

AUTOMATED AND CONNECTED VEHICLES POLICY FRAMEWORK FOR CANADA

PPSC WORKING GROUP ON AUTOMATED
AND CONNECTED VEHICLES

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AUTOMATED AND CONNECTED VEHICLES POLICY FRAMEWORK FOR CANADA

Developed by the Policy and Planning Support Committee (PPSC) Working group on Automated and Connected Vehicles

Participating Jurisdictions: Canada (Co-Chair), Ontario (Co-Chair), New Brunswick, Quebec, Alberta, British Columbia, Manitoba

Participating Organizations: Canadian Council of Motor Transport Administrators, Engineering and Research Support Committee, Transportation Association of Canada

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PREFACE

Automated and connected vehicles (AV/CVs) promise to improve the safety and efficiency of our transportation system, and to bring new economic opportunities for Canadians. They have the potential to reduce collisions, traffic congestion and emissions, and to improve mobility for all Canadians.

At the same time, if we don't manage these technologies well, their introduction could actually lead to more traffic, inequitable access to mobility and negative environmental impacts.

The future of AV/CVs could be highly disruptive, for better or worse. How government and industry collectively prepare for this change will have a profound effect on how we capitalize on opportunities and lessen risks associated with these technologies.

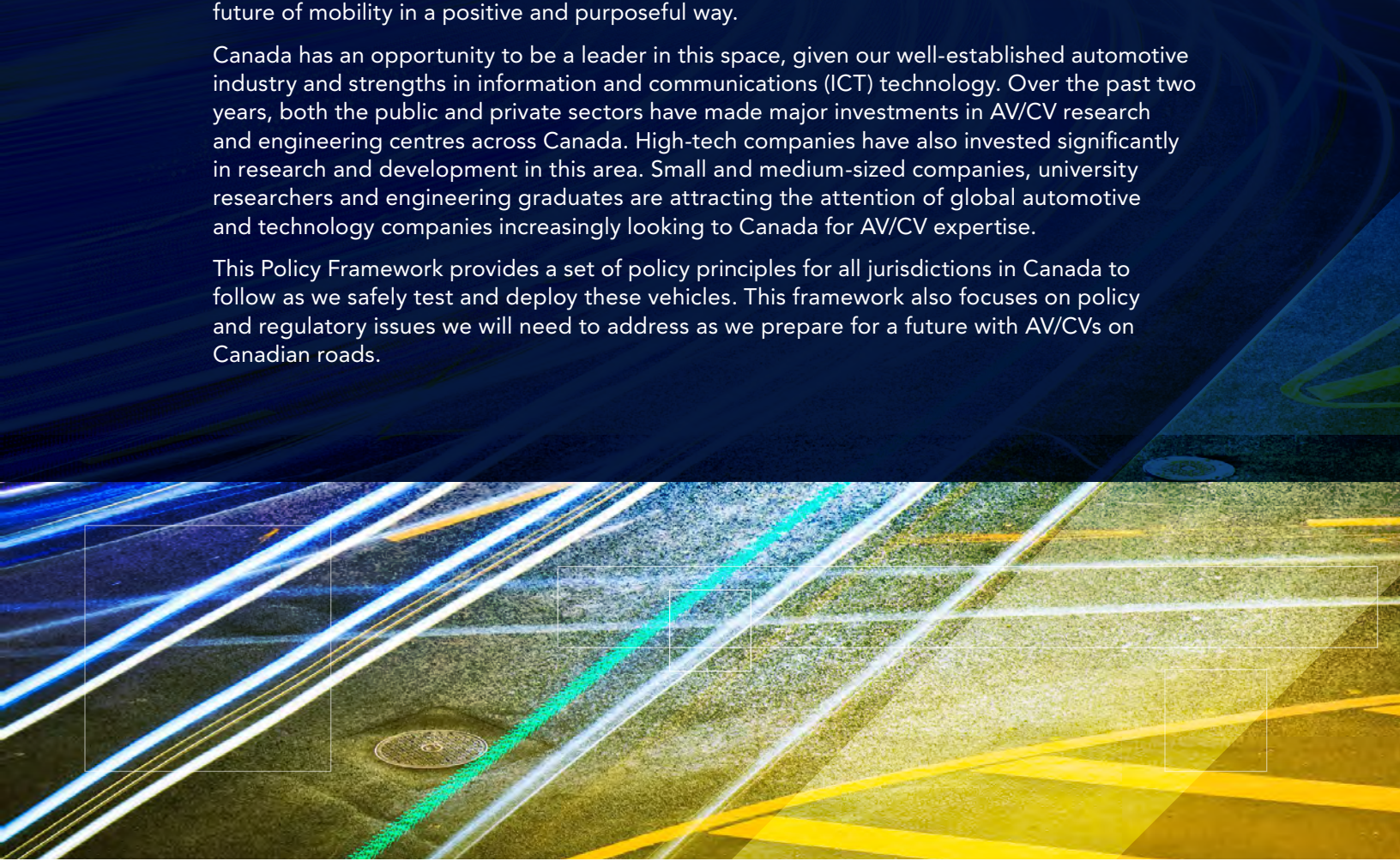
Governments and industry must be forward thinking. We need a strategic and aspirational vision for AV/CVs. We need to ask ourselves how evolving technologies will fit into our society and economy in a way that helps us achieve transportation solutions and future mobility goals for all users of our transportation system.

