

Automated Vehicles Tactical Plan and Readiness 2022

Date: October 2, 2019

To: Infrastructure and Environment Committee

From: General Manager, Transportation Services

Wards: All

SUMMARY

The Automated Vehicles (AV) Tactical Plan proposes an actionable path forward to prepare the City of Toronto for the introduction of highly automated vehicles - or driverless cars - on city streets, in public transit, and in the delivery of municipal services. The AV Tactical Plan builds on existing policies and strategies approved by City Council, recognizing that transportation automation should be a tool to help realize, and not hinder, the City's established vision for the future. To that end, the Plan sets the foundation for a future transportation system that optimizes mobility with improved social equity and health, environmental and economic sustainability, protection of privacy, integrated transportation options centred on public transit, increased efficiency, and progress toward achieving Vision Zero.

The AV Tactical Plan is a layered document that interprets the City's strategic vision for mobility and translates it into a set of seven high-level directions outlining how the City will support and manage the adoption of automated vehicles. A series of goals illustrate how the seven directions will look in the year 2050, together painting a picture of the future transportation system. The actions required to achieve those goals are identified as tactics, with a proposed level of progress to be reached over the next three years. A view to the potential use of automated vehicles in City operations is also included.

This first phase of preparation is intended to ensure that the City of Toronto is "AV Ready" in 2022 by undertaking an automated shuttle trial in the West Rouge neighbourhood, establishing focus areas for transportation innovation, developing AV testing response and incident preparedness protocols, undertaking public education initiatives, and furthering research and development. Details of these proposals are included in the AV Readiness Schedule and Budget 2020-22 for an estimated \$6.289M.

The proposed AV Tactical Plan was developed under the leadership of the City's Interdivisional Working Group on Automated Vehicles, which is comprised of 30 divisions and agencies, with substantial support from and consultation with academic institutions, community stakeholders and non-profits, automotive and technology industry members and associations, international experts, and the general public.

RECOMMENDATIONS

The General Manager, Transportation Services recommends that:

1. City Council adopt the Automated Vehicles Tactical Plan as contained in Attachment 1 as the framework for guiding future policy decisions related to automated vehicles in Toronto and request the General Manager, Transportation Services and other relevant Division Heads to report to the appropriate committee where additional authorities are required in order to implement the tactics as necessary.
2. City Council direct the General Manager, Transportation Services, Chief Planner & Executive Director City Planning, Chief Technology Officer, Information & Technology, General Manager, Fleet Services and General Manager Economic Development & Culture to implement the proposed three-year Automated Vehicle Readiness Schedule as contained in Attachment 2 including the Automated Shuttle Trial, Transportation Innovation Zones, Testing Response & Incident Preparedness, Human Learning and Research & Development Program projects, and to report to the appropriate committee where additional authorities are required in order to implement proposed actions in the Readiness Schedule.
3. City Council authorize the General Manager, Transportation Services to implement and operate an automated shuttle trial serving the Rouge Hill GO Transit Station in partnership with the TTC and Metrolinx and to negotiate, enter into, and execute any and all agreements, including with third-party private vendor(s), as may be required to implement and/or give effect to the automated shuttle trial, upon terms and conditions satisfactory to the General Manager, Transportation Services, and in a form satisfactory to the City Solicitor
4. City Council direct the General Manager, Transportation Services Chief Planner & Executive Director City Planning, Chief Technology Officer, Information & Technology and General Manager, Fleet Services to seek external opportunities to fund and/or enhance the implementation of the Automated Vehicles Tactical Plan.
5. City Council direct the General Manager, Transportation Services to report back to the Infrastructure and Environment Committee on a proposed framework for, and designation of, innovation zones in the City of Toronto by the fourth quarter of 2020.
6. City Council direct the General Manager, Transportation Services to publish an annual status report on the implementation of the AV Tactical Plan, and to report to the Infrastructure and Environment Committee with a full status report in the second quarter of 2022.
7. City Council forward this report to the Minister of Transportation for Ontario and the federal Minister of Transport, requesting the following:
 - a. A meeting to discuss how the provincial and federal governments could collaborate with the City of Toronto on the implementation of the AV Tactical Plan;

b. A public education initiative to reduce instances of distracted driving arising from the misuse of partial automation technology;

c. A public education initiative to increase awareness of how other road users, including public transit users, should interact with automated vehicles.

