TO:	**CHAIR AND MEMBERS** **CIVIC WORKS COMMITTEE** **MEETING ON MAY 28, 2018**
FROM:	**KELLY SCHERR, P. ENG., MBA, FEC** **MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING** **SERVICES AND CITY ENGINEER**
SUBJECT:	**CONNECTED AND AUTONOMOUS VEHICLES** **TECHNOLOGY STRATEGY**

RECOMMENDATION

That, on the recommendation of the Managing Director, Environmental and Engineering Services and City Engineer, the following actions **BE TAKEN** with respect to developing a policy and pilot project to address the introduction of connected and autonomous vehicle technology:

(a) the Civic Administration **BE DIRECTED** to develop a Connected and Autonomous Vehicle Strategic Plan;

(b) a Connected and Autonomous Vehicle Working Group **BE ESTABLISHED to** prepare for the introduction of connected and autonomous vehicles;

(c) the Civic Administration **BE APPROVED** to become a formal member of the Municipal Alliance for Connected and Autonomous Vehicles in Ontario (MACAVO);

(d) the Civic Administration **BE AUTHORIZED** to review potential pilot projects which address the introduction of connected and autonomous vehicle technologies; and

(e) the Civic Administration **BE DIRECTED** to coordinate with London Transit Commission (LTC) on the potential development and implementation of "first mile / last mile" (FMLM) transit pilots and programs.

2015-2019 STRATEGIC PLAN

The following report supports the 2015-2019 Strategic Plan through the strategic focus areas of:

- **Building a Sustainable City**

  o Creating robust infrastructure through management and upgrades.

  o Convenient and connected mobility choices through improved congestion management and roadway safety.

  o Responsible growth through new infrastructure investment.

- **Growing Our Economy**

    - Local, regional, and global innovation through new and emerging technology to improve quality of life.

    - Strategic, collaborative partnerships with key stakeholders and municipal neighbours.

BACKGROUND

In Canada, close to 1,900 fatalities occur on roadways each year. The automotive industry has been working to improve overall roadway safety through the introduction of various levels of artificial intelligence in connected and autonomous vehicle (CAV) technology. In the future, CAV technology will be integrated into all modes of transportation and it is no longer a question of if the technology will disrupt the way we travel within our cities, but a question of when. CAVs with a lower level of automation are currently available in the market place. It is anticipated that CAVs with a high level of automation or full automation will be widely available by 2040.

CAV technology has the potential to reshape our transportation system, improving road safety for all users, traffic congestion, mobility equity, land use and environmental health.

Automated vehicles are now being piloted on Ontario's streets in the Greater Toronto Area, in various forms and for a variety of purposes. Partially automated vehicles are providing assistance to drivers in the form of cruise control, automated braking, parallel parking and other safety features included in newer vehicles. Highly automated vehicles - often referred to as driverless or autonomous cars – are being tested on public roads in Ontario, including Toronto, through a permit from the Ministry of Transportation.

While discussions on the potential benefits of driverless vehicles have increased, it is not well understood what the adoption of the technology will mean for the cities that they will drive in. Instead of taking a reactive approach to the disruption created by the technology and in order to maximize the benefit of the technology, now is the time to evaluate, assess, and plan for the onset of vehicle automation.

The age of the autonomous vehicle will usher in sweeping changes to transportation, energy consumption, passenger safety and business efficiency. CAV technology will transform cities, and a Smart Cities approach will be needed to deploy the digital and physical infrastructure necessary to connect cars to vital information.

