For Action

Automated Transit Shuttle Pilot Project

Date: June 12, 2019
To: TTC Board
From: Chief Customer Officer

Summary

The purpose of this report is to provide a status update on the Automated Vehicles Tactical Plan 2019-2022 and Automated Transit Shuttle Pilot Project ("Minding the Gap").

The Automated Vehicles Tactical Plan 2019-2022 is being created to fill a gap: between emerging technical understandings of AVs and the City of Toronto's existing long-term visions, strategies, and plans of a healthy, equitable, livable and sustainable City. The AV Tactical Plan will outline how the City and the TTC should prepare for automated vehicles and how it can influence the direction of the technology in these early stages. The overall goal is to be proactive, ensuring that Toronto is well-placed to both maximize opportunities and mitigate impacts arising from the arrival of AVs in our city.

The Automated Transit Shuttle Pilot Project ("Minding the Gap") is the pilot of an automated shuttle. The objective of the pilot project is to test the deployment of an automated transit shuttle (8-12 passengers) on a public road in the City of Toronto for 6-12 months starting in late 2020. The route will provide a new connection from a transit hub to a nearby location that is not adequately served by conventional transit. The intent of the pilot is to use automated vehicle technology to expand the TTC's service network.

Recommendations

It is recommended that the Board:

1. Authorize the Chief Executive Officer to negotiate and enter into a memorandum of understanding with the City of Toronto and Metrolinx to provide the TTC's support, commitments, and obligations to deliver the "Minding the Gap" project; to provide:
    a. Project oversight through steering committee;
    b. Technology specifications for RFI and RFP;
    c. Technology evaluation during pilot;
    d. On-board ambassador; and
    e. Other supports generally in accordance with the terms and conditions set out in the June 25, 2018 City Council report.

Financial Summary

The Automated Transit Shuttle Pilot Project (Minding the Gap) is a jointly funded partnership between the City of Toronto's Transportation Services department, the TTC, Metrolinx and Transport Canada through the Program to Advance Connectivity and Automation in the Transportation System (ACATS). The total cost for this initiative is approximately $1.153 million and will be funded through the following funding partners:

Funding Partner	Funding (2018-2022)
Canada: Transport Canada	$365,000
City of Toronto	$ 284,100
Metrolinx	$252,000
Toronto Transit Commission	$252,000
Total	**$1,153,100**

The TTC is a participating partner and will support the project by providing project management and technology evaluation assistance, and an on-board ambassador for the shuttle in 2020 totalling $252,000. Sufficient funds for this expenditure are included in the TTC's 2019-2028 Capital Budget and Plan under 4.11 Autonomous Vehicle Program, which was approved by City Council on March 7th, 2019.

The Chief Financial Officer has reviewed this report and agrees with the financial impact information.

Equity/Accessibility Matters

This report outlines an automated vehicle pilot project that will test an automated shuttle for public use and integration into the transit system. The project will help TTC learn what is essential for accessibility when considering this new technology.

Consultations will take place as part of the pilot project. As a key component of the consultation process, TTC will make efforts to reach out to equity-seeking groups to ensure that a wide range of perspectives are heard, community priorities are identified, and the pilot project including the service concept and automated vehicle do not introduce new barriers to accessing public transit.

Decision History

The TTC is partnering with the City of Toronto and Metrolinx, with funding support from Transport Canada, to pilot an automated shuttle for public use and integration into the transit system.

The pilot project advances the TTC 2018-2022 5-Year Corporate Plan Corporate Plan: https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2018/January_25/Reports/Decisions/1_TTC_Corporate_Plan_2018-2022_Decision.pdf

At its March 22, 2017 Board Meeting, the TTC Board directed staff to continue to monitor the technological and legislative progress of AVs: https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2017/March_22/Reports/Decisions/10_Implications_of_Automated_Vehicles_for_TTC_Decision.pdf

Issue Background

The City of Toronto has taken a proactive and collaborative approach on preparing for automated vehicles. In 2016, an Interdivisional Working Group (IDWG) was created as a forum for learning, discussion, and coordination of the City's efforts to prepare for AVs. The TTC has been a member since the group's inception. The IDWG was tasked with reviewing, discussing, and making decisions on issues related to the introduction and adoption of this technology. This was necessary in order to ensure a consistent approach, avoid duplication of efforts, and encourage ownership of the process across divisions and service agencies.