FINANCIAL IMPACT

The financial impact of implementing the Automated Vehicles Tactical Plan is outlined in Attachment 2, Automated Vehicles Readiness Schedule and Budget 2020-22. Total expenditures over the three years are estimated to be \$6.7M, partially offset by \$0.4M of funding from Transport Canada (\$0.3M) and the Approved 2019-2028 Capital Budget & Plan for Transportation Services (\$0.1M). The estimated potential cost to the City is approximately \$6.3M net.

Funding is not currently available in the Operating Budgets of the following City Divisions: City Planning, Economic Development & Culture, Fleet Services, Information & Technology, and Transportation Services. Required funding will be included in the Divisional Operating Budget submissions for consideration during the 2020 and respective future budget processes.

Costs to implement the Automated Vehicles Tactical Plan will include additional staffing for the various projects outlined in Attachment 2: Automated Shuttle Trial, Transportation Innovation Zones, Testing Response & Incident Preparedness, Human Learning, and Research & Development Program.

Table 1: Estimated Operating Budget Impact for future years (2020-2022).

\$millions	2020	2021	2022	2020 - 2022
Expenses	\$1.6 M	\$2.5 M	\$2.5 M	\$6.7 M
Revenue	\$0.2 M	\$0.2 M	\$0.0 M	\$0.4 M
Net	\$1.5 M	\$2.3 M	\$2.5 M	\$6.3 M

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

DECISION HISTORY

City Council, at its meeting of January 31 and February 1, 2018, requested the General Manager, Transportation Services to report to the successor of the Public Works and Infrastructure Committee with specific recommendations and a detailed and comprehensive Automated Vehicles Tactical Plan. In addition, City Council requested that the General Manager explore opportunities to enhance partnerships with other levels of government, and to pursue formal membership in the Municipal Alliance for Connected and Autonomous Vehicles in Ontario (MACAVO).

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.PW26.4>

City Council, at its meeting of July 23-27 and July 30, 2018, authorized 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 for the "Minding the Gap" automated transit shuttle pilot project to be partially funded from Transport Canada's Program to Advance Connectivity and Automation in the Transportation System (ACATS).

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.PW31.7>

The Toronto Accessibility Advisory Committee, at its meeting of June 4, 2019, received a presentation on Preparing the City of Toronto for Automated vehicles.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.DI2.2>

COMMENTS

At the January 2018 meeting of the Public Works and Infrastructure Committee that considered the report on "Preparing the City of Toronto for Automated Vehicles," staff and stakeholders presented various research and projections regarding the potential adoption of automated vehicles and associated disruption. In the less than two years since that report, transportation innovations and technological developments have continued, with the arrival of new modes of transportation such as e-scooters and other micromobility, and the rapid adoption of services from private transportation companies such as Uber and Lyft.

At the same time, AV technology continues to advance, with an expanded testing framework in Ontario that now permits AV testing without a driver in the vehicle. There have been limited commercial deployments of shared passenger AV services in the Phoenix and Las Vegas areas, (human supervision of the vehicles is still provided in these cases). Dozens of other tests of automated transportation technology in various vehicle classes, including sidewalk delivery robots, recreational vehicles, and heavy trucks, have been reported on or announced in North America. At the same time, high-profile crashes involving privately owned, partially automated vehicles and highly automated test vehicles have dampened some of the enthusiasm regarding the technology. Furthermore, some industry leaders have publicly announced adjusted and extended timelines to developing fully automated technologies.