Canada's vision for the future of our transportation system is a system that is safe, secure, green, efficient and sustainable, and that improves the quality of life for all Canadians. We don't know the future impacts of AV/CVs, but these technologies are tools we can use to help Canada progress towards this vision.

It is critical that governments and industry continue discussing how AV/CVs can shape the future of mobility in a positive and purposeful way.

Canada has an opportunity to be a leader in this space, given our well-established automotive industry and strengths in information and communications (ICT) technology. Over the past two years, both the public and private sectors have made major investments in AV/CV research and engineering centres across Canada. High-tech companies have also invested significantly in research and development in this area. Small and medium-sized companies, university researchers and engineering graduates are attracting the attention of global automotive and technology companies increasingly looking to Canada for AV/CV expertise.

This Policy Framework provides a set of policy principles for all jurisdictions in Canada to follow as we safely test and deploy these vehicles. This framework also focuses on policy and regulatory issues we will need to address as we prepare for a future with AV/CVs on Canadian roads.



WHAT ARE AUTOMATED AND CONNECTED VEHICLES?

AV/CVs are among the most researched automotive technologies. The technologies currently available in today's vehicles are only a fraction of what is being researched and developed for the future.

The Society of Automotive Engineers (SAE) international standard J3016 uses a scale of 0 to 5 to illustrate existing and potential levels of vehicle automation: 0 (no automation); 1 (driver assistance); 2 (partial driving automation); 3 (conditional driving automation); 4 (high driving automation); and 5 (full driving automation). In this Framework, AV/CV focuses on automation levels 3 through 5.¹

Vehicles with lower levels of automation (up to level 2) are currently available for purchase in Canada. They have features such as adaptive cruise control, park assist, and automatic emergency braking. Fully automated vehicles are vehicles that can drive without human help in any situation and any location and likely won't be available for many years. Estimates for their arrival vary considerably and range from 10 to 20 years or more, depending on the source.

Global automotive manufacturers and technology companies are currently testing AV/CVs equipped with a variety of sensors, including radar, cameras and LIDAR (light detection). In addition, the technologies enable real-time positioning through GPS. These vehicles also use complex machine learning algorithms to process and respond to their surrounding environment, traffic and obstacles.

Connected vehicle (CV) technologies often appear in tandem with automated vehicle (AV) technologies. Vehicle to vehicle communication are currently available for purchase in Canada in some applications of vehicles. CVs do not make decisions for the driver. They do use wireless communications technologies to enable two-way data flows that provide information to the driver, and allow the vehicle to communicate with other nearby vehicles and roadway infrastructure.

CV technologies can also improve the situational awareness of drivers – beyond their normal line of sight – through the use of specialized communications technologies, such as dedicated short range communications (DSRC). The ability of CV technologies to help drivers “see around corners, or several vehicles ahead”, complements AV technologies, such as cameras and radar, with less visibility.

Combining AV and CV technologies is expected to be essential to achieving the highest levels of vehicle automation and to maximizing safety.

¹ Other terms commonly used to refer to vehicles with automation levels 3 through 5 include Highly Automated Vehicles (HAVs) and Connected and Automated Vehicles (CAVs). In some cases, Automated Driving Systems (ADS), the technology used for AV/CVs is used to refer to vehicles with automation levels 3 through 5. More colloquial terms include self-driving cars, autonomous vehicles and driverless cars.

INTRODUCTION

AV/CVs could bring many benefits, if we safely adopt and properly integrate them into Canada's transportation system. With up to 94% of collisions resulting from human error,² AV/CVs have the potential to reduce road accidents, deaths and injuries. They could also improve mobility choices for Canadians, along with the efficiency of our transportation system. And they may offer significant opportunities for innovation, job creation, investment attraction and economic growth.

