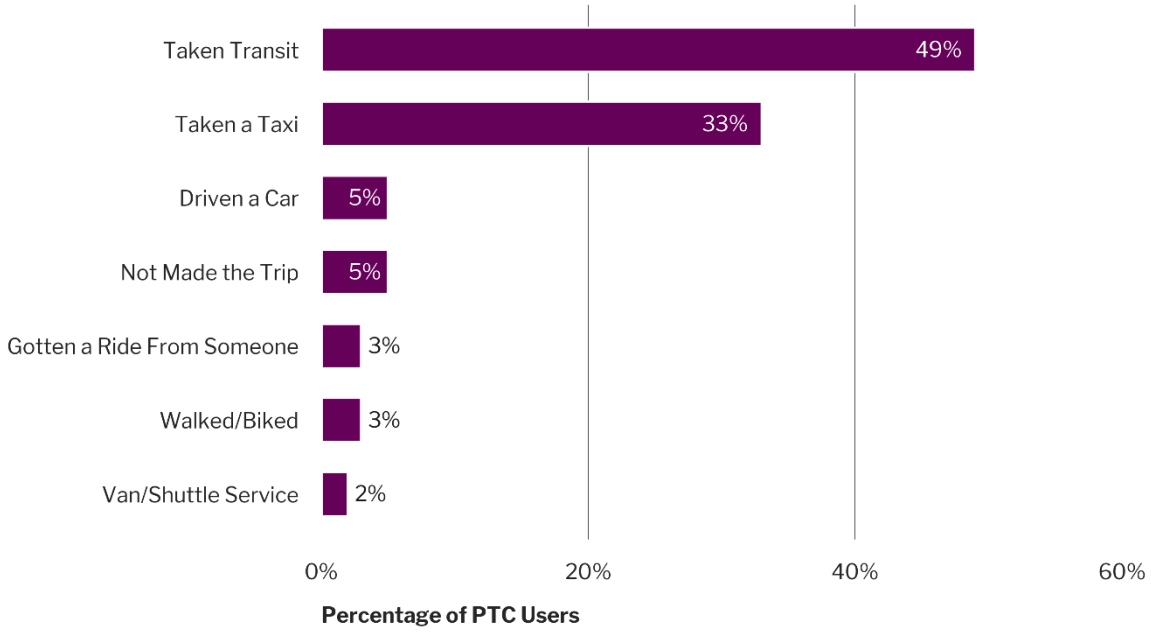
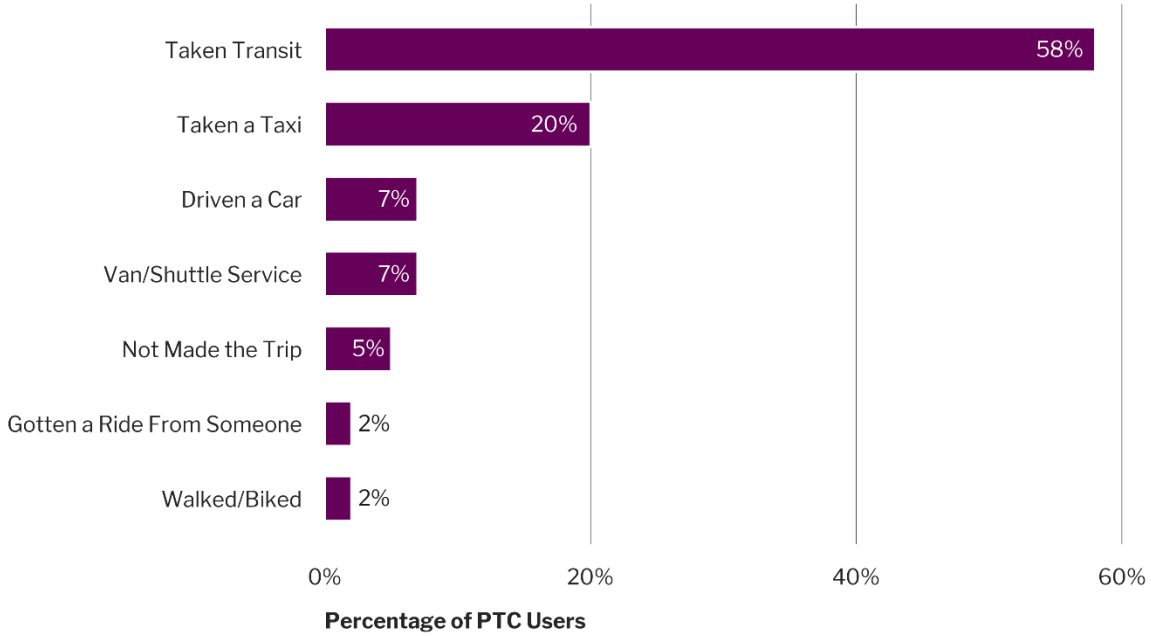


Exhibit 5-2: The Second Choice Mode for the Most Recent Commuting PTC Trip (Revealed Preference)



Respondents were also given hypothetical scenarios in which they were asked to make direct trade-offs between time, cost, and other relevant factors (comfort, convenience, etc.) As detailed in Exhibit 5-3, the modes most commonly replaced by PTCs within these hypothetical scenarios were transit (60% for commute trips, 35% for non-commute trips) and driving alone (24% for commute, 27% for non-commute). Of note, significantly fewer people (less than 1%) would have taken a taxi as their second option.

Exhibit 5-3: Travel Modes Replaced by PTC by Purpose (Stated Preference)

Travel Mode	Commute	Non-Commute
Drive yourself	62	74
Driven by Someone You Know	21	27
Public Transit	152	94
Taxi	2	2
Bicycle	0	4
Walking	17	70
Total	254	271

The survey results also revealed that mode choices are in large part driven by the importance users place on some key factors:

- Public Transit riders placed greater importance on travel time and reliability, factors that can be controlled to a certain extent through operations and planning.
- PTC users placed greater importance on convenience, comfort and safety. In addition, about two-thirds of respondents indicated that they were more likely to choose ride-hailing services than public transit if they are running late for an appointment or meeting.

5.2 PTCs are competing with transit but are also filling gaps in service

In order to understand the relative differences in service levels between PTCs and public transit in Toronto, the characteristics of trips completed by PTCs were compared to hypothetical transit trips conducted between the same origins and destinations on the same date and at the same time. UTTRI completed this analysis on a representative sample of PTC trips from September 2016 to April 2017 (see Appendix A). This helped identify where and when public transit had comparable travel times with PTCs and trips where PTCs offered significant travel time savings.

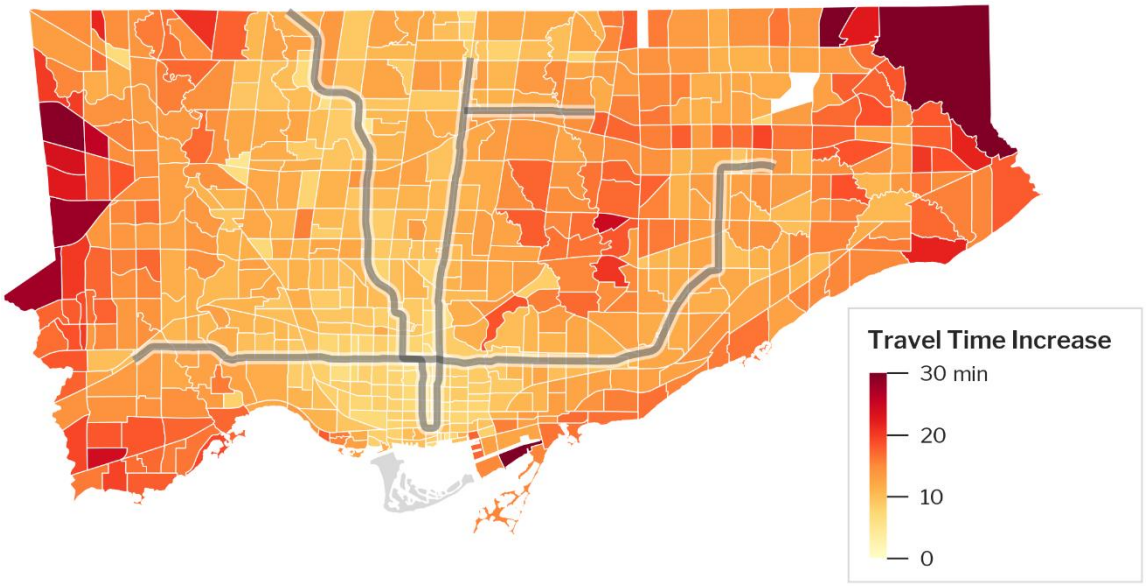
While direct comparisons of total travel time are instructive, research in travel behaviour has established that time spent outside of a vehicle (waiting, walking or transferring) is experienced very differently by users than the time spent in-vehicle. As a result, the analysis presented here splits travel time in to its component pieces:

- **In-Vehicle Travel Time:** Time spent inside a vehicle (e.g. a streetcar or PTC vehicle) that is en-route to its destination.
- **Out-of-Vehicle Travel Time:** Time spent either waiting for a vehicle or walking.