In the spring of 2017, the IDWG identified the need for a single vision to guide all City divisions and agencies in their work to prepare for vehicle automation. This resulted in the initiation of the Automated Vehicles Tactical Plan 2019-2022. A framework of the Plan was presented to City Council in January 2018, including a strategic direction that automated vehicle preparations and deployments be approached in a "transit-centric"

manner, so as to improve the reliability, efficiency, safety, and seamlessness of transit, as well as facilitating increased transit priority.

The Automated Vehicles Tactical Plan 2019-2022 is being created to fill a gap: between emerging technical understandings of AVs and the City of Toronto's existing long-term visions, strategies, and plans of a healthy, equitable, livable and sustainable City. The AV Tactical Plan will outline how the City and the TTC should prepare for automated vehicles and how it can influence the direction of the technology in these early stages. The overall goal is to be proactive, ensuring that Toronto is well-placed to both maximize opportunities and mitigate impacts arising from the arrival of AVs in our city.

The most recent draft of the plan identifies tactics that support – not replace – existing policies, plans, strategies, and directives approved by the TTC Board and City Council. In the fall of 2019, a detailed and comprehensive Plan is scheduled to be recommended to the Infrastructure and Environment Committee.

Comments

This section provides an overview of the automated transit shuttle project.

1. Project overview

Project objective

In 2017, Transport Canada announced a funding opportunity with the Program to Advance Connectivity and Automation in the Transportation System (ACATS). The Program provides funding for projects that contribute to the competitiveness of Canada by assisting in the preparation of connected and automated vehicles.

The TTC, City of Toronto and Metrolinx submitted a successful funding proposal to Transport Canada to pilot an automated shuttle for public use and integration into the transit system (see **Attachment 1**).

The objective of the pilot project is to test the deployment of an automated transit shuttle (8-12 passengers) on a public road in the City of Toronto for 6-12 months starting in late 2020. The route will provide a new connection from a transit hub to a nearby location that is not adequately served by conventional transit. The intent of the pilot is to use automated vehicle technology to expand the TTC's service network.

The pilot will include an evaluation and monitoring component to measure the success of the shuttle from both a user and technical perspective. An economic development strategy will also be developed as part of this project to attract the automated transit industry to the GTHA.

Project participants and roles

Table 1 provides a summary of the project participants and respective roles.

Table 1: Summary of participants and roles

Contributing Partners	**Role**
City of Toronto Transportation Services Economic Development & Culture	• Project lead, project management • Steering committee lead • Facilitation of knowledge transfer and dissemination • Economic development strategy
TTC	• Project oversight through steering committee • Technology specifications for RFI and RFP • Technology evaluation during pilot • On-board ambassador
Metrolinx	• Project oversight through steering committee • On-board ambassador
Evaluating Partners	**Role**
Ryerson University, School of Urban and Regional Planning	• Consumer research
University of Toronto Transportation Research Institute (UTTRI)	• Travel demand and traffic impacts

Project work plan and timeline

The project work plan is structured into three phases:

Phase 1 – Request for information
In the fall of 2018, the TTC issued a Request for Information (RFI) on behalf of the project team to gain a better understanding of the automated transit shuttle market. This allowed the project team to gain a better understanding of the existing technology, its capabilities and its limitations. This is informing Phase 2 of the project.

Phase 2 – Area selection, RFP development and procurement
The project team is currently undertaking work to identify a preferred area for the pilot as a result of our learnings during the RFI stage. The project team will also begin the development of a Request for Proposal (RFP) for procurement. This Phase is expected to be complete by winter 2020.

Phase 3 – Testing and Implementation
Once a proponent has been selected to provide the automated shuttle, there will be extensive time spent on set-up and testing the service. This is expected to occur in spring/summer of 2020. It is anticipated that the service will launch to the public in September 2020 and will run for 6-12 months, depending on funding and vendor pricing.

Extensive consultations will be completed as part of this study. A communications and education campaign will be implemented prior to the launch of the shuttle service, with particular attention paid to the immediate area surrounding the pilot location. While the shuttle is in operation, it will be monitored at all times by on-board ambassadors from the TTC and Metrolinx. A rotating exhibit of the shuttle will also be held throughout the Greater Toronto and Hamilton Area to provide the public with an opportunity to interact with automated vehicle technology.

2. Shuttle vehicle and operation

Automated shuttles typically seat 8-12 passengers and are designed to travel in low-speed, low-volume environments. Most are electric-powered and operate at an automation level of four ("high automation"), as per the scale established by the Society of Automotive Engineers. While an on-board driver may not necessarily be required to operate the vehicle, this pilot project will include "ambassadors" who will staff the vehicle at all times. These ambassadors will be paid staff by the TTC and Metrolinx.