While some industry members are discontinuing their AV research, others are continuing to develop and implement the technology. Nearly \$1.5B of private sector investment related to the research and development of automated vehicles has been announced for Ontario since 2017. In addition, the Provincial government has committed \$80M in funding over five years for the Autonomous Vehicle Innovation Network (AVIN), and the federal government has allocated millions for initiatives such as the Program to Advance Connectivity and Automation in the Transportation System (ACATS). A unique aspect to the AVIN initiative is the recently launched WinterTech Development Program, which focuses on refining the technology to meet Ontario's challenging winter climate.

Purpose of the AV Tactical Plan

Urban transportation is changing systematically with technological innovation and is doing so at a rapid pace - and is expected to continue to do so, despite recent changes to the pace of development of automated technologies. Any pause in the introduction of AVs in Toronto only provides an opportunity to become "AV Ready" in advance. In this regard, the AV Tactical Plan is designed to take advantage of a once-in-a-century opportunity to harness technological change for broader public policy objectives. In Toronto, visible signs of the last transformation of the transportation system, from horse-drawn carriage to the internal combustion engine-powered automobile, are ever-present. These historical shifts in the transportation system have altered land use, commute times, road safety, public health, social equity, employment opportunities and required skillsets, and City services overall; and the next shift could have similar consequences that may take decades to address.

The AV Tactical Plan was created to fill a gap between emerging technical understanding of AVs and the City of Toronto's existing long-term visions, strategies, and plans to be a healthy, equitable, livable and sustainable city. The Plan outlines how the City should prepare for AVs and how it can influence the introduction 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 potential externalities placed on the municipality, the public, and workers from the arrival of AVs in the City. It is important that government and the public proactively articulate a vision for the adoption of the technology.

Structure of the AV Tactical Plan

The Automated Vehicles Tactical Plan consists of seven broad directions that reflect the City of Toronto's existing strategic vision for the future of the transportation system, as well as sections focusing on public service vehicles, future-proofing, and data governance. Each direction statement is built on a foundation comprised of existing City policies, plans and strategies. The seven directions are as follows:

1. *Social Equity & Health: The City of Toronto will encourage the adoption of driving automation systems in a manner that improves social equity and health.*
2. *Environmental Sustainability: The City of Toronto will encourage the adoption of driving automation systems in a manner that increases environmental sustainability across a vehicle's entire lifecycle.*
3. *Economic Sustainability: The City of Toronto will support and enhance sectors related to automated vehicles, with a particular focus on attracting industries, investment, and employment, as well as on exporting products and services.*
4. *Privacy: The City of Toronto will support and enhance data privacy as it relates to the generation, collection and use of information by automated vehicles.*
5. *Road Safety & Security: The City of Toronto will encourage the adoption of driving automation systems that are proven to create a net benefit to road safety and security.*

6. Integrated Mobility (centred on public transit): *The City of Toronto will encourage the adoption of driving automation systems that further integrate space-efficient and active modes of travel, and better manage all traffic impacts from the movement of goods.*

7. Transportation System Efficiency: *The City of Toronto will enhance its ability to manage traffic in real-time through driving automation systems for the purpose of increasing the efficiency of moving people and goods.*

The Plan is organized according to each direction, and includes a brief description of its purpose, followed by guiding policies and strategies. After the introduction for each direction, there are key performance indicators (KPIs) included for monitoring the progress of the AV Tactical Plan. These KPIs are connected to a 2050 Goal.

Eighteen goals paint a mental image of what life in the City of Toronto could be like in 2050 if the City has successfully harnessed the potential of automated vehicles to achieve the broader vision. Goals are a long-term outcome, meant to be achieved at any time between tomorrow and 2050; they are not specific targets to be met over a 30-year time period. A series of actions or "tactics" contribute to the success of these goals; a total of 78 tactics are proposed to support the seven directions and City operations. The full Plan is included as Attachment 1 to this report.