Exhibit 5-4 shows that transit trips in the downtown core are on average 5-11 minutes longer than those equivalent trips taken by PTCs. Outside of the

core, most trips are 8-20 minutes longer. PTCs offer substantial travel time savings for most trips, even when trips begin or end in close proximity to the subway network where transit speeds are fastest.

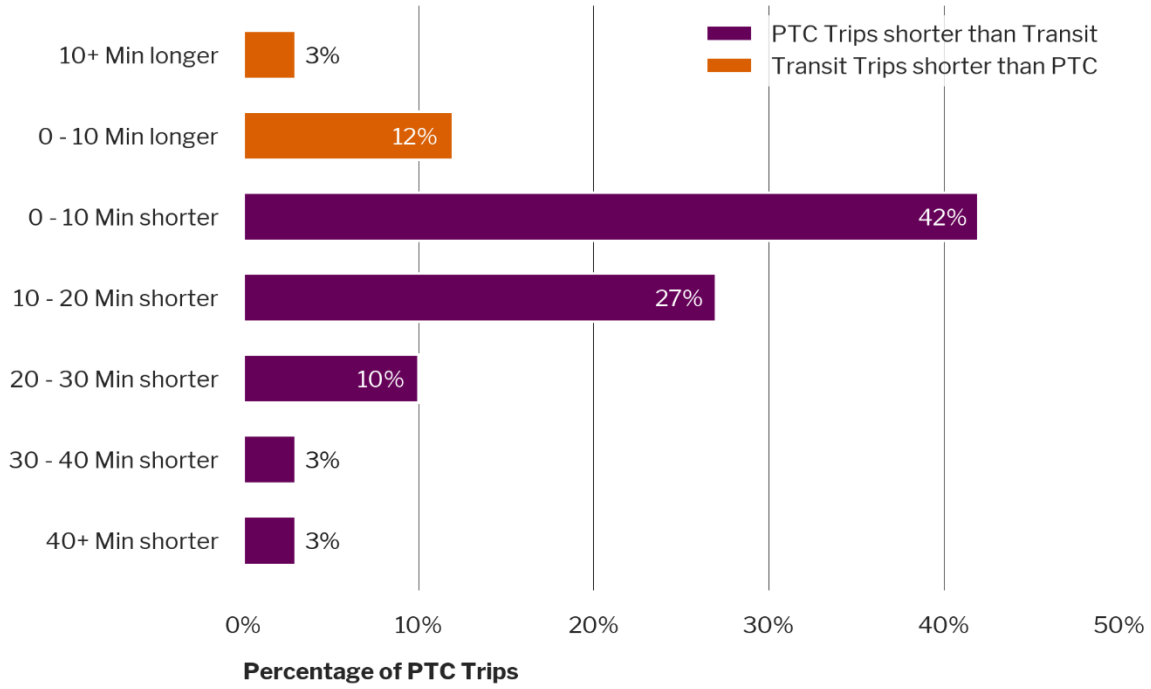
Exhibit 5-4: Average Difference in Total Transit Time, Transit vs. PTC



On average, trips made using transit are 12 minutes (57%) longer than the equivalent PTC trip, with 20% of trips being more than twice as long. Exhibit 5-5 illustrates that while most trips are longer by transit, 15% of PTC trips would have been faster by transit. These PTC trips tend to be travelling at slower speeds, indicating that they have potentially been slowed by traffic congestion. This congestion would equally affect transit travel times if the alternative routes are on the surface and in mixed traffic.

For 7% of all PTC trips, walking would have been faster than taking transit as an alternative. 75% of these trips are less than 1.5 km long and tend to occur overnight and in the downtown.

Exhibit 5-5: Distribution of PTC Travel Times vs. Comparable Transit Travel Time

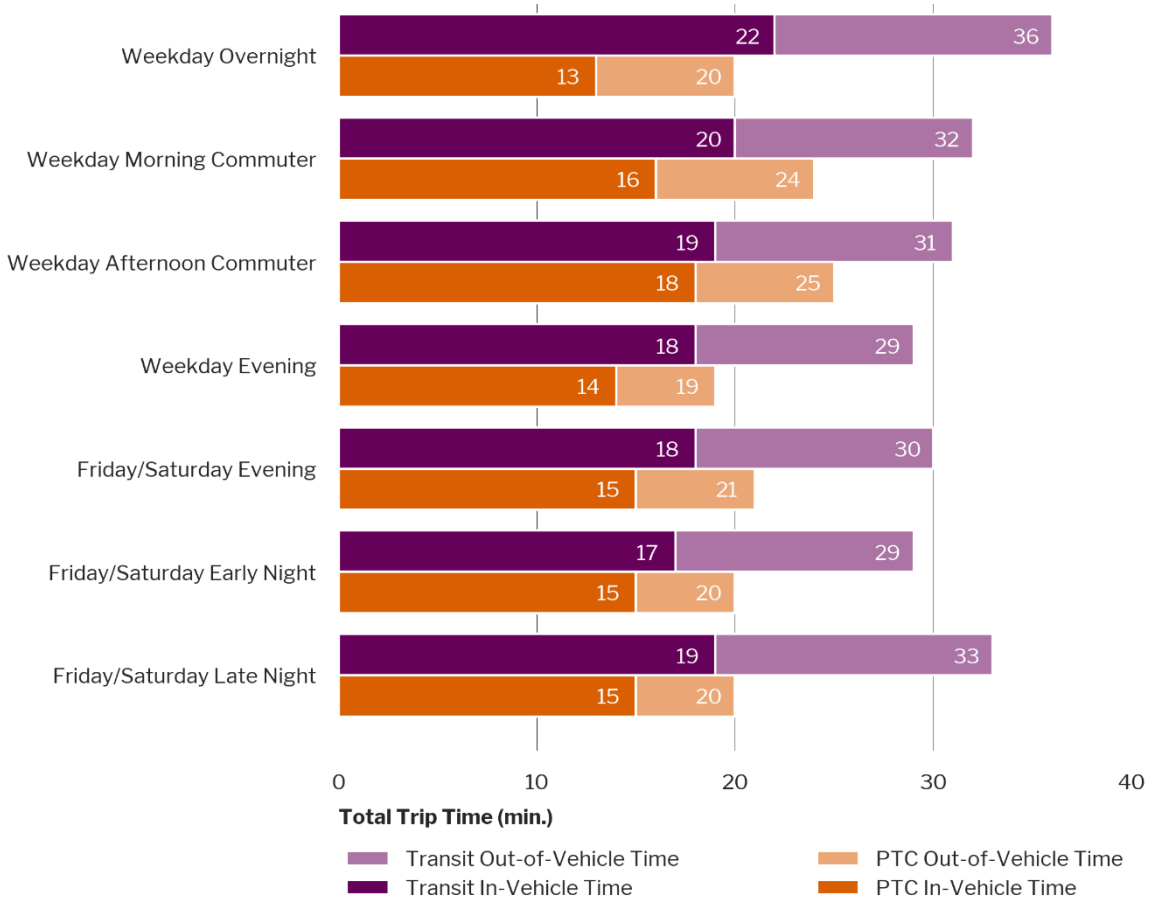


5.3 PTCs save the most time compared to transit outside of peak commuting periods

The travel time difference between the PTCs and transit is mostly due to the additional out-of-vehicle time spent walking to a transit stop or waiting for a vehicle to arrive. The average PTC in-vehicle time was 15 minutes compared to an average of 19 minutes for transit. As summarized in Exhibit 5-6, 64% of the total difference in travel times between PTCs and transit is explained by differences in out-of-vehicle travel time.