Automated shuttles have been demonstrated in numerous cities around the world. Most recently in the fall of 2018, the City of Calgary conducted a driverless shuttle pilot on a small route that served the zoo.

The type of vehicle chosen for this pilot project will be an established shuttle model that has been tested in other jurisdictions. In the fall of 2018, the project team completed an RFI to learn more about the various shuttles on the market. The project team gathered safety records from original equipment manufacturers and detailed operational information. The results of the RFI are being used to help inform the development of a RFP.

The shuttle operator must comply with Ontario Regulation 306/15, Pilot Project - Automated Vehicles to the Highway Traffic Act in order to operate on a public roadway; approval by the Registrar will be a requirement of the request for proposals to original equipment manufacturers of shuttle vehicles.

3. Shuttle pilot location

One of the objectives of this pilot is for the TTC to test a microtransit service offering. Microtransit is just one of many mobility services that can play a role in moving people around the city. The TTC understands that it can use microtransit to reach new markets in areas previously not served.

Microtransit services consist of private vehicles that offer rides to multiple passengers along fixed or variable routes. On the spectrum of transportation services, microtransit fits between taxis (low occupancy) and municipal transit systems (high occupancy vehicles). Microtransit is not a new phenomenon; informal microtransit/ride-sharing networks like New York's Dollar Vans and 'Route Taxis' have operated for years. However, microtransit services have increased and evolved over recent years due to widespread access to smartphones, ever-increasing data on mobility patterns, and innovations in fare payment which all facilitate flexible on-demand microtransit services. This has increased both the spontaneity and convenience in which individuals can request microtransit services.

Historically, public transit microtransit services typically serve areas with very low passenger demand where conventional services are not feasible, and a niche service catering to a specific market or need that has been identified. Customers are usually required to book a ride in advance. Although ridership is low, microtransit is useful for providing effective service coverage over a large area.

Given that automated transit shuttles typically are designed to travel in low-speed, low-volume environments, the pilot project is an excellent opportunity to test this type of service offering for new and existing TTC customers.

At this time, the specific pilot area has not been chosen; however, the project team is focusing on identifying an area with the following criteria:

- Outside of the existing TTC 400m service area
- Close proximity to a transit hub (transfer location)
- Productivity of less than ten passengers per hour which is comparable with the literature review and TTC Community Bus targets
- Ability to clearly delineate the pilot area
- Ability to clearly communicate to potential customers
- Ability to meet capacity and technology limitations of shuttle

The final service concept will be confirmed once the RFP has been awarded. This includes details such as: hours of operation, on-demand vs fixed/scheduled route, how customers will book a ride (if service is on-demand), where/if stops will be created, how/where the vehicle will charge. TTC staff will report back to the Board via a briefing note once these details have been confirmed.

4. Project relevance

This is an innovative and exciting project with many research benefits. The pilot project will help:

- Determine automated vehicle operations needs e.g. mapping, markings, etc.
- Assess the range limitations of electric and automated shuttles
- Determine and experience charging and storage facilities
- Determine redundancy/back-up/reliability needs with automated shuttles
- Determine demand and related service scheduling levels
- Determine seasonal variations in automated shuttle operations and limitations

- Observe, monitor, and evaluate road speeds and interactions with traffic
- Observe, monitor, and determine consumer acceptance levels
- Assess impacts on ridership growth/satisfaction from automated shuttles
- Determine accessibility requirements for automated shuttles

5. Conclusion

The TTC has been an active participant in the City's IDWG on AVs. As part of this group, an Automated Vehicles Tactical Plan 2019-2022 has been developed. A framework of the Plan was presented to City Council in January 2018, including a strategic direction that automated vehicle preparations and deployments be approached in a "transit-centric" manner, so as to improve the reliability, efficiency, safety, and seamlessness of transit, as well as facilitating increased transit priority.

In addition to the AV Tactical Plan, there is an opportunity to test the deployment of an automated transit shuttle (8-12 passengers) on a public road in the City of Toronto for 6-12 months starting in late 2020. This is an exciting opportunity to use automated vehicle technology to expand the TTC's service network.