AV Readiness 2022

The Automated Vehicle Readiness Schedule and Budget 2020-22 - or "AV Readiness 2022" - is the proposed set of actions and progress to ensure Toronto is ready for the introduction of commercially available or deployed automated vehicles in three years (see Attachment 2). It is currently predicted that by 2022, fleet-based vehicles with highly automated driving features may begin to operate in larger markets as part of ride-hailing services, and that some luxury model vehicles may be available for purchase and use with advanced features. It is further anticipated that automakers will continue to develop automated driving systems, but that they will not yet be ready for mass commercialization; however, partially automated feature packages – such as traffic assistance and highway pilots – will become standard on new consumer vehicle models. To prepare for these developments, the following projects are proposed to be developed and implemented from 2020 to 2022, with a mix of existing staff resources and proposed new positions, as well as new operating budgets:

1. Automated Shuttle Trial at Rouge Hill GO station

The Automated Shuttle Trial project reflects the AV Tactical Plan's transit-centric approach. In this temporary trial, an automated shuttle service will be provided to riders as part of the transit network. It will test the ability of an automated shuttle to address gaps in the current transit system, particularly first-mile/last-mile connections to rapid transit stations. The Shuttle Trial is jointly delivered by the City of Toronto, TTC and Metrolinx with financial contributions from Transport Canada and the City of Toronto. Authority to receive the remaining \$315,000 in federal funding for the project was granted by City Council in July 2018.

The Shuttle Trial, which is expected to begin in September 2020, is proposed to connect the West Rouge neighbourhood (east of Ridgewood Road) to the Rouge Hill GO station, where users can transfer to GO, TTC and Durham Region Transit services. At a minimum, the Shuttle Trial will provide a commuter service timed to transport passengers from the neighbourhood to the station to meet GO commuter rail service in the morning and afternoon. This temporary service will be in operation for several months with no fare required to ride the automated shuttle.

There have been hundreds of other shuttle demonstrations and trials around the world and in Canada (including in Vancouver, Calgary, Ottawa, Candiac, and Montreal). However, this will be the first for Toronto and the only trial in Canada that has been conducted in partnership with transit agencies. To support the AV Tactical Plan goals, project partners in the Shuttle Trial want to understand the value of an automated service in the transit system, how users and community members respond to this service, and to provide an opportunity for the public to learn more about automated vehicles. There is no intention to make this project permanent and/or scale up the use of automated shuttles at this time.

Resources required: Permanent staffing in Transportation Services; dedicated operating costs are already funded through the Congestion Management Plan and Transport Canada.

2. Transportation Innovation Zones

In recent years there has been a proliferation of new transportation technologies (including vehicles and infrastructure) on the market that may provide opportunities to improve the transportation system. The Transportation Services Division is increasingly approached by private and academic sector actors with requests to trial new technologies in the public right-of-way. Currently, the Division does not have a framework for systematically assessing requests or obtaining Council approval for proposed trials.

The City of Toronto Transportation Innovation Zone framework will include an internal process and external-facing portal to ensure systematic review, public consultation, and decision making regarding transportation technology trials proposed by third-party actors (academic and private sector). The objectives of the framework will be to ensure that any third-party led transportation trials undergo adequate public consultation and have the potential to support existing City priorities. The framework may include the identification of geographical zones or corridors where certain kinds of testing are appropriate. Specifically, the framework will propose (a) a fair and transparent process for Transportation Services to receive and assess requests from third parties, (b) an approach for Transportation Services to obtain proactive expressions of interest from the public and stakeholders to create potential innovation zones or corridors, (c) a process to streamline Council approvals for appropriate trial activities that enter through the framework, and (d) potential mechanisms to support innovation in City operations, such as data-sharing agreements.

Resources required: Additional staffing in Transportation Services; \$350,000

3. Testing Response & Incident Preparedness (TRIP)

The Interdivisional Working Group on AVs is working to ensure that it is prepared for driverless vehicle testing on Toronto roads by developing a Testing Response & Incident Preparedness (TRIP) system. Adopted in 2016, Ontario Regulation 306/15: Pilot Project - Automated Vehicles allows testing of level 3, 4 or 5 automated vehicles on Ontario roads (including in the City of Toronto) under certain conditions. Administered by the Ontario Ministry of Transportation, eligible participants in the program include automobile manufacturers, technology companies, academic/research institutions and parts/systems/equipment manufacturers. The City of Toronto does not currently receive notifications of applications to, or testing activities occurring under, this provincial program.