As was outlined in Section 3.4, fewer PTC trips are made overnight and outside of the downtown core, however the PTC users traveling in these times and locations see large travel time benefits from using PTCs. For these trips markets, the best transit alternative is at least 70% longer and in some cases infeasible. Conversely, travel in the downtown core and during peak hours is where and when public transit is the most competitive with PTCs. For these trips, time savings are often 5-10 minutes.

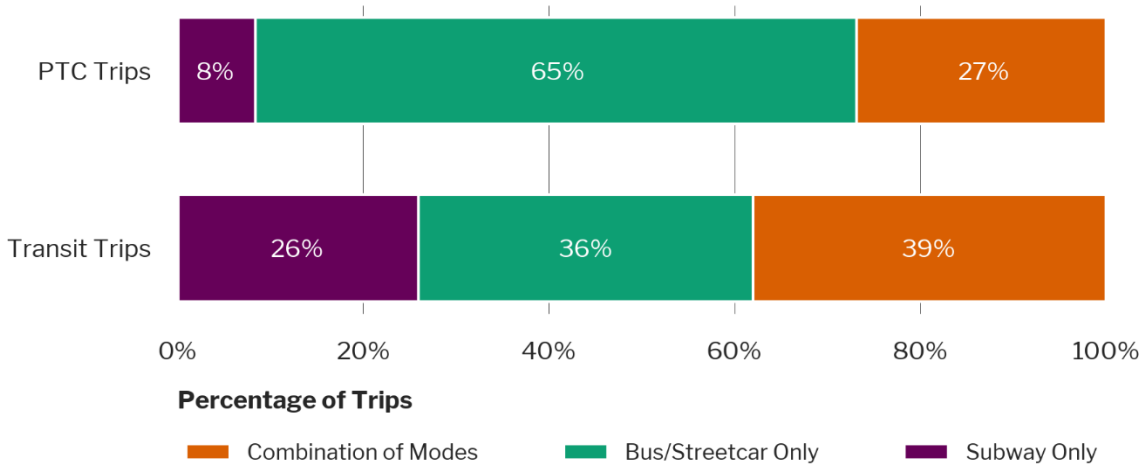
Exhibit 5-6: In-vehicle and Out-of-vehicle Transit Time (Waiting and Walking) by Time Period, (PTC vs Transit)



5.4 PTC trips are largely competing with surface transit routes

Exhibit 5-7 compares the distributions of transit mode usage (subway vs. other surface transit) for all transit trips with those that could have been taken instead of a PTC trip. PTC trips often do not both start and end near a subway station, and subway alone trips would be the alternative for fewer than 9% of all PTC trips (26% of all TTC trips are made using subway alone). Of transit trips that would have replaced those made by PTCs, 65% would not have accessed the subway network at all, compared to only 36% for all transit trips made in the city. These proportions are stable for the sample of PTC trips throughout the week, outside of those made during overnight hours when the subway is closed.

Exhibit 5-7: Distribution of Comparable TTC Trips by Surface vs. Subway



5.5 PTC activity near subway stations increases significantly during disruptions

While PTCs can directly compete with public transit, they also provide a viable alternative to transit users during transit service disruptions. To determine the extent that this alternative is being used by transit users, subway disruptions were identified using public TTC subway delay data and matched with PTC pick-up data near the affected subway stations. As detailed in Exhibit 5-8, PTC demand increases significantly near stations affected by significant subway disruptions, particularly when delays exceed 15 minutes.

While PTC services can increase the resiliency of the transportation network, they also have been noted to create operations issues interfering with shuttle bus service. Shuttle buses are dispatched by the TTC when delays are predicted to be greater than 30 minutes.

While 67.5% of subway disruptions cause delays totalling less than five minutes, for all disruptions greater than 5 minutes, there is an increase of on average 21% in PTC usage near affected stations. This is equivalent to approximately 1.5 extra pick-ups per hour. As delays increase from 5-10 minutes to over 30 minutes, PTC demand increases from 9% to over 100% are seen. An example of this increase is illustrated in Exhibit 5-9, which shows a large increase in PTC activity on June 18, 2018 at College Station relative to the same time period the following day. TTC service was significantly affected as a result of a 76-minute subway disruption that morning.

Exhibit 5-8: Percentage Increase in PTC Activity by Length of Subway Delay

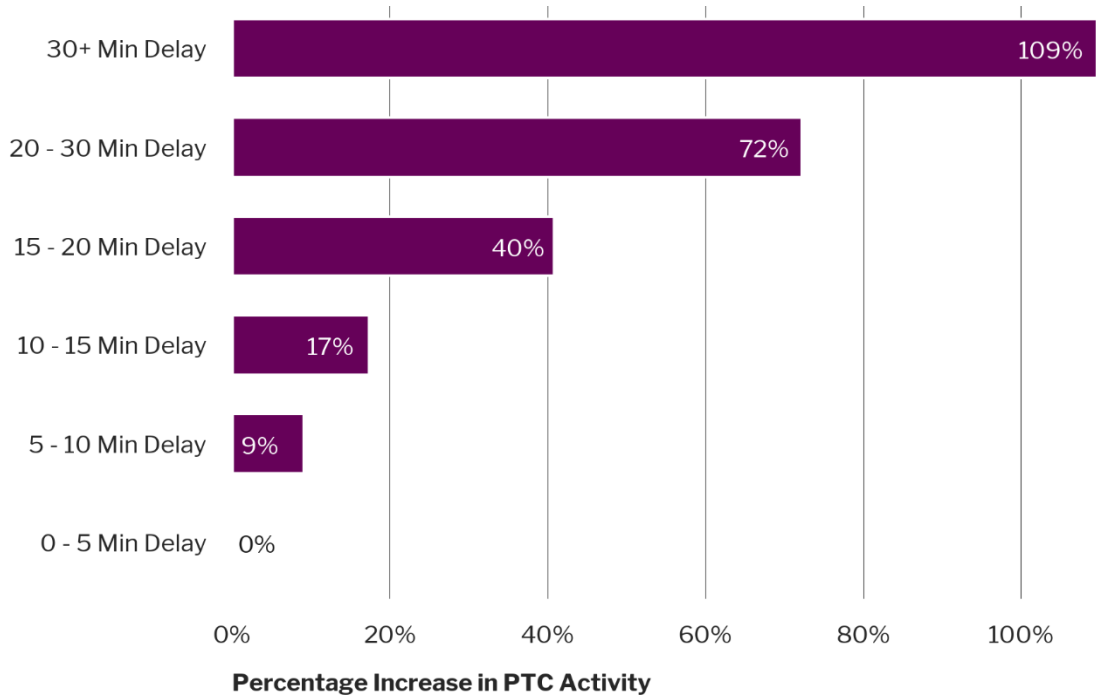
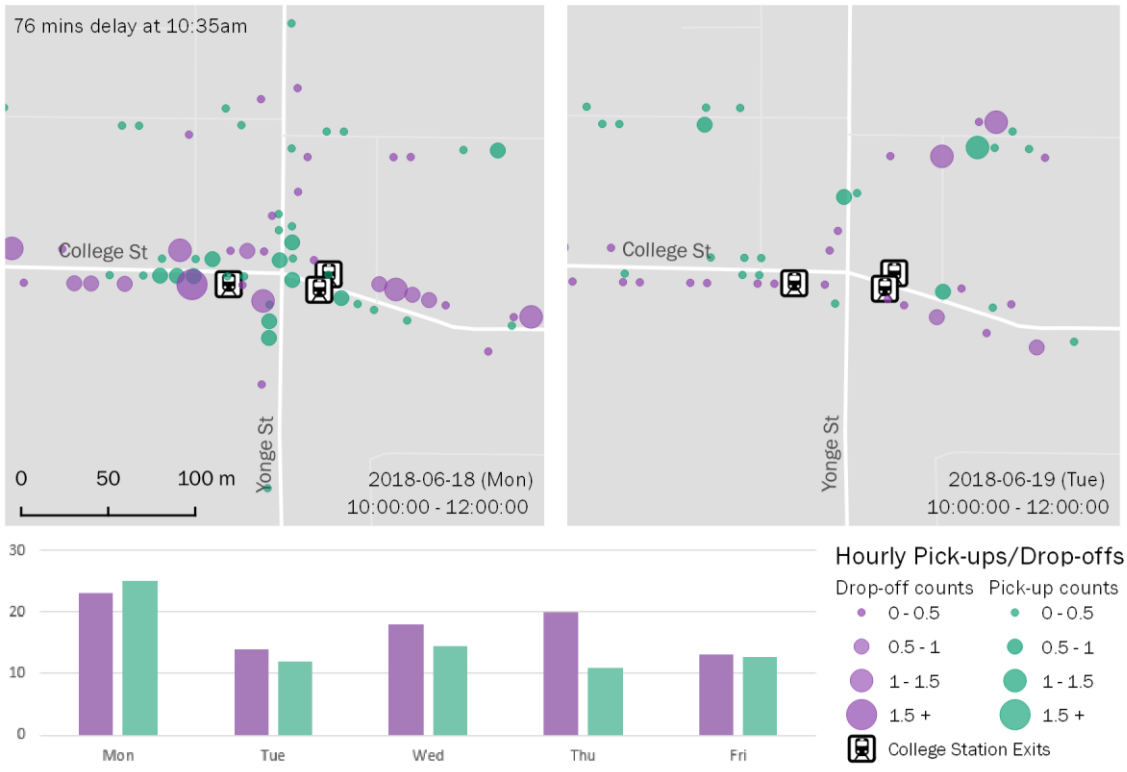