The emergence of CAVs as a significant mode of travel and movement for goods and services will have disruptive impacts on transportation systems as a whole and industry in general in a similar fashion to the emergence of conventional automobiles over a century ago.
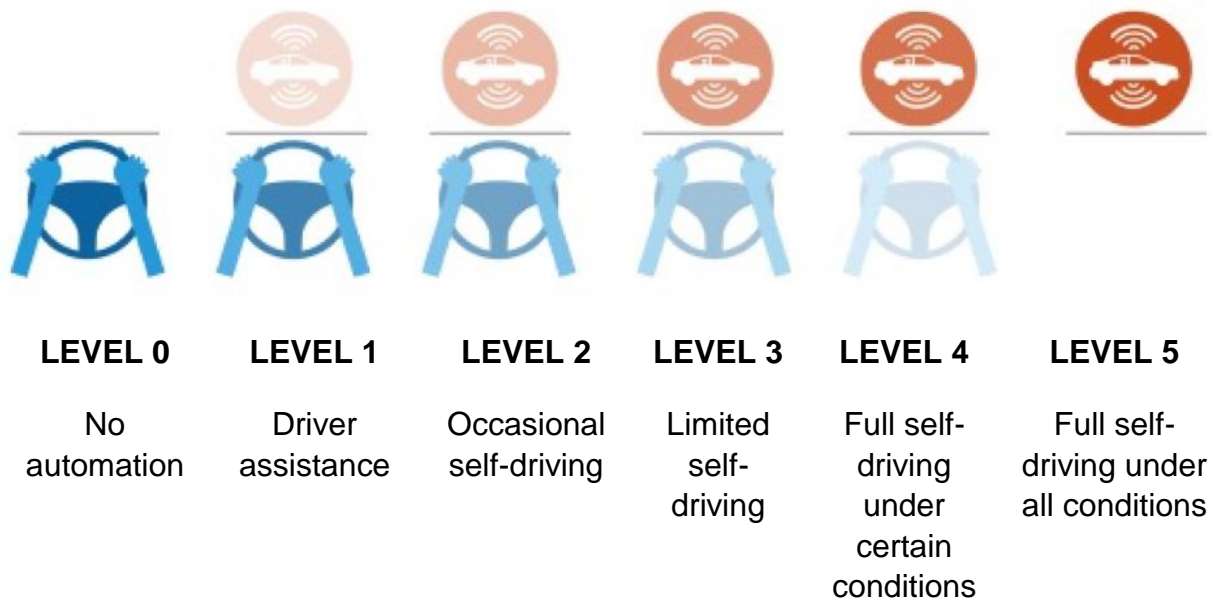
The following report outlines how the City can begin to prepare for the introduction of CAVs on its streets.

<div style="text-align: center;">**DISCUSSION**</div>

Overview: Connected and Autonomous Vehicles

Autonomous vehicles (AVs) are driverless or self-driving vehicles that are capable of detecting the surrounding environment using artificial intelligence (AI), a variety of sensors, and a global positioning system (GPS) coordinates among other means to successfully and safely navigate a transportation system.

There are six levels of driving automation developed by the Society Automotive Engineers (SAE) which span from no automation (Level 0) to full automation (Level 5).

LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
No automation	Driver assistance	Occasional self-driving	Limited self-driving	Full self-driving under certain conditions	Full self-driving under all conditions

AVs have the potential to deliver the following if properly managed:

- Environmental benefits;

- Economic prosperity;

- Societal betterment;

- Safety improvements;

- Reduce traffic congestion; and

- Improved flow of goods and services.

Interrelated with autonomous vehicles is connected vehicle (CV) technology, which is integral to providing up-to-date information to AVs through a variety of channels, including:

- Vehicle-to-Vehicle (V2V) communications;

- Vehicle-to-Infrastructure (V2I) communications; and

- Vehicle-to-Everything (V2X) communications.

Some elements of CV technologies are already being implemented in other cities and are being considered for the City's current Transportation Intelligent Mobility Management System (TIMMS) project.

Legislative Structure and Programs

Automated vehicles, including personal vehicles, taxis, small buses, and delivery robots are currently being tested in a number of locations within the United States, Australia, New Zealand, Europe, and Asia by both industry and government agencies. Nearly all automobile manufacturers have vehicles available commercially that include automation capabilities at SAE Levels 1 and 2. Most manufacturers have also developed prototypes or have partnered with suppliers and technology companies to test SAE Levels 3, 4, and 5 automated vehicles.