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Signature

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Attachments

Attachment 1 – City of Toronto Report for Action - Minding the Gap - Request for Authority to Receive Federal Funding for an Automated Shuttle Pilot Project

TORONTO

REPORT FOR ACTION

Minding the Gap - Request for Authority to Receive Federal Funding for an Automated Shuttle Pilot Project

Date: June 25, 2018
To: Public Works and Infrastructure Committee
From: General Manager, Transportation Services and General Manager, Economic Development & Culture
Wards: All

SUMMARY

In September 2017, Transport Canada announced a Call for Proposals under the Program to Advance Connectivity and Automation in the Transportation System ("ACATS"), providing funding for supported activities including research and evaluation, development of codes and standards, as well as capacity-building and knowledge-sharing on connected and automated vehicles.

The City of Toronto's submission to ACATS has been selected, and the City is to receive up to a maximum of $365,000 to fund the research and piloting of an automated shuttle service.

The purpose of this report is to obtain Council authorization for the General Manager, Transportation Services and General Manager, Economic Development & Culture to enter into the necessary agreements with Metrolinx, TTC and the Federal Government to advance this project.

The shuttle is intended to test the technology's ability to meet an existing unmet need in public transit, such as filling the lower-demand "last mile" gap. While the location of the pilot has not yet been selected, the shuttle will not be tested on an existing transit route.

A set of decision-making criteria will be established in mid-2019 to review potential locations for the pilot, determine the level of service, and to select a single route. It is anticipated that the pilot will operate for 6-12 months, depending on the number of vehicles required.

RECOMMENDATIONS

The General Manager, Transportation Services and General Manager, Economic Development & Culture recommend that:

1. City Council authorize the General Manager, Transportation Services to negotiate, enter into, and execute a memorandum of understanding with the Toronto Transit Commission and Metrolinx to secure their respective support, commitments, and obligations to deliver the "Minding the Gap" project generally in accordance with the terms and conditions set out in the report (June 25, 2018) from the General Manager, Transportation Services and the General Manager, Economic Development and Culture, and upon such additional terms and conditions satisfactory to the General Manager, Transportation Services, and in a form acceptable to the City Solicitor.

2. City Council authorize the General Manager, Transportation Services to negotiate, enter into, and execute an agreement with Her Majesty the Queen in Right of Canada, as represented by the Minister of Transport, including any associated Certificates as may be required, for the Program to Advance Transportation Innovation (Program to Advance Connectivity and Automation in the Transportation System) generally in accordance with the terms and conditions set out in the report (June 25, 2018) from the General Manager, Transportation Services and the General Manager, Economic Development and Culture, and upon such additional terms and conditions satisfactory to the General Manager, Transportation Services, and in a form acceptable to the City Solicitor.

3. City Council authorize the General Manager, Transportation Services to accept $50,000 in federal funding for related expenditures in 2018 and increase the 2018 Operating Budget for Transportation Services by $50,000 gross and $0 net, on a one-time basis.

4. City Council direct the General Manager, Transportation Services and the General Manager, Economic Development and Culture to include the remaining $315,000 in federal funding in their respective operating budget submissions for the year 2019-2022 as appropriate.

FINANCIAL IMPACT

The total project value for "Minding the Gap" is $1.1531M including both cash and in-kind contributions. Funding from Her Majesty the Queen in Right of Canada, as represented by the Minister of Transport ("Transport Canada") totals $365,000 over four federal fiscal years (April 1 to March 31 annually). Eligible expenditures incurred from April 1, 2018 to March 31, 2022 will be reimbursed by Transport Canada upon filing of a project report and financial claim. No costs have been committed, nor incurred, to date.

The City of Toronto's cash contribution totals $60,000 for a portion of the lease of the shuttle vehicle(s), and is entirely within the 2020 calendar year. This amount will be requested by Transportation Services in its 2020 Operating Budget submission. An in-

kind contribution of staff time, vehicle storage, and other supports from the City is valued at $224,100 over the project period (2018-2022).

Partner in-kind contributions are valued at $252,000 each from Metrolinx and the Toronto Transit Commission. The $50,000 in federal funding provided in 2018 will support baseline attitudinal research to be conducted by Ryerson University.

The Interim Chief Financial Officer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

At its meeting of January 31 and February 1, 2018, City Council requested the General Manager, Transportation Services to explore opportunities to enhance partnerships with other levels of government including other municipalities in the Greater Toronto and Hamilton Area, Province of Ontario, and across Canada to share strategies and develop best practices.