Exhibit 5-9: Pick-up and Drop-off Activity Over a 2 Hour Period During a Subway Delay at College Station



6 Equity Impacts

6.1 PTCs raise questions on equity in access to mobility

The introduction of PTCs raises interesting questions about fairness in residents' access to mobility. Specifically, is an unintended financial burden being placed on some of the City's poorest and most vulnerable residents as PTCs continue to play a larger role in filling gaps in mobility and accessibility. PTCs, however, have clearly increased mobility options and are providing a service that residents are using with increasing frequency across the City.

Isolating and evaluating the equity impacts of any single policy or program is difficult and complex. For example, a resident in Rexdale who has started commuting regularly to their place of work using a PTC may be making the choice because the transit alternatives for that trip are too burdensome; that same resident, however, may have also made the decision to forgo purchasing a vehicle. Investigating the cases in which PTC travel has increased the most can potentially call attention to locations and travel markets that have fewer mobility options and are not currently as well served by public transit (e.g. trips to work for shift workers in the early morning).

For this study, the impacts of PTCs on equity were evaluated by comparing the differences in PTC trips between the City's NIAs and nearby neighbourhoods within the same District. NIAs are defined as neighbourhoods with a Neighbourhood Equity Scores (NES) lower than an established baseline. The Toronto NES was developed in 2014 as part of the Toronto Strong Neighbourhoods Strategy 2020 initiative. The index was created to reflect a variety of economic, health and social development scores created by the Urban HEART@Toronto research initiative.

6.2 NIAs do not have distinct travel characteristics from nearby neighbourhoods

Exhibit 6-1 directly compares attributes of PTCs and public transit observed in NIAs against those in nearby neighbourhoods in the same District. The Toronto - East York NIAs are distinct from the other districts as there are only two NIAs within the district (Parkdale and Regent Park) and they are both served by high frequency transit services. The neighbourhoods are compared in terms of PTC trip density, growth in PTC trips, PTC wait times, the ratio of PTC to transit travel times, and the proportions of shared trip requests. The following observations can be made:

- NIA residents make less PTC trips per capita in three out of four districts;
- Wait times are 6-12% higher in NIAs in three out of four districts. Scarborough is the only district with shorter wait times in NIAs;
- Transit travel times are similar between NIAs and nearby neighbourhoods;
- The number of transit transfers required are also similar between NIAs and nearby neighbourhoods; and,
- The proportion of shared trip requests is higher in NIAs in three out of four districts.

Exhibit 6-1: Comparison of Equity Metrics, September 2018

A. Trips per 1000 People

Location	Etobicoke	North York	Scarborough	Toronto East York
NIAs	26	45	21	64
Other	38	39	22	112

B. Average PTC Wait Time (min)

Metric	Etobicoke	North York	Scarborough	Toronto East York
NIAs	3.7	3.7	3.1	3.1
Other	3.3	3.5	3.3	2.8

C. Ratio of Transit Travel Time to PTC Travel Time

Location	Etobicoke	North York	Scarborough	Toronto East York
NIAs	1.6	1.5	1.6	1.6
Other	1.7	1.6	1.7	1.5

D. Number of Transfers for Equivalent Transit Trip

Location	Etobicoke	North York	Scarborough	Toronto East York
NIAs	0.92	0.90	0.88	0.60
Other	1.00	0.90	0.88	0.57

E. Proportion of Shared Trip Requests to Total Trips (%)

Location	Etobicoke	North York	Scarborough	Toronto East York
NIAs	46%	44%	28%	24%
Other	37%	35%	31%	19%

From these observations, NIAs do not appear to be served any differently by transit than nearby neighbourhoods as transit travel times and transfers are comparable. The other indicators show that residents in NIAs are slightly less likely to use PTCs as witnessed in the lower trip density and slower trip growth. For those that do choose to take a PTC trip, residents in NIAs are more likely to choose a shared ride request.

Further study is required to understand the overall impacts PTC services have had with respect to mobility equity within the City. There is also a need to investigate whether additional City policies are needed to address future changes in mobility and equity related to PTC travel demand. Future analyses should look for data and other factors that may have an impact on mobility for populations in NIAs and other vulnerable communities.

7 Transportation Network Impacts

Isolating the impacts on the transportation network from the introduction and continued growth of PTCs from other factors is extremely challenging. Factors that impact traffic and congestion are complex and tend to interact with each other, whether from high demand, population and employment growth, construction lane closures, traffic collisions, special events, weather or other changes. For example, a construction lane closure on a street in close proximity to an active sporting event can have a multiplier effect that is greater than the total impact caused by each of these effects on their own. The downtown area in particular (where the largest number of PTC trips are concentrated) has experienced operational changes in the past two years from various construction projects as well as from the King Street Transit Pilot.

Appendix A provides an overview of studies on the Transportation Impacts of PTCs completed in other North American Jurisdictions. These studies have largely shown that PTCs do result in an increase in total Vehicle Kilometres Traveled (VKT), which translates in varying degrees to increased travel times and delays for car drivers and passengers.

This study provides an initial review of impacts on the transportation network by first establishing the scale of total PTC VKT in Toronto (i.e. the total distance traveled by PTCs), and then considering travel time trends in the downtown where the concentration of PTC traffic is highest.

7.1 PTC traffic is made up of in-service and deadheading travel

The impact of PTCs on the transportation network is largely a function of the amount of driving its vehicles are adding on to the City's road network, measured in VKT. Outside of any potential impacts on traffic congestion, additional VKT can also directly affect the City's ability to meet its climate change goals under the TransformTO Climate Action Strategy, it's Vision Zero road safety goals and any potential modal split goals. Increased VKT has also been found to have adverse impacts on air quality, health, safety, and noise. PTC vehicles contribute to total VKT on City streets in two distinct ways:

- **In-Service Trips**: Distances travelled by vehicles carrying passengers; and,
- **Deadheading:** Distances travelled by vehicles either cruising for passengers or en-route to pick-up a passenger

As referenced in Section 2.2, a methodology was developed to use PTC trip data to develop estimates of the total amount of PTC travel in the City, both in-service and while deadheading. The full methodology is described in detail in Appendix A. Two simplifying assumptions were made in completing this work due to limitations in the data available:

- There was insufficient data available to determine the amount of VKT travelled when PTC drivers are cruising without a specific purpose (i.e. driving without passengers while waiting for a trip request); and

- There was insufficient data available to determine the amount of VKT spent by PTC drivers commuting for the express purpose of serving PTC demand (e.g. commuting from home into downtown Toronto to drive a PTC, or repositioning to a new geographic area).