Capitalizing on opportunities and addressing risks will require governments to consider a full range of policy options. Policymakers face added complexity, given that:

- AV/CVs may have a broad range of economic and social impacts, many of which extend beyond transportation;
- The potential effects of wide-spread use of AV/CV are both positive and negative (for example, job creation in the ICT sector, but possible job losses for professional drivers in the taxi and trucking industries);
- We are still uncertain about timelines for AV/CVs:
 - Some predict level 5 automation to be a few years away, but others believe that fully autonomous vehicles will not be available on Canada's market for decades; and
 - The impacts on our transportation infrastructure are currently not well understood. (For instance, potential changes in infrastructure designs and standards will be needed to enable deployment and adoption in the long-term).

Although the timing around the arrival of AV/CVs is uncertain, all levels of government have a key leadership role to play to prepare Canadians for the benefits and challenges associated with the new technology.

² Standing Senate Committee on Transport and Communications (2018). *Driving Change; Technology and the Future of the Automated Vehicle*. <https://sencanada.ca/en/info-page/parl-42-1/trcm-driving-change/>

BACKGROUND

On January 29, 2018, the Council of Ministers responsible for Transportation and Highway Safety endorsed the report *The Future of Automated Vehicles in Canada*.

The report provides Canadian transportation officials with an overview of short, medium and long-term policy implications related to the introduction of AV/CVs on public roads. One of the next steps this report recommended was to develop a Policy Framework for Canada that would help guide government and industry in the safe deployment of AV/CVs.

The AV/CV Policy Framework for Canada is part of a larger coordinated approach to prepare Canada for the safe deployment of this technology.

The Framework provides foundational principles that can help government, industry and academia:

- Establish shared objectives;
- Find ways to collaborate; and
- Prepare proactively for when Canada deploys and adopts AV/CVs on our roads.

The Framework is supported, and will be implemented in practice, through a number of current guidance materials such as Transport Canada's *Testing Highly Automated Vehicles (HAV)³ in Canada – Guidelines for Trial Organizations* and the Canadian Council for Motor Transport Administrators' (CCMTA) *Canadian Jurisdictional Guidelines for Safe Testing and Deployment of Highly Automated Vehicles*.

WHY THE NEED FOR AN AUTOMATED AND CONNECTED VEHICLE POLICY FRAMEWORK?

Our vision is an aligned approach nationwide for the testing and deployment of AV/CVs on Canadian roads for a safer, more efficient and innovative transportation system.

To achieve this, the Policy Framework:

1. Supports and ensures the safe use of these vehicles by providing guidance to trial organizations as well as Canadian jurisdictions for the safe testing and deployment of AV/CVs.
2. Aligns Canadian jurisdictions around key policy and legal issues.
3. Deepens government partnerships with industry and academia to support us all in promoting, testing and investing in AV/CV technology.

³ The document uses the term Highly Automated Vehicles (HAVs) to refer to AV/CVs.

ROLES AND RESPONSIBILITIES

The regulation of vehicles and road safety is a shared responsibility among all orders of government. Please refer to Annex 1 for a more detailed list of the AV/CV responsibilities among all levels of government in Canada.

The federal government:

- Leads the harmonization of regulations across Canadian jurisdictions, including regulations for pilot testing systems;
- Facilitates collaboration among all levels of government and industry; and
- Holds vehicle manufacturers accountable for safety standards compliance, technology standards internationally, particularly in the United States and Mexico.

Provincial and territorial governments:

- Create a legislative framework for AV/CV testing and deployment in their own jurisdictions;
- Create legislation that incorporates federal vehicle safety requirements; and
- Manage:
 - Driver licensing
 - Vehicle registration and insurance
 - Rules of the road; and
 - Changes to highway infrastructure we may need to support AV/CV deployment.

Municipalities:

- Execute the legislative and regulatory framework created by provinces and territories, including for AV/CV safety enforcement;
- Make land use planning decisions; and
- Operate transit systems.

LIST OF PRINCIPLES

SAFETY IS OUR NUMBER ONE PRIORITY

AV/CVs are rapidly developing and being tested on public roads for entry into the market in the near future. While there is pressure to adapt quickly to emerging technologies, the safety of Canadians is a top priority for testing and deploying these vehicles.

WE NEED EXCHANGES OF INFORMATION TO ENSURE AV/CVs ARE SAFE AND SECURE

The information and data we need to make sure AV/CVs are safe and secure must be shared with governments and law enforcement, while protecting privacy.