Different stakeholders have different roles in the development and implementation of new technology like connected and autonomous vehicles (Figure 1). Private industry develops the technology while all three levels of government (Federal, Provincial and Municipal) play a role in how the technology is regulated and deployed.

In Canada, vehicle standards are regulated by the federal government through the Motor Vehicle Safety Act, which includes the Canada Motor Vehicle Safety Standards. In "Transportation 2030: A Strategic Plan for the Future of Transportation in Canada" the federal government has indicated support for the use of connected and automated vehicles.

Figure 1 – CAV Partnerships
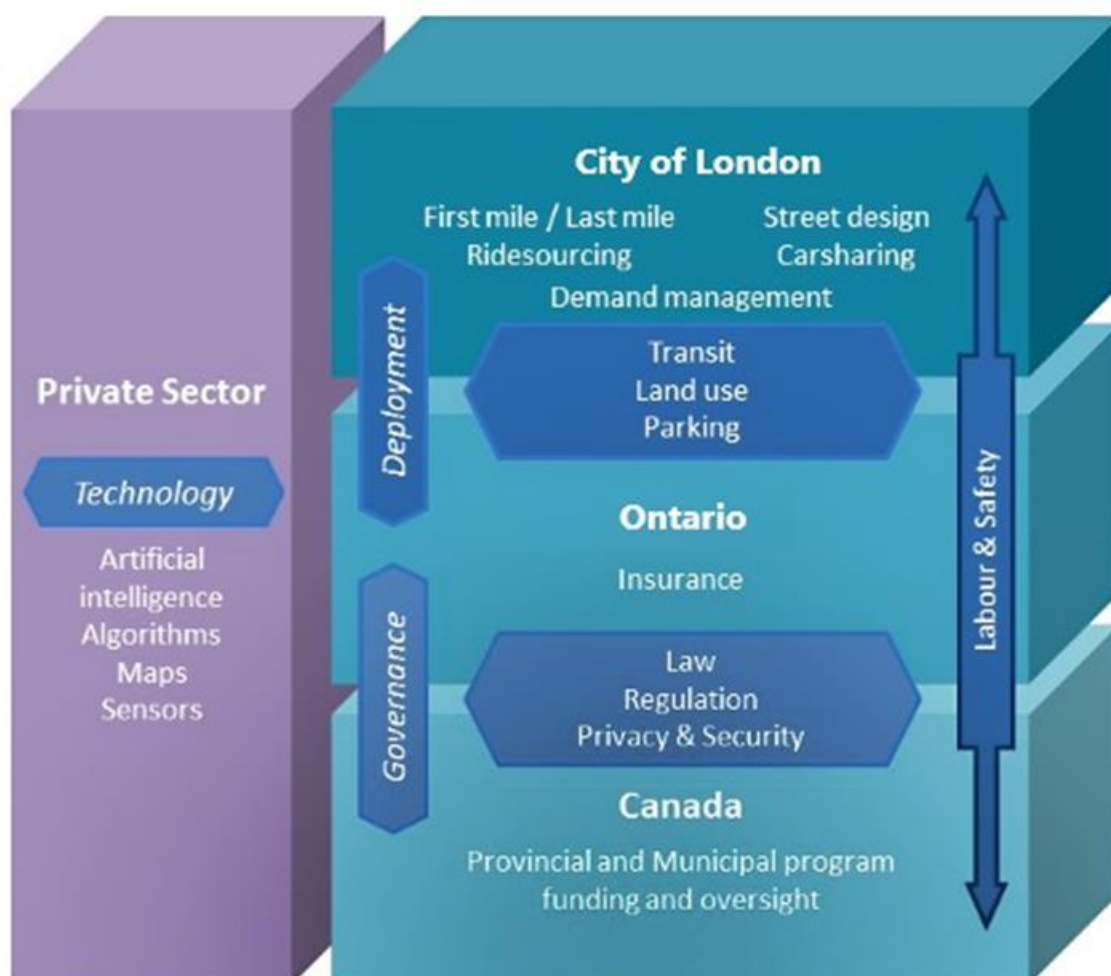
In Ontario, the use of public roads by all vehicles is governed by the Province of Ontario through the Highway Traffic Act. On January 1st, 2016, Ontario became the first province in Canada to pilot an on-road test program for automated vehicles and related technology. The pilot program follows strict governance to ensure public safety as CAV technology develops and matures.