Due to these restrictions, all VKT estimates in the study should be considered conservative.

7.2 PTCs in Downtown Toronto made up 5-8% of total traffic in September 2018

An analysis was conducted based on trips made on Thursday, September 13th, 2018, the busiest typical weekday with detailed trip record data available at the time of this report. Approximately 149,000 trips were made on September 13th, 2018. On this day, PTCs accounted for approximately 1,230,000 VKT. This is estimated to be 1.9% of the total 67,200,000 VKT traveled in Toronto on this day.

Based on the research conducted by UTTRI (Section 5.1), the second choice alternative for 41% of PTC trips would be driving or taking a taxi, meaning that 59% of this VKT, or 726,000 VKT per day could be considered new VKT due to PTCs.

Exhibit 7-1 shows an estimate of the percentage of total distance travelled by PTCs as a proportion of the total distance travelled by all vehicles in the City of Toronto. Total traffic volumes estimates were derived from observed traffic counts at select locations across the City of Toronto.

The largest volumes of PTCs are concentrated in downtown neighbourhoods where a conservative estimate of PTC volumes shows that PTCs now account for between 5 and 8% of overall daily traffic. The busiest neighbourhood is Waterfront Communities-The Island, bordered by Bathurst St, Queen St/Front St, the Don River, and Lake Ontario where PTCs make up 7.9% of overall daily traffic. Exhibit 7-2 presents the breakdown of PTC VKT and total VKT for Waterfront Communities, Toronto East York and the total City of Toronto. The proportion of traffic in AM and PM peak commuting periods is slightly lower than the overall daily totals, reflecting the higher relative PTC volumes that occur during overnight hours.

Exhibit 7-1: Proportion of PTC VKT by Neighbourhood, September 2018

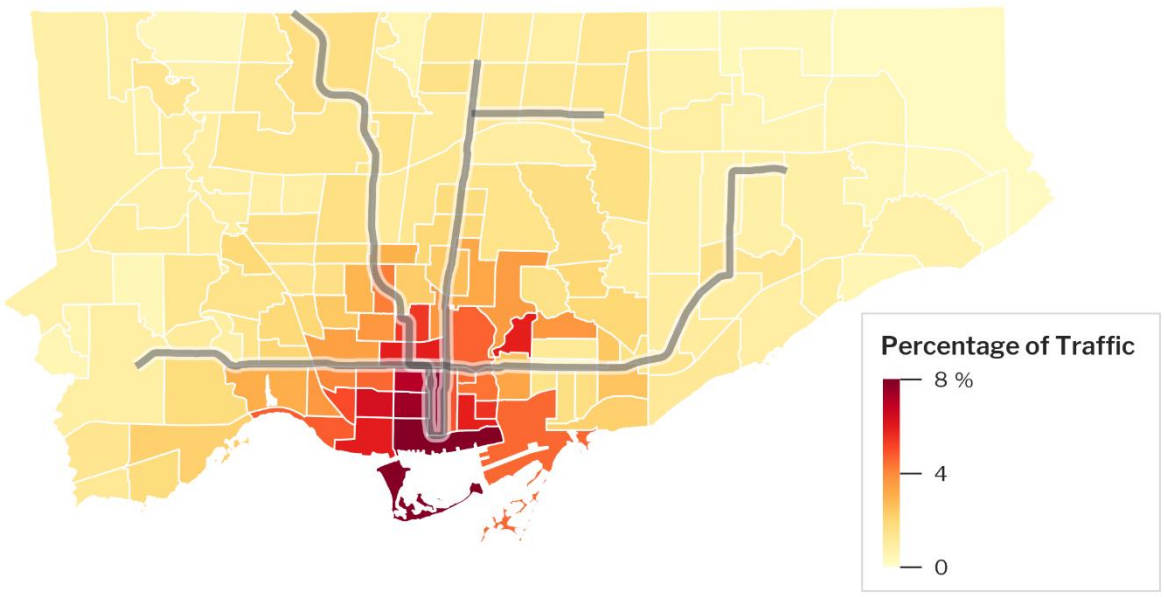


Exhibit 7-2: PTC VKT and Total VKT, September 2018

A. AM Peak Period (7-10 AM)

Period	Waterfront Communities (77)	Toronto and East York	City of Toronto
PTC VKT	12,900	77,400	194,000
Total VKT	192,000	1,870,000	12,000,000
PTC %	6.7%	4.1%	1.6%

B. PM Peak Period (4-7 PM)

Period	Waterfront Communities (77)	Toronto and East York	City of Toronto
PTC VKT	12,600	90,800	211,000
Total VKT	206,000	2,000,000	12,900,000
PTC %	6.1%	4.5%	1.6%

C. Daily

Period	Waterfront Communities (77)	Toronto and East York	City of Toronto
PTC VKT	84,700	538,000	1,230,000
Total VKT	1,070,000	10,400,000	67,200,000
PTC %	7.9%	5.2%	1.8%

7.3 Downtown Toronto travel times have been stable over 18 months while PTC volumes increased by 196%

The City of Toronto collects car travel time data on the major streets in the downtown core shown in Exhibit 7-3. This area also corresponds to where PTC trip concentrations are highest. This data shows marginal changes in travel times over the last 18 months in the downtown core. Between October 2017 and March 2019, downtown travel times on major streets has increased by 4% in the morning peak hour (7 to 10 a.m.), and decreased by 1% in both the afternoon peak period (4 to 7 p.m.) and Friday and Saturday nights (10 p.m. to 1 a.m.). This same period is associated with a 96% increase in PTC trips city-wide, from 83,800 to 164,000 daily trips. In Toronto and East York, the percentage of PTCs as a proportion of total traffic increased from 2.3% to 4.5% as was shown in Exhibit 7-2.

These findings are consistent with the recently-completed evaluation of the impacts of the King Street Transit Pilot which showed no significant changes in travel times on downtown streets over the Pilot period.