POLICY AND REGULATORY ALIGNMENT IS VITAL

Promoting policy and regulatory alignment within Canada, and with the United States and international partners, is essential.

WE NEED TO RAISE PUBLIC AWARENESS OF THE CAPABILITIES AND LIMITATIONS OF AV/CVs

Governments and industry will play an important role in making Canadians aware what AV/CV technologies can and cannot do.

WE NEED TO PROACTIVELY PREPARE FOR THE INTRODUCTION OF AV/CVs ON PUBLIC ROADS

All levels of government and authorities must get ready for the introduction of AV/CV technologies, along with their potential implications for safety, mobility and land use planning.

CONTINUOUS COLLABORATION IS ESSENTIAL

Canada must foster a culture of cooperation and collaboration among everyone in the AV/CV sector.



01

SAFETY IS OUR NUMBER ONE PRIORITY

AV/CVs are rapidly developing and being tested on public roads for entry into the market in the near future. While there is pressure to adapt quickly to emerging technologies, the safety of Canadians is a top priority for testing and deploying these vehicles.

The introduction of AV/CVs demands involvement from all levels of government to assess emerging technologies and develop standards, policies and regulations that facilitate the safe introduction of AV/CVs on public roads.

The continuing evolution of these technologies represents a transformative opportunity to improve road safety by reducing vehicle collisions, fatalities and the risk of injury. AV/CVs could potentially reduce the 500,000 motor vehicle collisions and 1,800 fatalities that already occur each year in Canada⁴. Governments have already implemented driver training systems, infrastructure designs and education awareness programs in attempts to reduce road collisions and fatalities. The next wave in road safety improvements may be in new and emerging technologies.

As stated in Canada's Road Safety Strategy 2025, leveraging AV/CV technologies could contribute to Canada's long-term aspirational vision of making Canada's roads the safest in the world, with zero fatalities and serious injuries. But it is important to keep in mind that AV/CVs will not get us there immediately. We still need to do a lot of work before this long-term vision becomes a reality.

We can only have widespread public acceptance if AV/CVs are demonstrated to be safe. They must be able to operate in extreme conditions, including severe weather and nearby unexpected construction. Increased automation and connectivity also creates the risk of cyber-attacks. Developing safe and cyber-secure AV/CV systems requires extensive testing in a variety of operational environments, including on public roads and closed test facilities, in order for industry to continue to develop – and for regulators to understand – the capabilities and limitations of these vehicles in all circumstances.

⁴ Driving Change: Technology and the Future of the Automated Vehicle, Report of the Standing Senate Committee on Transport and Communications, January 2018.

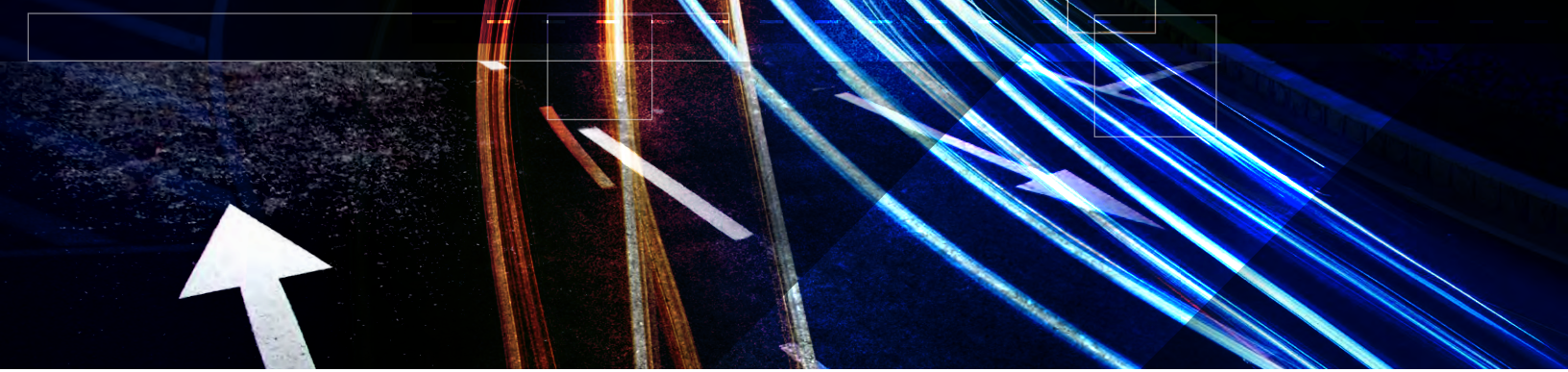
Safety standards, along with policy and regulatory frameworks are the key to delivering the focus on safety we need, together with the benefits of AV/CVs we envision. Replacing human operators with automated technology raises a number of risks. This is why it is imperative to develop minimum standards.