The Committee decision can be viewed at:
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.PW26.4

COMMENTS

In September 2017, Transport Canada announced a Call for Proposals under the Program to Advance Connectivity and Automation in the Transportation System (ACATS). Eligible applicants, including municipalities, could request up to $500,000 for projects that may span up to four federal fiscal years, from April 1, 2018 to March 31, 2022. Supported activities include research and evaluation, development of codes and standards, as well as capacity-building and knowledge-sharing related to connected and automated vehicles.

The City of Toronto's application to ACATS was focused on automated vehicles, with a transit-centric approach as suggested in the Draft Automated Vehicle Tactical Plan 2019-2021, which was developed by the City's Interdivisional Working Group on Automated Vehicles. The Draft Plan was included for information in the January 5, 2018 report to Public Works and Infrastructure Committee entitled, "Preparing the City of Toronto for Automated Vehicles." Specific recommendations and a detailed and comprehensive Tactical Plan will be submitted to the Committee in 2019.

The Project, Partners, and Agreements

The ACATS submission, known as "Minding the Gap," involves a partnership of the City of Toronto, Toronto Transit Commission ("TTC"), and Metrolinx to research and test an automated shuttle that can operate without a driver. The project is intended to provide exposure to and experience with this new type of vehicle for local transit operators the TTC and Metrolinx, and for the City's Transportation Services Division as the manager of the road-based transportation system. The pilot shuttle service will also allow the public to learn about these new vehicles and the potential type of service gap they could

fill. The University of Toronto Transportation Research Institute and Ryerson University School of Urban and Regional Planning will play a supporting role in assisting in the monitoring and evaluation of the shuttle service impacts and response. A full list of the project's goals and objectives are included in Attachment 1, with a description of the project in Attachment 2.

In order to access the project funding, an Agreement for Minding the Gap: Advancing Toronto's Transit System Through Automation (the "Agreement") must be executed by the City of Toronto with Transport Canada. The Agreement sets out the terms and conditions upon which Transport Canada will agree to provide the City with funding, based on the project proposal and related third-party contributions. This report seeks authority for the General Manager, Transportation Services, to negotiate, enter into, and execute the Agreement, including any Certificates pursuant to the Agreement, generally in accordance with the terms and conditions set out in the body of this report and Attachment 3, and upon such other terms and conditions satisfactory to the General Manager, Transportation Services.

In addition, this report seeks authority for the General Manager, Transportation Services, to negotiate, enter into and execute a Memorandum of Understanding with the Toronto Transit Commission as well as Metrolinx, generally in accordance with the terms and conditions set out in the body of this report and Attachment 3, and upon such other terms and conditions satisfactory to the General Manager, Transportation Services.

The participation of Ryerson University and The Governing Council of the University of Toronto, as evaluating partners, will be secured through agreements in accordance with current City authorities.

Economic Development

As part of Minding the Gap, the Economic Development & Culture division will develop a plan to increase the attractiveness of Toronto as a global hub for the development of automated transit vehicle technology. The development of a needs assessment study for economic development will be completed by March 31, 2020. It will ensure that the City of Toronto remains at the forefront of research and development on connected and automated vehicle technology and transit-related issues by developing a plan to establish the necessary supply of talent to support this industry going forward.

Shuttle Vehicle and Operation

Automated shuttles typically seat 8-12 passengers and are designed to travel in low-speed, low-volume environments. Most are electric-powered and operate at an automation level of four ("high automation"), as per the scale established by the Society of Automotive Engineers. While an on-board driver is not required to operate the vehicle, this pilot project will include "ambassadors" who will staff the vehicle at all times. These ambassadors will be paid staff by the TTC and Metrolinx, and forms the bulk of their contributions to the project. Automated shuttles have been demonstrated in numerous cities around the world, with more significant pilot projects in Las Vegas and

a number of European cities. The City of Calgary recently announced a pilot shuttle will launch to serve the Calgary Zoo.

The type of vehicle chosen for the "Minding the Gap" pilot will have be an established shuttle model that has been tested in other jurisdictions. The RFI will gather the vehicle safety records from original equipment manufacturers, and inform the criteria to be included in the service RFP. From the reports of testing in North America, most collisions with automated vehicles result from human error by drivers in other vehicles.

In response, a communications and education campaign will be implemented prior to the launch of the shuttle service, with particular attention paid on the immediate area surrounding the pilot location. In addition, an automated shuttle "road show" will travel to various locations within the Greater Toronto and Hamilton Area for broader public education. While the shuttle is in operation, it will be monitored at all times by on-board ambassadors from the TTC and Metrolinx.