Exhibit 7-3: Downtown Bluetooth Reader Coverage

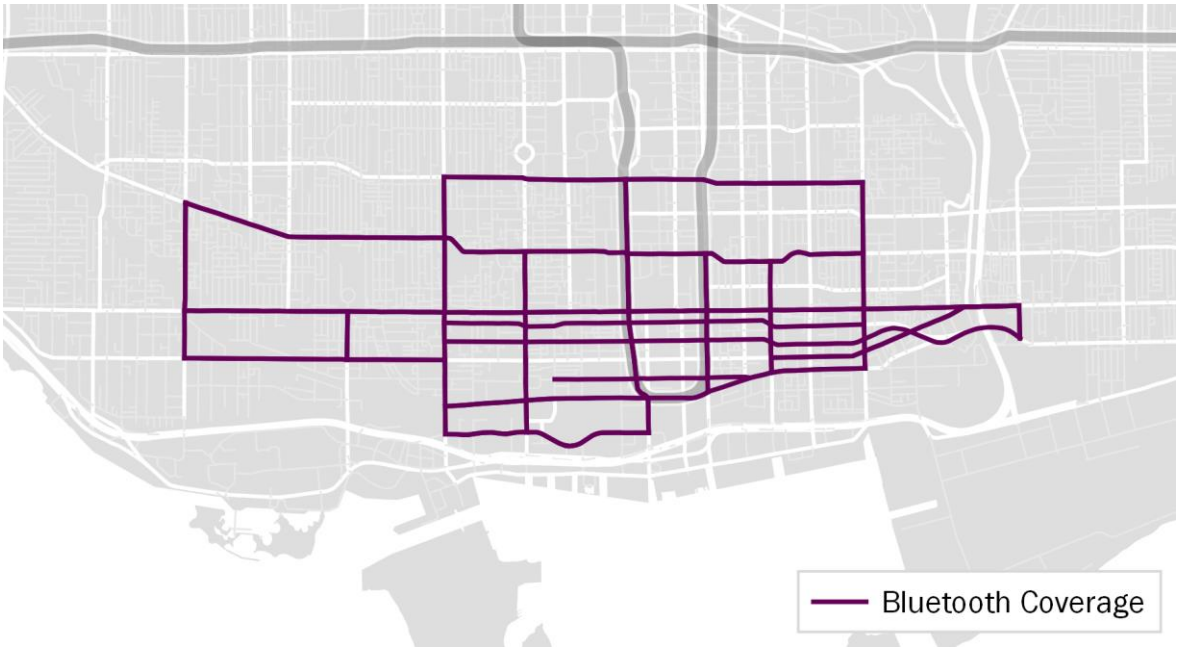
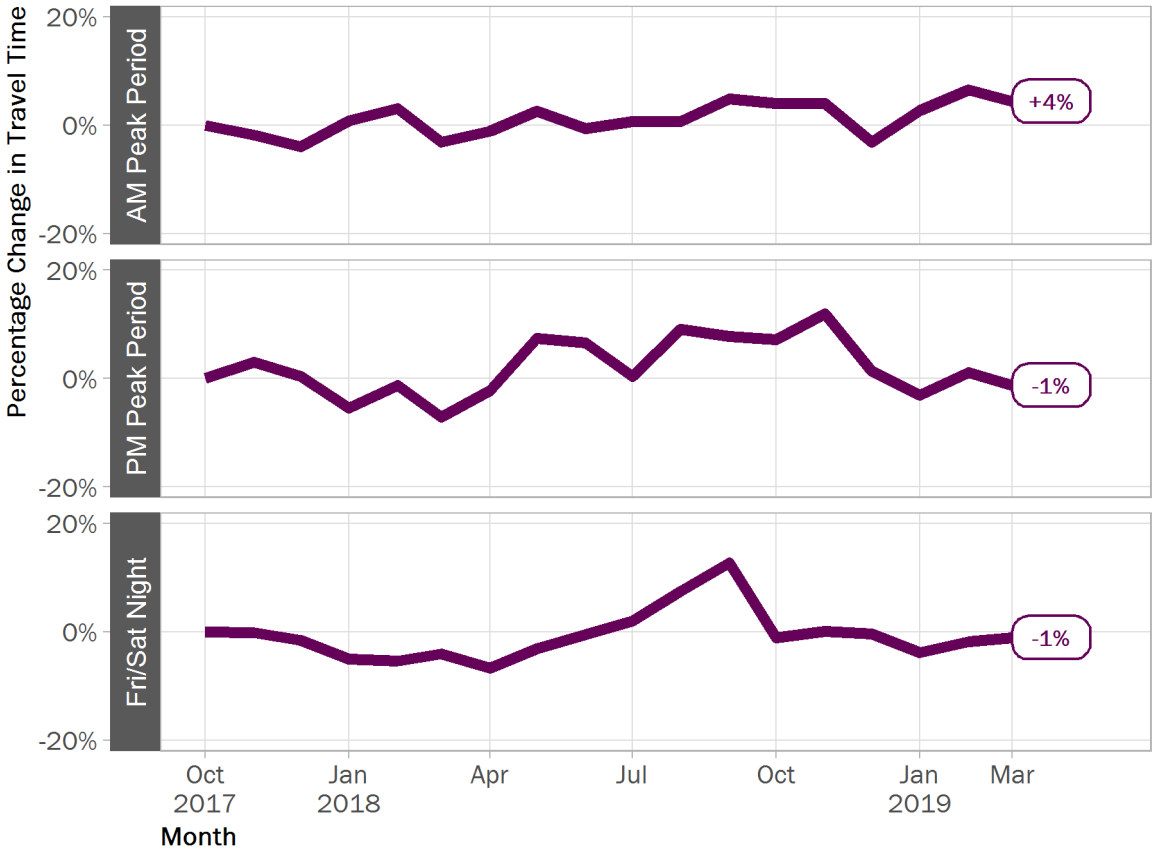


Exhibit 7-4: Changes in Travel Time in the Downtown Core Compared to an October 2017 Baseline



Given that changes in travel times have been negligible in the neighbourhoods where PTCs make up the largest proportions of overall traffic, there is insufficient evidence at this time to make any definitive linkages between PTC volumes and changes in travel time.

While the increase in PTC and overall VKT has not to-date resulted in a measurable increase in travel times, this does not mean that PTCs have not had an impact. For example, it is not possible to assess what travel times would have been without PTCs. As the total VKT continues to increase and the proportion of total traffic increases, the chances of increased impacts on travel times and the reliable operation of the transportation network will also increase.

Transportation Services will continue to monitor and explore methods for measuring congestion, including the impacts of PTC trips on the City's street network, through the development of its analytics and monitoring program under the Congestion Management Plan.

8 Curbside Impacts

This section assesses where and when PTC pick-up and drop-off activity conflicts with other curbside regulations and uses, in particular bicycle facilities and no stopping zones. Many of these regulations are in place to either facilitate the movement of traffic on these streets or to ensure the safety of people either needing access to the curb or the lane adjacent to it (e.g. cyclists). The introduction of PTCs, a mode of transportation heavily dependent on access to the curbside on streets on which pedestrian activity is highest, raises important questions on the efficacy of these regulations as they currently exist.

To facilitate this analysis, Transportation Services received nine weeks of pick-up/drop-off data in 2018 from Uber and Lyft using SharedStreets as a broker (see Appendix A for a more detailed description of the data).

It is important to note for this analysis that side of street for pick-up and drop-off is based on the direction of travel of the vehicle prior to stopping. For one-way streets where vehicles could be stopping on either side of the street all pick-up and drop-off activity has been aggregated to the right-hand side.

8.1 There is significant PTC activity in no-stopping zones

Transportation Services has digitized curbside bylaws for sections of Toronto, East York, and Scarborough. This area, shown in Exhibit 8-1, represents 71.5% of pick-up and drop-off activity in the City.

Exhibit 8-1: Extent of Digitized Bylaws

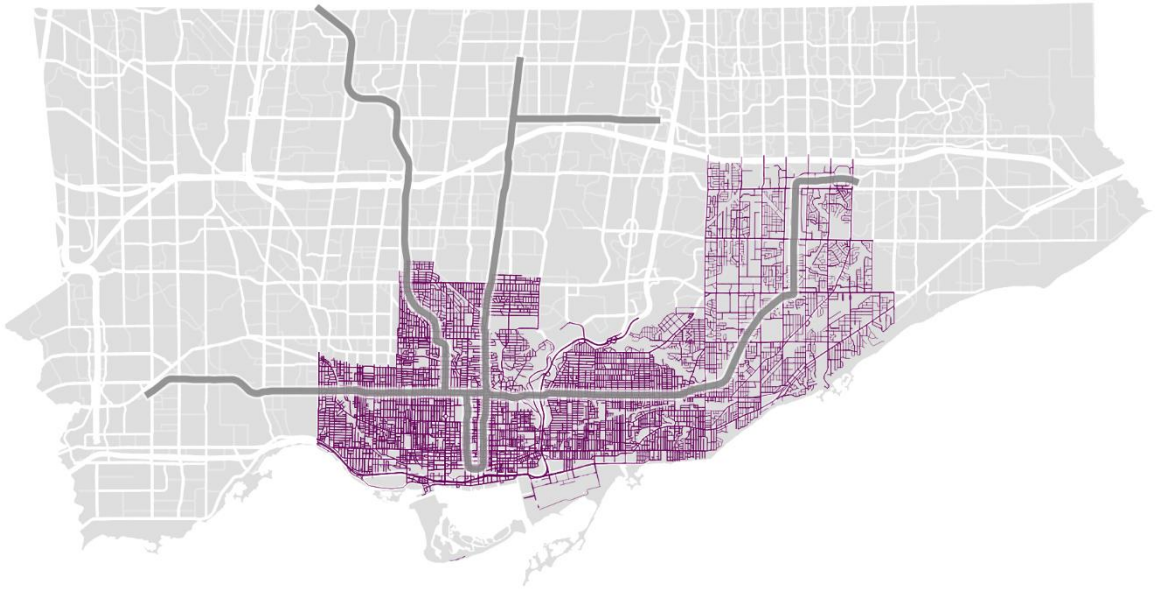


Exhibit 8-2 lists the bylaws selected to examine in further detail. Note that Passenger Loading Zones (Schedule 950 VII of the Toronto Municipal Code) are zones that explicitly allow stopping to load and unload passengers.