In December 2017, the Ministry of Transportation (MTO) identified through the Ontario Regulatory Registry proposed amendments to the AV pilot regulation. These proposed enhancements to the AV pilot program are to:

- **Permit driverless testing of AVs.** The testing of AVs as part of the pilot through additional application requirements, such as a law enforcement and work zone interaction plan and alerting local municipalities of AV testing.

- **Expanded data reporting requirements.** Pilot participants would need to indicate the SAE level of the AV tested, annual reports on unplanned or non-scheduled disengagements, in-vehicle telematics (e.g. hours tested, distanced travelled, speed, harsh braking, etc.), weather conditions, and road types.

- **Permit public registration of SAE Level 3 AVs.** This would include Original Equipment Manufacturer (OEM) AV technology eligible for sale in Canada, not aftermarket and/or AV conversion products. The MTO expects SAE Level 3 AVs to be commercially available in the near future. MTO communications will include updated beginner driver education handbooks and outreach to auto industry stakeholders to leverage the availability of safety information to consumers.

- **Permit cooperative truck platoon testing.** A new pilot (within the existing AV pilot) that allows the testing of cooperative truck platooning with a driver present in each vehicle, under strict conditions and along specified routes. Cooperative truck platoons utilize a form of adaptive cruise control with V2V communication that allows for closer following distances and improved efficiencies.

The effective date of the above-proposed amendments has not been identified.

Autonomous and Connected Vehicle Technology Collaboration

Numerous organizations in Ontario and across Canada have taken up the task (with public and/or private support) to further develop CAV technology through various programs and projects. These organizations include the Ontario Centre of Excellence, the Autonomous Vehicle Innovation Network, the Institute of Transportation Engineers (ITE), Transportation Association of Canada (TAC), the Canadian Urban Transit Association, the Canadian Urban Transit Research and Innovation Consortium, and the National Operations Center of Excellence.

Leading the way in Canada, several cities have more actively pursued CAV development programs and projects, including Calgary, Edmonton, and Toronto. Civic administration has been networking directly with Canadian and international municipalities, through direct outreach and through involvement in various task forces and committees at ITE and TAC.

The City of London has been participating informally through the Ontario Good Roads Association's Municipal Alliance for Connected and Autonomous Vehicles in Ontario (MACAVO). The purpose of the Alliance is to provide a forum for municipal staff to collaborate on researching, facilitate vehicle testing with industry and academics, and to share resources and knowledge for integrating connected, automated and autonomous

vehicles into municipal operations. Other cities such as Toronto, Barrie, Brampton, Hamilton, and Stratford, as well as the Regions of Durham and York, are participating in MACAVO.

Transit and CAV Technology

Transit is a major component of mobility. Electric vehicles, autonomous technology, and driverless shuttles could all combine to create a new vision of what transit service looks like. The adaptation of CAV technology may lead to changes in the designation of space in public rights of way. Large-scale rapid transit systems in dedicated lanes have the flexibility to control what types of vehicles can use the dedicated lanes, when they can be used, and to leverage the infrastructure to optimize operations as technology evolves.

Coordination of the interaction between mass transit and CAV mobility providers to ensure that an integrated mobility model, which moves the largest amount of people, will be the key to ensuring congestion is managed in the future.