Shuttle Pilot Location

The pilot shuttle service will be located within the City of Toronto, and connect to at least one rapid transit station (either TTC or GO Transit). The intention of the pilot is to fill an existing gap within the public transit system, such as linking two transfer points or solving the first-mile/last-mile challenge. It will not replace conventional service. The exact criteria for selecting a location will be determined following the completion of the request for information (RFI) and more fulsome understanding of the capacity, range limitations, and other specifications of the available commercial technology. It is anticipated that the shuttle will operate in a relatively low-speed, low-volume mixed traffic environment. The shuttle must comply with Ontario Regulation 306/15, Pilot Project - Automated Vehicles to the Highway Traffic Act in order to operate on a public highway; approval by the Registrar will be a requirement of the request for proposals (RFP) to original equipment manufacturers of shuttle vehicles.

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SIGNATURE

_____	_____
Barbara Gray	Mike Williams
General Manager	General Manager
Transportation Services	Economic Development & Culture

ATTACHMENTS

Attachment 1: Project Goals and Objectives
Attachment 2: Detailed Project Description
Attachment 3: Terms and Conditions for the Agreement with Transport Canada and MOU with Metrolinx and TTC

Attachment 1: Project Goals and Objectives

1.Increase understanding and knowledge of the technical requirements to operate an automated shuttle.

A. Determine the technical specifications of automated shuttles currently available in the marketplace by March 31, 2019.

B. Test and measure the performance of automated shuttles against the technical specifications by February 28, 2022.

2. Increase understanding and knowledge of the administrative requirements to deliver service through an automated shuttle.

A. Determine location, projected travel demand, number of vehicles required, length of pilot, and related service scheduling by August 31, 2019.

B. Prepare supports and logistics required for establishing pilot shuttle service by August 31, 2020.

C. Determine automation and procurement opportunities and challenges by December 31, 2021.

3. Increase understanding and knowledge of the interaction of an automated shuttle in the transit and transportation system.

A. Launch shuttle service by September 1, 2020 for a pilot term of between six and 12 months.

B. Observe, monitor, and evaluate the interaction between automated shuttles and existing traffic control devices (e.g. signs, pavement markings, traffic signals) by December 31, 2021.

C. Observe, monitor, and evaluate impacts of interactions with other vehicles by December 31, 2021.

4. Increase understanding and knowledge of human response to an automated shuttle.

A. Survey and assess baseline opinions for panel customer survey by August 31, 2020. Survey and assess post-launch opinions of same customers between three to six months after launch. Survey and assess post-pilot opinions of same customers by September 30, 2021.

B. Survey and assess baseline opinions for panel community/stakeholder survey by August 31, 2020. Survey and assess post-pilot opinions of same community/stakeholders by September 30, 2021.

C. Survey and assess baseline opinions for “on-board ambassadors” by April 30, 2020. Survey and assess post-training, pre-launch opinions of same

ambassadors by August 31, 2020. Survey and assess post-launch opinions between 3-6 months after launch. Survey and assess post-pilot opinions by September 30, 2021.

5. Increase understanding and knowledge of the value of an automated shuttle service in the transit and transportation system.

A. Assess impacts on ridership growth/satisfaction from automated shuttles by December 31, 2021.

B. Conduct cost-benefit analysis of automated shuttle service and determine where this form of transit can be optimized by December 31, 2021.

6. Increase public support for the use of innovation in the public transit system.

A. Survey and assess baseline public attitudes toward vehicle automation by March 31, 2019. Survey and assess post-pilot public attitudes by December 31, 2021.

B. Promote the shuttle pilot service and project results through communications and public engagement by February 28, 2022.

7. Develop a plan to increase the attractiveness of Toronto for investment in the development and export of automated transit vehicle technology.

A. Develop a strategy to attract the automated transit and related industries to Toronto by March 31, 2020.

8. Provide leadership in automated vehicle preparedness at the municipal level through knowledge transfer and exchange.

A. Disseminate information gathered and lessons learned through exchange with at least 250 peers by March 31, 2022.

Attachment 2: Detailed Project Description

Stage 1: Set-up, Exploration, and Learning (April 1, 2018 - March 31, 2019)

After assembling the project team and establishing research agreements with university partners, the City of Toronto will need to build its knowledge on the various types, specifications, and needs of this disruptive technology. The first major activity for the City will be to research and prepare a request for information to the automated transit industry in the fall of 2018, with an anticipated launch in January 2019. This RFI will enable the City to gain an understanding of the available models of this technology, as well as its various operational needs.