Exhibit 8-2: Relevant Curbside Bylaws for Pick-up Drop-off Activity

Municipal Code Schedule[7]	Schedule Name
§950-1313. Schedule XIV	No Stopping
§886-19. Schedule D	Designated Lanes for Bicycles
§886-19. Schedule E	Cycle Tracks
§950-1336. Schedule XXXVII	School Bus Loading Zones
§950-1304. Schedule V	Stands for Taxicabs
§950-1305. Schedule VI	Commercial Loading Zones
§950-1306. Schedule VII	Passenger Loading Zones
§950-1309. Schedule X	Bus Loading Zones

Exhibit 8-3 and Exhibit 8-4 show the hotspots for PTC pick-up and drop-off activity within no-stopping areas. The hotspots are concentrated primarily around Bay St and Adelaide St in the Financial District.

Many of the streets with the highest stopping activity are on arterials carrying large volumes of vehicular and transit traffic, a large part of the reason why stopping restrictions exist. Further analysis is required to determine whether this activity has had an impact on safe and reliable people movement on these corridors. Data on activity in these no-stopping zones and other bylaws where stopping is prohibited will inform ongoing work in the Transportation Services' Curbside Management Strategy.

[7] Chapter 950, Traffic and Parking: https://www.toronto.ca/legdocs/municode/1184_950.pdf
Chapter 886, Footpaths, Pedestrian Ways, Bicycle Paths, Bicycle Lanes And Cycle Tracks: https://www.toronto.ca/legdocs/municode/1184_886.pdf

Exhibit 8-3: Hotspots of Pick-up/Drop-off Activity in No-stopping Areas (7 to 10 a.m.), September 2018

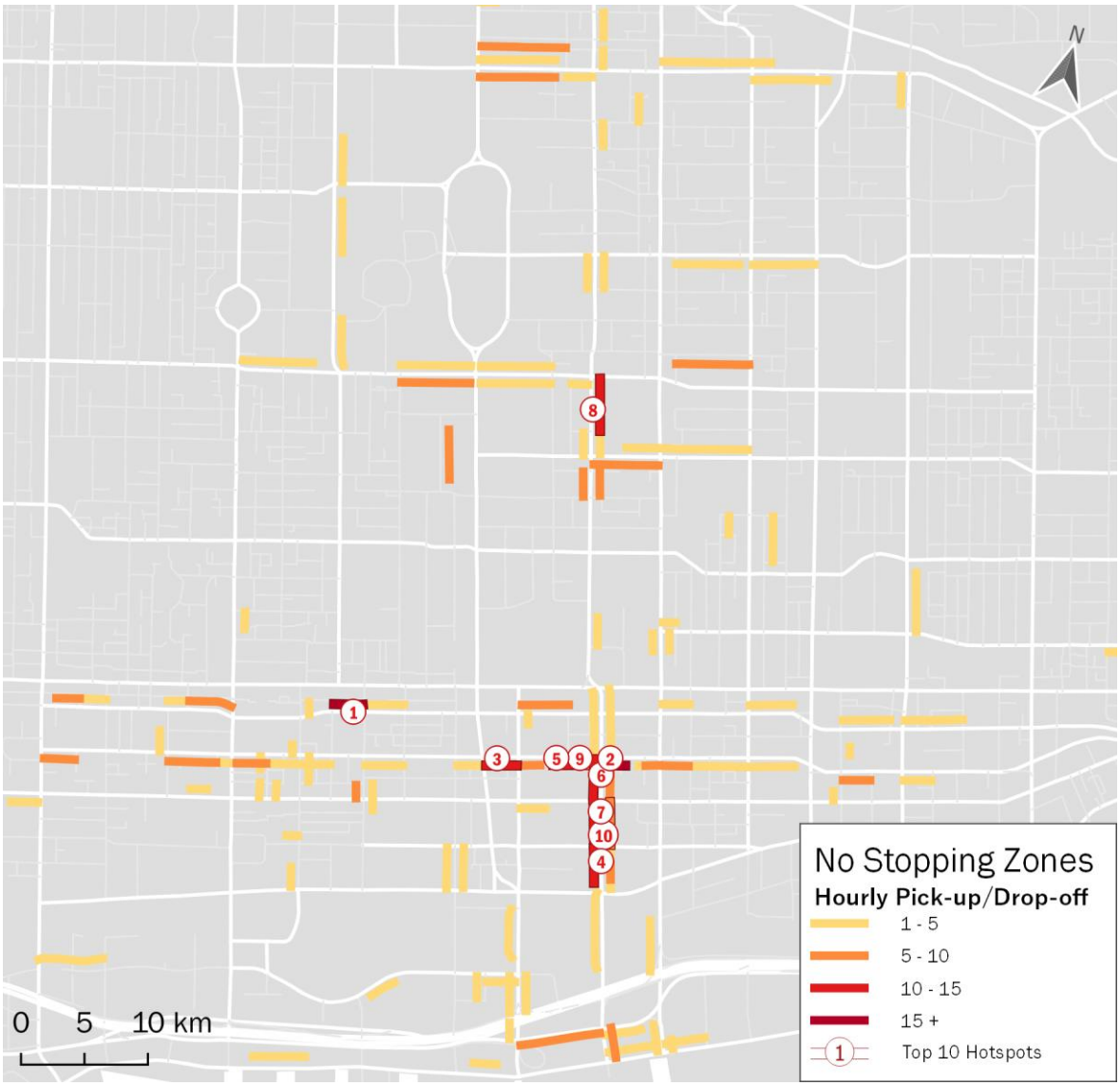


Exhibit 8-4: Top 10 Streets, Infractions in No Stopping Areas (7 to 10 a.m.), September 2018

Rank	Location	Hourly Activity
1	Richmond Street from John Street to Widmer Street	20
2	Adelaide Street West from Bay Street to Yonge Street	18
3	Adelaide Street West from University Ave to York Street	14
4	Bay Street from Wellington Street West to Front Street West	14
5	Adelaide Street West from York Street to Sheppard Street	12
6	Bay Street from Adelaide Street West to King Street West	12
7	Bay Street from King Street West to Wellington Street West	12
8	Bay Street from Gerrard Street East to College Street	11
9	Adelaide Street West from Sheppard Street to Bay Street	10
10	Bay Street from Wellington Street West to King Street West	10

8.2 There is significant PTC activity near cycling infrastructure

A particular safety concern with PTC pick-up and drop-off activity is potential conflicts with cyclists, especially when it occurs in close proximity to cycling infrastructure. Common curbside PTC manoeuvers that pose safety risks for cyclists include vehicles moving into and stopping in the bike lane, requiring a cyclist to manoeuvre around the blocked lane (compounded when streetcar tracks are present); drivers and/or passengers opening car doors; passengers attempting to cross the lane after exiting the vehicle; and drivers encroaching onto or coming close to bike lanes while making U-turns to pick-up or drop-off in a particular direction. While it is impossible to conclude from the available data whether the PTC vehicle was within or adjacent to a bike lane while picking up or dropping off passengers, hotspots indicate where they may be a high risk of conflicts.

Exhibit 8-5 and Exhibit 8-6 show the volume of PTC activity adjacent to bike lanes and separated bike facilities between 7 a.m. and 7 p.m. during a typical weekday in September 2018. There is a significant volume of pick-up and drop-off activity near high-use bike facilities. Toronto also has relatively high cycling rates on non-cycling infrastructure routes due to underlying demand. Future analysis will also look at pick-up and drop-off activity on other popular bike routes that don't currently have any dedicated cycling infrastructure. Further analysis is required to determine if this activity correlates with increased rates of pedestrian and cycling injuries and fatalities. This information can inform future upgrades to cycling facilities and the Curbside Management Strategy.