Here are the key current Canadian guidance materials that aim to provide a consistent Canada-wide approach to safe testing and deploying AV/CVs on public roads in Canada:

1. **Testing HAV Vehicles in Canada – Guidelines for Trial Organizations:** This document, published by Transport Canada, establishes a series of guidelines to direct the safe conduct of HAV trials in Canada, agreed upon by federal, provincial and territorial representatives of CCMTA.

These guidelines:

- Promote Canada as a destination for HAV trials;
 - Outline for trial organizations the different roles and responsibilities for jurisdictions in facilitating these tests; and
 - Establish a set of voluntary minimum safety practices that trial organizations are expected to follow in Canada.
2. **Canadian Jurisdictional Guidelines for Safe Testing and Deployment of HAVs:** These guidelines, developed by CCMTA, in partnership with Transport Canada and provincial/territorial road transportation officials, provide a series of considerations and recommendations that will support Canadian jurisdictions in developing AV/CV testing programs and preparing for the deployment of these emerging technologies. Overall, the document discusses the various roles and responsibilities of the federal, provincial and territorial governments involved in facilitating trials and deployment of AV/CVs, along with the various disciplines of vehicle registration, driver licensing and law enforcement.



02

WE NEED EXCHANGES OF INFORMATION TO ENSURE AV/CVS ARE SAFE AND SECURE

The information and data we need to make sure AV/CVs are safe and secure must be shared with governments and law enforcement, while protecting privacy.

The two-way exchange of relevant data and research is critical for the decision-making process. Anyone involved in developing and deploying AV/CVs can benefit from the exchange of lessons learned from government and industry testing, and academic research, development and demonstration. This same information will help governments develop regulations and standards that not only protect the public interest with regard to AV/CVs but also enable rapid and continuous improvement of the technology.

Data exchange will also be crucial when AV/CVs are fully deployed onto public roads. The exchange of relevant situational information from trials such as road and traffic conditions and pavement markings is crucial for successful deployment. In addition, AV/CVs must be able to communicate with other vehicles and with infrastructure technologies in a seamless manner. If we develop these technologies in silos, we may not realize their full benefits.

Pilot testing provides an opportunity to evaluate the type of facilities and infrastructure needed to leverage the full benefits of AV/CVs and accelerate Canada's readiness to adopt these new technologies. Building upon successful pilots will also lay the foundation for the development of future regulations.

Governments should continually provide the most up-to-date road information to industry, while industry and academia involved in pilot testing should share data that could assist government in developing policies, regulations and in making future infrastructure investments.

In the short term, governments should leverage industry and academic insights to create and continually update guidelines for AV/CV testing. Data shared from tests could also help to inform future safety requirements.

As we prepare for deployment, and during deployment, the exchange of information between governments and AV/CV-focused industry members has the potential to improve navigation and operation data. For example, governments could relay information about construction zones and congestion, while industry could test the accuracy and adequacy of infrastructure elements like pavement markings and signage. This exchange of information would be mutually beneficial, helping to improve the safe navigation and operation of AV/CVs.

Data exchange is vital to determining AV/CV-related best practices and standards. Canadian governments should work together with industry and other key players to integrate data-sharing models with global best practices. A data-sharing model could encourage voluntary information exchange for common and shared benefits or be mandated through legislation or regulation. By fully exchanging information, governments can help Canada stay on track to be a leader in the safe and successful development and deployment of AV/CVs.



03

POLICY AND REGULATORY ALIGNMENT IS VITAL

Promoting policy and regulatory alignment within Canada, and with the United States and international partners, is essential.

Canada is committed to working towards a coordinated national approach for introducing of AV/CVs on public roads. Given the clear distinction between federal, provincial/territorial, and municipal roles, all jurisdictions should commit to a common approach for the testing and use of AV/CVs.

Our ultimate goal is to ensure that policies and regulations across Canada are aligned so testing organizations can operate consistently across Canada. A patchwork of policies and regulations that inhibit innovation and the development of new safety features, new kinds of vehicles, technologies, and systems is not in the public interest.

Also, in order to leverage the full benefits and encourage the efficient use of this technology, policies and regulations will need to be properly drafted to attain goals that go beyond safety, such as reducing congestion and vehicle emissions.

Maintaining policy and regulatory alignment with the United States and international partners is equally important. Given the integrated nature of the North American transportation sector, we need to ensure that Canada's transportation system is ready for the deployment of AV/CVs – in tandem with the United States.