The City of Toronto's request for information will facilitate capacity-building within the project partners regarding the procurement, development and implementation of this technology. In addition, it will bolster the City's understanding of the safety concerns, cybersecurity issues, environmental impacts, and potential equity benefits from these automated shuttles, and more broadly, in the surface transportation system. A knowledge transfer and exchange (KTE) will follow the RFI, and will assist in enhancing the transportation sector in the GTHA.

Concurrent with the RFI, Ryerson University will conduct a baseline survey of public opinion related to automated vehicles. The survey will be statistically significant for each region or single-tier city in the Greater Toronto and Hamilton Area. The questionnaire will build off of a similar exercise conducted by Ryerson in late 2016. Where possible, results from the two surveys will be compared to measure changes over the two-year period.

Stage 2A: Service Planning and Procurement (April 1, 2019 - March 31, 2020)

Once the City has gathered information from the automated transit industry, the administrative considerations and further procurement of the shuttle can begin. Metrolinx, TTC and the City will be able to determine the criteria to recommend the location of the pilot and determine projected travel demand, number of vehicles required, the length of the pilot, and related scheduling for this service.

The City of Toronto will issue a request for quotations (RFQ) or request for proposals (RFP), depending on the complexity of the procurement, no later than January 2020, with vendor selection scheduled for March 31st, 2020.

Stage 2B: Economic Development Strategy (April 1, 2019 - March 31, 2020)

The City of Toronto's Economic Development and Culture division will develop a plan to increase the attractiveness of Toronto as a global hub for the development of automated transit vehicle technology. This strategy will contribute to the competitiveness of Canada and its transportation system by enabling transport-sector innovation in a leading municipality.

The development of a needs assessment study for economic development will follow the RFI and gathering information on the automated transit industry, and will be

completed by March 31, 2020. It will ensure that the City of Toronto remains at the forefront of research and development on CAV and transit-related issues by developing a plan to establish the necessary supply of talent to support this industry going forward.

Stage 3: Service Preparation (April 1, 2020 - August 31, 2020)

This stage sets the baseline for the shuttle launch, including initial surveys of the on-board ambassadors (operators) who will staff the shuttles, community stakeholders, and transit riders. It also involves all the logistical preparations for the shuttle service, such as storage and charging access. Communications materials will also be developed for use during the service launch.

Stage 4: Service Launch
(September 1, 2020 – March 31, 2021 or August 31, 2021)

On or around September 1st, 2020, the Toronto Transit Commission, Metrolinx, and the City of Toronto will soft-launch the automated shuttle service in Toronto. The initial weeks of the shuttle pilot will be utilized to test cybersecurity risks on the automated shuttle. When the shuttle is deployed for service to the public, it will connect to a rapid transit station and fulfill an existing transit gap. A "road show" allowing people to interact with a demonstration shuttle will also be implemented across the GTHA.

Stage 5: Evaluation (April 1, 2021 - February 28, 2022)

To assess the success of this pilot from both a user perspective, as well as a technical perspective – extensive evaluation, monitoring and training will be conducted throughout the length of this project. The City of Toronto and its transit provider and post-secondary partners (the University of Toronto and Ryerson University), will be assisting and conducting evaluation regarding the response by on-board ambassadors (operators), shuttle riders, drivers interacting with the shuttle, the local community, GTHA residents, and technical observations.

Stage 6: Knowledge Transfer and Exchange (KTE)

The final major activity of Minding the Gap will be an extensive knowledge transfer and exchange aspect to ensure that the City is providing leadership in automated vehicle preparedness at the municipal level. Each goal of the City's project provides a different level of knowledge dissemination that is valuable for many groups within Canada.

In addition, the City will provide information on the lessons learned from automated vehicles operating in mixed traffic. These lessons include: its interaction with traffic control devices, and traffic itself (other vehicles). This information will be disseminated to project partners, and other municipal transportation.

Attachment 3: Terms and Conditions for the Agreement with Transport Canada and MOU with Metrolinx and TTC

Term	*Contribution Agreement with Transport Canada*	*Memorandum of Understanding with TTC and Metrolinx*
End Date	March 31, 2023	March 31, 2023
Final Claim Date	June 30, 2022; Transport Canada will not pay any claims submitted after the final claim date unless otherwise accepted by Transport Canada; and will not pay any claims until the requirements under the applicable Schedule to the agreement are complied with.	N/A
Project Completion Date (meaning the date by which all funded activities of the project under the agreement need to be completed)	March 31, 2022	March 31, 2022
Upset Funding Limit of Eligible Expenditures	Funding of not more than 100% of total eligible expenditures up to $365,000; Transport Canada may reduce or terminate funding. If the City requests that an amount to be paid by Transport Canada in a particular fiscal year of the project be re-allocated, and such re-allocation is not approved, Transport Canada may reduce the amount of funding by the re-allocation amount.	N/A
Project Partner Contributions	Estimated at $60,000 in cash and $224,100 in in-kind support from the City of Toronto.	Estimated at $252,000 for each of TTC and Metrolinx.