Exhibit 8-5: High PTC Activity Adjacent to Bicycle Lanes (7 a.m. to 7 p.m.), September 2018

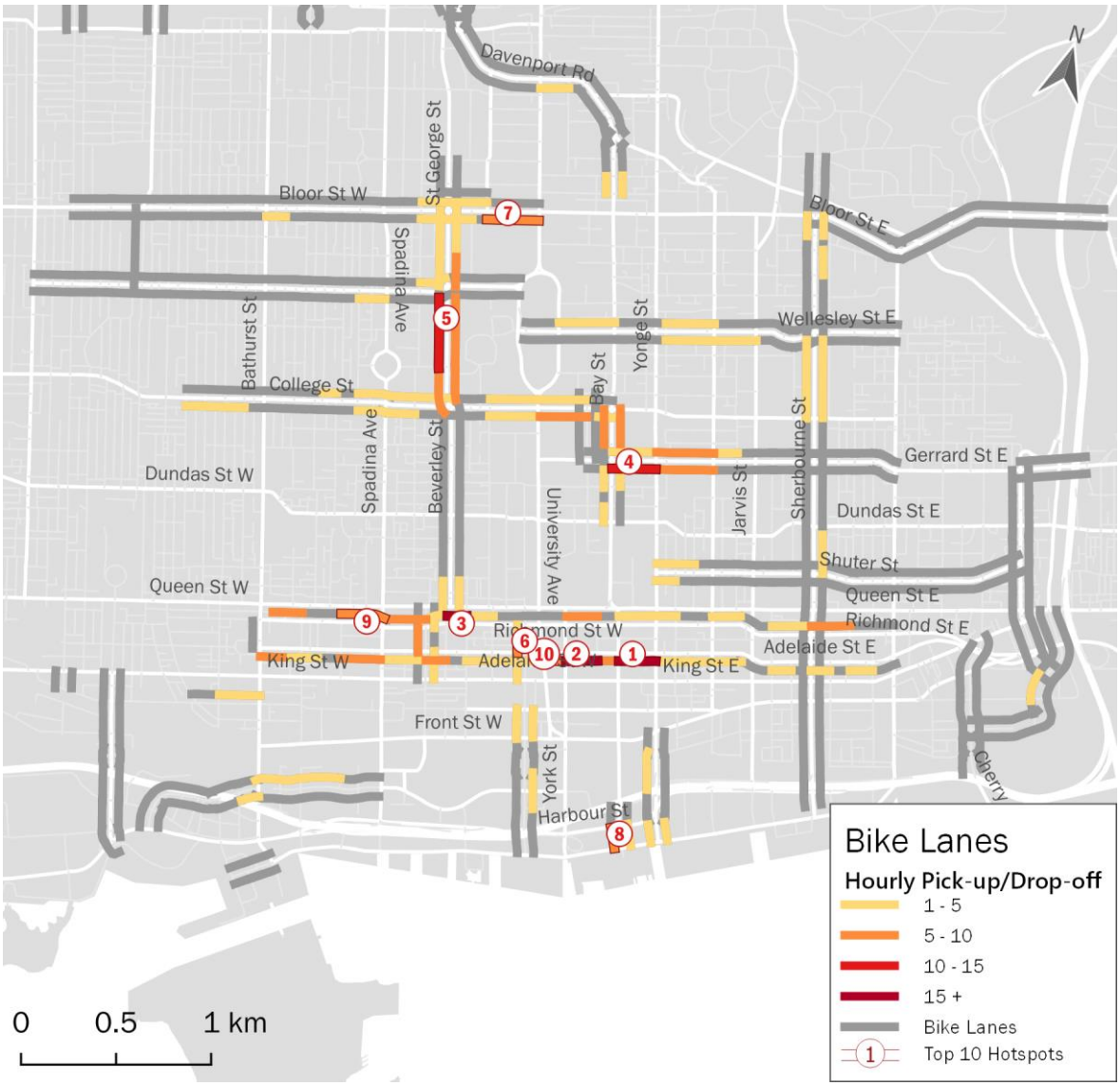


Exhibit 8-6: Top 10 Locations, PTC Activity near Bicycle Lanes (7 a.m. to 7 p.m.), September 2018

Rank	Location	Hourly Activity
1	Adelaide Street West from Bay Street to Yonge Street	24
2	Adelaide Street West from York Street to Sheppard Street	19
3	Richmond Street West from John Street to Widmer Street	16
4	Gerrard Street from Bay Street to Yonge Street	11
5	St George Street from Russel Street to Harbord Street	10
6	Simcoe Street from Nelson Street to Adelaide Street West	10
7	Bloor Street West from Bedford Road to Avenue Road	10
8	Bay Street from Queens Quay West to Harbour Street	10
9	Richmond Street from Spadina Avenue to Brant Street	9
10	Adelaide Street West from University Avenue to York Street	9

9 Next Steps & Recommendations

This study has looked at what is most likely the first wave of disruptions from new mobility-as-a-service (MaaS) businesses. Based on the analysis in this study, trip growth is not anticipated to slow in upcoming years. While there is no evidence that the increase in PTC trips to date has resulted in increased travel times on City streets, continued increases in the future will likely create traffic and operational changes throughout the City. In addition, without a substantial shift in existing vehicular use to active transportation, increased volumes of vehicles-for-hire will negatively impact the City in reaching its climate goals and will contribute additional impacts to air quality, health, safety, and noise. However, PTC services have been immensely popular with Toronto residents as evidenced by the rapid growth in trips. PTC services now play an important role in many residents' daily travel patterns including an increasing role in daily commuter travel.

The goal of the Transportation Impacts Study has been to build a deeper understanding of these new services. This will enable future work to allow the City to keep in front of these changing trends and to be able to define policy to support the benefits of PTC services for residents while minimizing adverse impacts to traffic, to the environment and to the equity of mobility services

9.1 Follow-up work is required to keep on top of this new rapidly changing mode of travel

1. Transportation Services to build a monitoring program as part of the Congestion Management Plan to monitor the impacts of Vehicles-for-Hire on VKT, traffic congestion and GHG emissions and to better-understand the relationship with traffic congestion trends in the city.
2. Transportation Services to continue to study the impact of Vehicles-for-Hire on the Curbside Management plan and related policies.
3. Transportation Services to investigate whether there is a road safety impact of Vehicles-for-Hire and to collaborate with MLS and the Toronto Police Service to collect appropriate data.
4. In order to be able to continuously monitor and evaluate the impact of vehicles-for-hire on the transportation network, changes are required to the data currently being collected to include information on PTC volumes, wait times, trip cancelations, deadheading and curbside activity. (see Section 9.3 for further details)

9.2 Further research is required on the impacts of PTCs on transit, equity and travel behaviour

While this report has provided an initial review of these issues, the impacts in these areas are complex and require additional exploration, in particular on the impacts on TTC ridership, the impacts on mobility equity for vulnerable populations, and the impacts on travel choices and modal shifts.

9.3 More data will enable the City to continue to monitor the impacts of PTCs

While excellent and comprehensive data was available for this study, Transportation Services supports data provisions being updated to reflect the data lessons learned in this study, and the importance of each of the specific pieces of information received from vehicles-for-hire. The following new or modified data sets would enable the City to continue to monitor the impacts of vehicle-for-hire on the transportation network and travel behaviour.

1. **Vehicle-for-Hire Collision Records**: Collision records would allow the City to be able to study collision trends among vehicle-for-hire drivers and to track the effectiveness of driver training programs and other safety initiatives.

2. **Taxi Data**: Similar taxi trip data would allow the City to monitor and understand changes in taxi demand and travel patterns and to monitor and study the impacts of the whole vehicle-for-hire industry on the transportation network.

3. **Modifications to current trip data:** Modifications to include trip wait times, cancelled/rejected trips and minute-level time stamps will allow the City to be able to reproduce the analysis in this report in the future and to properly track trends in PTC service levels.

4. **Fare paid and airport trip data fields:** New information appended to trip records including the fare paid and whether the trips served an airport would allow the City to better understand the equity impacts of PTC services and to better understand the demand for trips serving Pearson International Airport.

5. **Street volumes:** Street-level data on the volume of PTC vehicles by status (cruising, en-route, with-passenger) would allow the City to more accurately measure PTC VKT and monitor growth in PTC volumes and the role of deadheading.

6. **Pick-up and drop-off data:** This data was provided by Uber and Lyft through SharedStreets and the Open Transport Partnership for this study. Continuing to regularly provide this data will allow the City to monitor the impacts of PTCs on curbside management issues.

7. **Data sharing:** Provisions should allow PTC data to be shared with transportation and planning agencies to support planning, operations and research as well to the public through Open Data.