Currently, Transport Canada's *Motor Vehicle Safety Act* (MVSA) and related Canadian Motor Vehicle Safety Standards are already closely aligned with legislation and standards in the United States. As the technology evolves, governments should continue to work proactively to align regulatory frameworks.

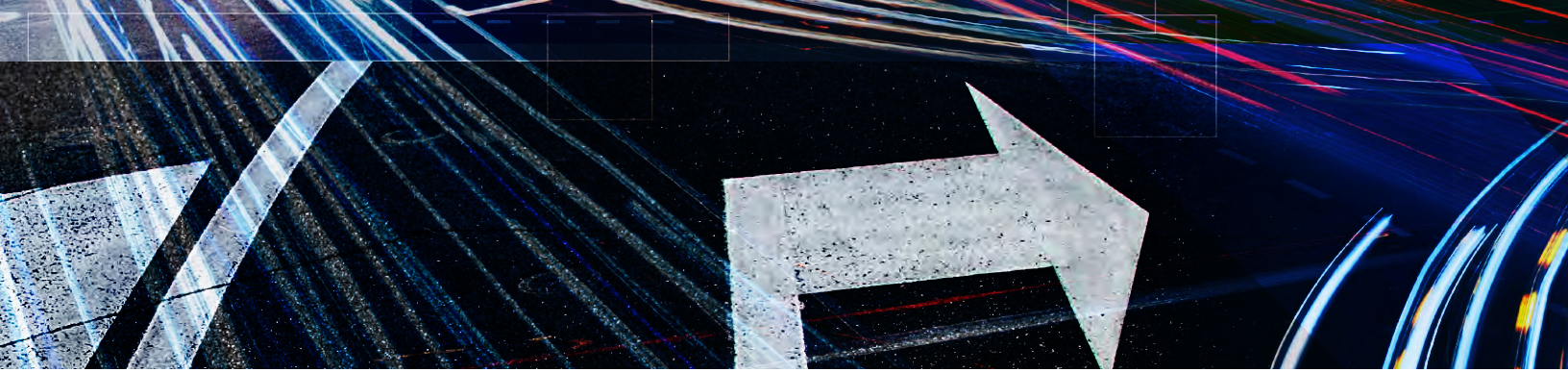
Jurisdictions worldwide are working to identify the policy and legal issues associated with AV/CV testing and deployment. Countries with large automotive manufacturing interests are making significant investments in research and development, deploying large-scale demonstration projects, engaging in public-private cooperation, and developing regulatory frameworks and standards informed by testing results and best practices:

- The U.S. Department of Transportation’s National Highway Traffic Safety Administration (NHTSA) has released voluntary safety guidelines for the safe development and deployment of AV/CVs (SAE Automation Levels 3 through 5).
- The American Association of Motor Vehicle Administrators (AAMVA), in which the province of Ontario and Alberta currently represent Canada, has recently released a set of voluntary recommendations for consideration by AAMVA jurisdictions under the various disciplines of vehicle registration, driver licensing and law enforcement.
- The Australian government has published guidelines for AV/CVs trials to provide clarity to industry, and so that trials can take place across all states and territories.
- An Ethics Commission appointed by Germany’s Federal Ministry of Transport and Digital Infrastructure published its report on the algorithms of AV/CV driving systems in the form of 20 ethical rules for AV/CV vehicular traffic. This document offers direction for both developers and consumers when considering the ethical principles that should guide machines reacting to different situations that impact human life.
- The United Kingdom has been making large investments in the research and development of AV/CVs and has four cities conducting driverless car trials: Bristol, Greenwich, Milton Keynes and Coventry.
- The European Commission adopted a European Strategy on Cooperative Intelligent Transport Systems (C-ITS). This strategy will make it possible to deploy vehicles that can communicate with each other and the infrastructure on EU roads as of 2019. It aims to avoid a fragmented internal market, use a mix of communication technologies, address security and data protection issues, develop the right legal framework, and cooperate at the international level.

Monitoring, testing and deployment efforts that are underway in a number of G7 and OECD countries to promote the use of AV/CVs will help Canada identify best practices and assess how to use and adapt them in the Canadian context. Canada should also identify where our leadership and expertise can be used and leveraged internationally.

An active international presence can benefit Canadian efforts to influence regulatory standards and identify Canadian global leadership opportunities.

As we move closer towards deployment and greater adoption of AV/CVs, and their integration with smart cities, the connectivity of these vehicles will become even more essential. Industry has a role to play in ensuring their AV/CVs can communicate with one another as well as with infrastructure. Over the next few years, Canadian jurisdictions need to start including AV/CVs as part of their planning processes for any new digital or physical infrastructure investments, and to make sure that they are aligned with other provinces and territories.