Amendments to the Ontario Pilot Project for Automated Vehicles were made in January 2018 via Ontario Regulation 517/18. Prior to these amendments, a human driver was required to be in the vehicle at all times during testing. The 2018 amendments, however, established a new stream to permit driverless testing wherein full human oversight can be provided by a passenger in the vehicle or by remote monitoring.

There are new application requirements set out by the Ministry of Transportation for applicants who wish to conduct driverless testing under the program. The applicant must alert the impacted municipality and/or regional municipality in writing prior to testing to advise where the driverless testing will take place. The Ministry recommends that applicants contact the relevant Municipal Clerk's Office.

In supplement to the application, the applicant to driverless testing must "provide to the Ministry of Transportation, municipalities (City Clerk) and relevant authorities such as law enforcement and first responders a work zone and law enforcement interaction plan, in writing and prior to testing, explaining how the vehicle will interact with police and emergency vehicles, how the vehicle will react to construction zones and how the vehicle will interact with police and construction personnel on public roads." The Ministry may also begin to require annual reporting by program applicants; the content of these reports has not yet been established.

No applications have been made to conduct driverless testing in Ontario at this time and no notifications have been received at the City of Toronto under the new requirements; however, this activity could begin at any time. A limited number of other jurisdictions similarly permit driverless testing, and limited testing has begun in some places.

The City's Interdivisional Working Group is developing processes and procedures to both receive location notifications and work zone and law enforcement interaction plans from organizations testing automated vehicles under Ontario's Pilot Project, while also addressing the impact of these notifications and testing on City services. The Testing Response & Incident Preparedness (TRIP) system will be an administrative system and series of response protocols to better manage automated vehicle (including driverless) testing that occurs on Toronto streets, to ensure that first responders and law enforcement are prepared for this technology.

Resources required: No additional resources.

4. Human Learning

The introduction of partial and full automation into the transportation system will result in changes to driver behaviour and communication with other road users, as well as straining existing norms and rules of the road, such as driver distraction. A significant amount of public education will be required to ensure that the interactions between road users remain courteous, efficient, and most importantly, safe. Responsibility for this education rests across all stakeholders in the transportation system.

A centralized discovery and learning mechanism could provide a neutral voice for the public that addresses all of the concerns and opportunities across key players, in relation to automated vehicles. This project will ensure that the public knows how to interact with automated vehicles both as direct users and as sharers of space. A third-party group that can broker funding and messaging across government and industry is the ideal mechanism for the development of this project. Early education will focus on what is an automated vehicle, the importance of avoiding distraction with automated features, and how drivers and vulnerable road users should interact with AVs.

Resources required: Additional staffing in Transportation Services; \$200,000

5. Research & Development Program

Over the next three years, the City's AV Research & Development Program will investigate a number of issues and applications related to automated vehicles, setting a foundation of knowledge before moving toward the implementation of new programs and policies. This research and development will be undertaken by staff, consultants, and with research partners such as the University of Toronto's Transportation Research Institute (UTTRI), and is proposed to include, but not be limited to, the following highlights:

- Development of data privacy standards, governance, oversight, and protections;
- Research, development, analysis, and consultation on the integration of automation into City of Toronto fleet vehicles to support increased safety for staff and other road users, increased effectiveness of service delivery, and operational changes required to manage fueling, contracts, and data collection;
- The potential for automated sidewalk snow clearing in areas that do not currently receive mechanical snow clearing (primarily Toronto & East York);
- Potential impacts of automated vehicles on land use planning regulations, standards, and guidelines.
- Potential impacts of automated vehicles on parking demand.