Term	*Contribution Agreement with Transport Canada*	*Memorandum of Understanding with TTC and Metrolinx*
Project Activity Reporting	Twice yearly progress reports are to be filed with accompanying claims for contribution funding.	Twice yearly activity reports to be filed in accordance with City of Toronto's progress reporting obligations to Transport Canada.
Contribution Exceeding 100% of Project Costs	If Transport Canada's contribution toward the project is more than 100% of the project's total eligible expenditures or if the total financial assistance received by the City in respect of the project is more than 100%, then Transport Canada can recover the excess from the City or reduce its contribution to the City by an amount equal to the excess. Any amounts due and owing by the City to the federal Crown is recognized as a debt due to the federal Crown and may be set-off by Transport Canada against any moneys payable by Transport Canada under the Agreement.	N/A
Contribution Holdback	Transport Canada may withhold up to 10% of its contribution towards eligible expenditures.	N/A
Auditing	Transport Canada has audit rights.	City of Toronto has audit rights solely to the extent required to meet its obligations to Transport Canada.
Project Communications	The Parties will comply with a Communications Protocol as attached to the agreement; basic information on the project must be developed by the City in both official languages.	The Parties will comply with a Communications Protocol in accordance with the City of Toronto's obligations to Transport Canada.

Term	*Contribution Agreement with Transport Canada*	*Memorandum of Understanding with TTC and Metrolinx*
Project Intellectual Property	All intellectual property that arises in the course of the Project will vest in the City of Toronto.	Intellectual Property terms will be negotiated.
Default or Inability to Complete the Project	In the event of default, Transport Canada may suspend or terminate any obligation to contribute, including any obligation to pay any amount owing prior to such date, may terminate the Agreement, and may require the City to reimburse Transport Canada all or part of the funds paid. If, at any time during the term of this Agreement, one or all of the Parties determine that it will not be possible to complete the Project for any reason, the Party will immediately notify the other Party of that determination and Transport Canada may suspend its funding obligation. The Recipient will, within thirty (30) business days of a request from Transport Canada, provide a summary of the measures that it proposes to remedy the situation.	In the event of default, the City of Toronto may terminate the MOU with the defaulting organizations or with all parties. If, at any time during the term of this MOU, one or all of the Parties determine that it will not be possible to complete the Project for any reason, the Party will immediately notify all other Parties of that determination.

Term	*Contribution Agreement with Transport Canada*	*Memorandum of Understanding with TTC and Metrolinx*
Liability and Indemnity	A limitation of liability clause in favour of Transport Canada. A broad indemnity in favour of Transport Canada, including that the City will indemnify and save harmless Transport Canada, its officers, servants, employees, or agents, from and against all actions, claims, demands, losses, costs, damages, suits or proceedings, whether in contract, tort (including negligence) or otherwise.	The liability and indemnity terms will be negotiated.
Disposal	The City will not dispose of any real or personal property or immovable or movable asset acquired, purchased, constructed, rehabilitated or improved, in whole or in part, with funds contributed by Transport Canada under the agreement prior to March 31, 2023 unless the City has first notified Transport Canada in writing and Transport Canada consent's to the disposal. Unless Transport Canada's consent has first been obtained, any alternate use or disposal of any assets, which includes selling, leasing and encumbering directly or indirectly, the City may be required to reimburse Transport Canada in whole or in part an amount of the funds paid by Transport Canada to the asset under the agreement.	N/A
Certificates	Certificates of compliance for progress claims and for final claim will be required.	N/A

Term	*Contribution Agreement with Transport Canada*	*Memorandum of Understanding with TTC and Metrolinx*
Project Governance	The Parties will establish an Agreement Monitoring Committee of two (2) members, including one Federal Co-chair, and one City of Toronto Co-chair, to administer and monitor this Agreement.	The Parties will establish a Project Steering Committee of three (3) members, including one City of Toronto member and one member from each of TTC and Metrolinx, to oversee the project activities and monitor this MOU.