04

WE NEED TO RAISE PUBLIC AWARENESS OF THE CAPABILITIES AND LIMITATIONS OF AV/CVs

Governments and industry will play an important role in making Canadians aware of what AV/CV technologies can and cannot do.

Public education and outreach is an important activity for government and industry. Federal, provincial, territorial, and municipal governments can also facilitate a successful deployment and broad public acceptance of AV/CVs during early phases of adoption by proactively taking steps to address public uncertainties.

As vehicles get closer to full automation, public outreach will be vital for informing people about the safety benefits, limitations, vulnerabilities and risks of AV/CVs.

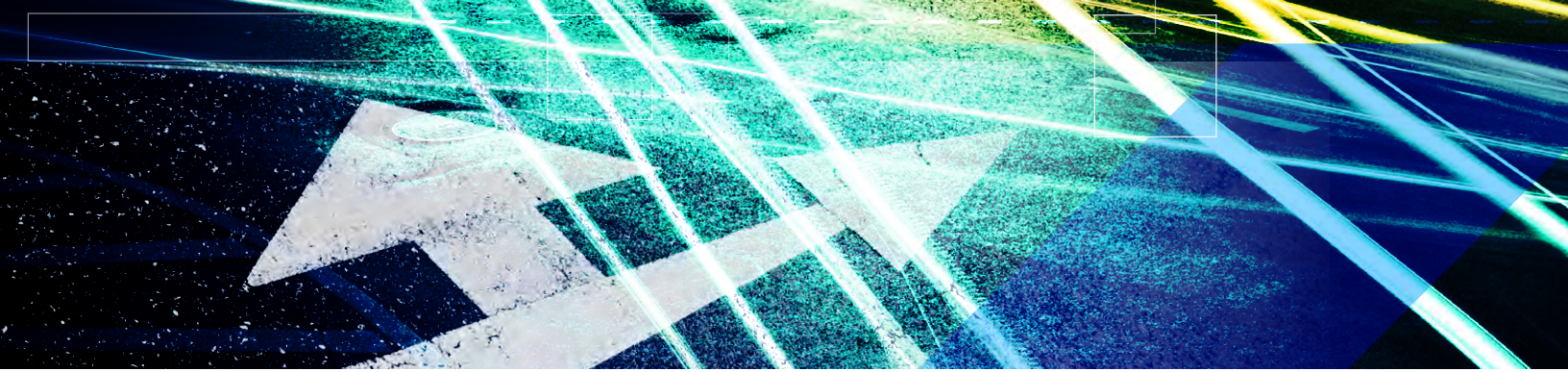
This will be especially important during the transition period as we assess the practical complexities of adopting AV/CVs on public roads. The public relies on the government to pave a safe path forward.

The public will need to be educated on several aspects of these technologies, including:

a) The benefits that AV/CVs may offer, such as:

- Fewer traffic collisions through better collision avoidance and reduced driver error;
- Reduction in traffic congestion and increase in highway capacity;
- Improved fuel efficiency and reduced vehicle emissions;
- Convenience, time savings and lower stress for drivers and commuters;
- Enhanced mobility and mobility equity;
- Improved efficiency of infrastructure use (roads and parking);
- Emergence of new transportation service models;
- Additional applications to public transit; and
- Improved access to transportation, serving those who are currently under-served, such as the elderly, people with disabilities and people living in rural and remote communities.