Resources required: Additional staffing in City Planning, Fleet Services, Information & Technology, and Transportation Services; \$2.015M

Stakeholder Consultation and Expert Review Panel

Three rounds of consultation took place to support the development of the AV Tactical Plan, focusing on the generation of ideas, response to early proposals formed from the ideas, and then refinement of the comprehensive draft of the Plan. The first round

included a series of workshops with community stakeholders, providing education on automated vehicles and solicitation of potential actions for the City to implement. A primer on AVs was developed and presented by students from the Masters program at Ryerson's School of Urban and Regional Planning; it is currently available through a hyperlink from the City's website [www.toronto.ca/automated-vehicles]. The students also completed a report on the workshops, and provided feedback in a presentation to the Interdivisional Working Group on AVs.

In the Spring of 2018, City and TTC staff partnered with the Harvard Kennedy School to explore the impacts of AVs on municipal revenue streams, and to apply a "policy scrum" methodology to addressing the challenges and opportunities around a transit-centric approach to AVs. Both initiatives were intended to generate potential actions for the City to consider under the AV Tactical Plan. Additional ideas were fed into the development of the Plan from previous research projects conducted by faculty and/or students at the University of Toronto, Ryerson University, Massachusetts Institute of Technology (MIT), and staff at the Canadian Automated Vehicles Centre of Excellence (CAVCOE). Proposals developed by the National Association of City Transportation Officials (NACTO) and cities such as Boston, Dubai, Los Angeles, Portland, San Jose, and Seattle were also incorporated into the process.

Individual meetings were held with industry representatives and staff at other levels of government to collect additional input. More than 80 proposals were then formed from the ideas gathered. Near the end of 2018, a second round of consultation took place in the form of online surveys about these proposals to solicit feedback from industry, stakeholders, City staff, and the general public, as well as a special consultation with the Toronto Planning Review Panel. For groups who wanted to discuss the proposals in greater detail, five publicly accessible "listening sessions" were scheduled in North York and downtown in January 2019, subsequent to the online survey period.

Most of the stakeholder and industry members involved in the development of the AV Tactical Plan were located in the Greater Toronto and Hamilton Area; an illustration of the significant local interest in AVs. To ensure that the proposals of the AV Tactical Plan were both comprehensive and realistic, staff partnered with the Autonomous Vehicles Innovation Network (AVIN), an initiative by the Government of Ontario and delivered on their behalf by the Ontario Centres of Excellence (OCE), to engage a panel of experts that had not been involved in the consultation rounds. These experts, who were largely from outside of Ontario, were asked to independently review and critique an early version of the AV Tactical Plan, and then to discuss their feedback as a group. A meeting of the Expert Review Panel was hosted at the office of OCE on April 15, 2019, with a professional facilitator and chaired by AVIN/OCE. Experts on the Panel travelled or joined remotely from Australia, Europe, United Arab Emirates, and the United States. A high-level summary of the facilitator's report is also included in Attachment 3, and feedback from the Panel was incorporated into a revised draft of the AV Tactical Plan prior to the final round of consultation.

Following a refinement of the proposals and assembly of a draft plan, and the Expert Review Panel described below, a final draft of the AV Tactical Plan was posted on the City's website for public comment, with a notice sent to all previously engaged groups. Approximately 350 organizations, representing both community stakeholders and firms

involved in the production and support of automated vehicles, were invited to participate in the rounds of consultation. A detailed summary of all three rounds is included in Attachment 3.

AV Tactical Plan Monitoring and Evaluation

Administration of the AV Tactical Plan, including progress monitoring, is proposed to rest with the City's staff-level Interdivisional Working Group on AVs (membership is listed in Attachment 4). With administrative support from the proposed staff in Transportation Services, the Group will be responsible for tracking the implementation of the proposed tactics and the amount of external funding secured, as well as establishing baseline data to support the key performance indicators (KPIs) proposed in the Plan. Annual reports will be posted on the City's website, with a full progress report to the Infrastructure and Environment Committee proposed for the second quarter of 2022.

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ATTACHMENTS

Attachment 1: Automated Vehicles Tactical Plan
Attachment 2: Automated Vehicles Readiness Schedule and Budget 2020-22
Attachment 3: Automated Vehicles Tactical Plan Consultation Summary
Attachment 4: City of Toronto Interdivisional Working Group on Automated Vehicles