The London Transit Commission (LTC) has been engaged with the Canadian Urban Transit Research & Innovation Consortium (CUTRIC), an organization that supports projects that develop the next-generation of mobility and transportation technologies for Canadians. CUTRIC is pursuing a bid through the National Smart Vehicle Demonstration and Integration Trail with the City of Calgary, York Region and Trois-Rivières.

This project plans to integrate semi-autonomous and fully autonomous, connected, and electric vehicle shuttles/pods and buses across up to 12 Canadian municipal jurisdictions as "first-mile / last-mile" applications.

CUTRIC's National Smart Vehicle Project is being developed following the successful launch this year of CUTRIC's $45 million Pan-Canadian Electric Bus Demonstration & Integration Trial in Vancouver, Brampton, and York Region.

The National Smart Vehicle Project has a planning completion deadline of December 2018, and a full funding confirmation deadline of September 2019, with expected on-road launches in up to nine cities in Canada by 2020. The LTC and City had an initial discussion with CUTRIC but the project parameters limited the LTC's ability to participate. The project will be monitored and assessed for future opportunities.

Connected and Autonomous Vehicle Technology Strategy

With the introduction of CAVs onto our streets, it is recommended that a Connected and Autonomous Vehicle Technology Strategic Plan be developed and that a multidisciplinary working group be created to guide this initiative including representatives from the following departments and commissions:

- Environmental and Engineering Services;

- Development and Compliance Services;

- Planning;

- Information Technology Services; and,

- London Transit Commission.

The CAV Working Group would collaborate with external partners such as Western University, Fanshawe College, London Economic Development Corporation and other community partners.

The goal of the strategic plan will be to help prepare the City of London for this change, review the potential implications for City departments and commissions, and develop a cross-divisional strategic position to ensure preparedness amongst all City services. The strategy should also develop a framework for pilot projects that incorporate collaboration among transportation professionals, telecommunication providers, vehicle companies, and software technology companies, in order to encourage innovation and incentivize development.

The City of London should consider potential policy implications and develop a strategy that balances the many interests and issues at play. A number of the considerations for CAVs that should be reviewed include:

- Infrastructure upgrades and improvements including technological/ICT infrastructure;

- Land use policy (e.g. zoning, density, parking, etc.);

- Transit service policy and enhancements;

- Parking strategies and revenue impacts;

- Safety implications of CAV technology;

- Privacy and security of IT systems, data management and sharing;

- Accessibility policy to make transportation access more equitable; and

- Public awareness and education on CAV technologies.

A more detailed technical background on CAVs is provided in **Appendix A**.

CONCLUSION

Connected and autonomous vehicles have the potential to impact the existing legislative environment and a wide array of City policies, programs, and services, as well as how the City conducts business.

While early implications will primarily be focused on the transportation system, over the long-term and with higher levels of automation, there may be larger implications beyond the transportation network that City departments need to prepare for.

The development of a Connected and Autonomous Vehicle Technology Strategy will ensure this technology is developed in a way that increases mobility, safety, accessibility, innovation, and economic growth in the City of London within the regulatory barriers developed at the Federal, Provincial, and Municipal levels.

Acknowledgements

This report was prepared by Michelle Morris, EIT, Transportation Planning and Design, and Jon Kostyniuk, P.Eng., Roadway Lighting and Traffic Control Division.

SUBMITTED BY:	REVIEWED BY:
SHANE MAGUIRE, P.ENG. DIVISION MANAGER, ROADWAY LIGHTING & TRAFFIC CONTROL	**EDWARD SOLDO, P.ENG. DIRECTOR, ROADS AND TRANSPORTATION**
RECOMMENDED BY:	
KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES AND CITY ENGINEER	

Attach: Appendix A – Connected and Autonomous Vehicles: Technical Background

cc: George Kotsifas, Managing Director, Development and Compliance Services and Chief Building Official
John Fleming, Managing Director, Planning and City Planner
Mat Daley, Director, Information Technology Services
Kelly Paleczny, General Manager, London Transit Commission
Chair and Members, Transportation Advisory Committee