- b) Capabilities and limitations of AV/CVs, given that these technologies are continually evolving and the transition to full automation will be gradual. Therefore, what AV/CVs can and cannot do must be well articulated and easily accessible to consumers and the general public. This will promote awareness around the safe use of these technologies along with consumer acceptance. Governments have a dual role in working with industry to develop safety systems that can mitigate potential issues (such as sensors that can detect when a human driver is not paying attention) and educating the public.
- c) Potential vulnerabilities of the technology, such as:
- **Cyber security:** As vehicles and transportation infrastructure become more automated and connected, they potentially become more vulnerable to cyber-attacks. The automotive industry faces unique challenges with cyber security. Vehicles are built to be “in service” for many years and, as a result, defending against cyber-attacks throughout the life-cycle of a vehicle may be challenging, given how quickly technology evolves. All levels of government and industry stakeholders will have an important role in providing cyber security guidance and improving awareness among Canadians.
 - **Privacy:** AV/CVs stand to play a central role in the lives of Canadians, and the resulting potential risks to privacy are significant. These risks increase where there is a lack of clarity or understanding among industry and consumers about the rules for collecting and using personal information. Canada’s existing privacy laws clearly apply, but we still face a lack of clarity as to how the *Personal Information Protection and Electronic Documents Act* (PIPEDA) principles translated to best practices in the automotive industry. Given the broad acknowledgement that the flow of information in an AV/CV ecosystem is both complex and opaque to owners, passengers, and operators of such vehicles, it is clear that initiatives to increase understanding of risks and obligations must be a multi-stakeholder effort. Governments will need to work with our partners to develop an industry-specific code of best practices for privacy protection.
- d) Changes to insurance coverage and liability by level of automation will be a continuing challenge. As we anticipate that these vehicles will result in fewer automobile collisions over time, we will need clear ways to identify who is responsible in a collision. It is possible that liability could shift from the driver to the automobile manufacturer or technology/software provider. This issue is even more challenging when a vehicle is partially automated and the automobile manufacturer or technology/software provider may share liability with the driver. Amendments to provincial legal frameworks for vehicle liability and insurance will need to reflect the unique risks associated with AV/CVs.



05

WE NEED TO PROACTIVELY PREPARE FOR THE INTRODUCTION OF AV/CVs ON PUBLIC ROADS

All levels of government and authorities must get ready for the introduction of AV/CV technologies, along with their potential implications for safety, mobility, and land use planning.

Being proactive will help governments do their part to prepare the public for the promises of AV/CVs, which are positioned to bring a range of economic, social and environmental benefits to Canadians. At the same time, governments should consider the potential negative effects of AV/CVs on traffic congestion, urban sprawl, and vehicle emissions. To realize the benefits of the technology and to minimize negative outcomes in the long term, governments, road and transit authorities and providers of transportation services need to prepare for these new technologies now.

Governments will need to closely monitor the development and evolution of AV/CVs and determine the impact these technologies will have on road infrastructure, cities and communities. They will also need to continue monitoring how these technologies can complement public transit, particularly how their adoption could support the first and last mile of travel for urban transit users.

Jurisdictions across Canada are conducting pilot programs, pursuing research and collecting data to understand the impacts of AV/CVs and the needs of users. This information will help governments adapt and improve infrastructure and long-term regional transportation plans to accommodate and facilitate the potential widespread deployment of AV/CVs. Sound research and preparation will also help optimize the range of benefits these technologies can offer, if governments are prepared to use the data generated from AV/CVs to improve the overall transportation system.

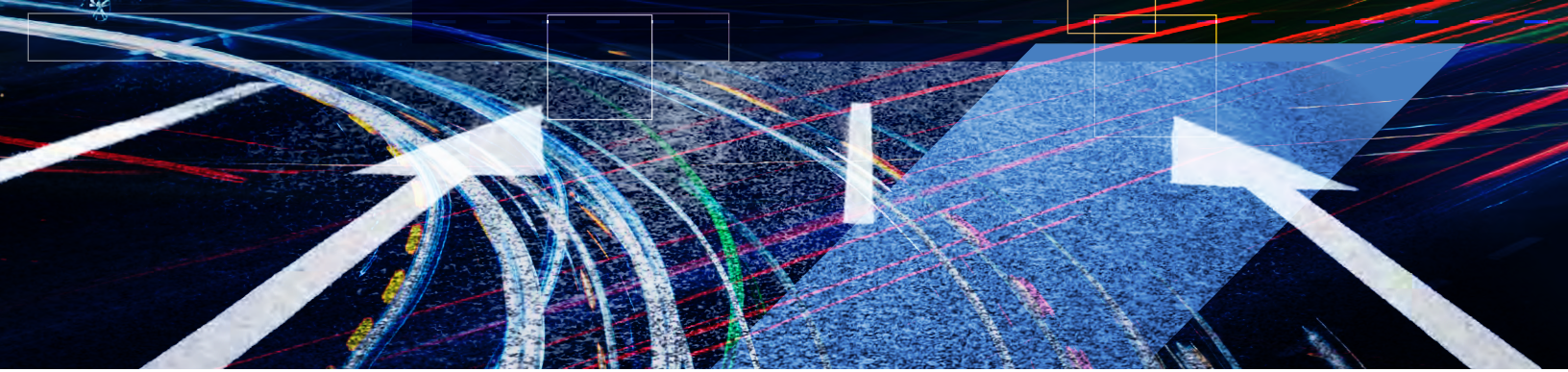
Furthermore, through expanded data and new research that engages top experts from Canada and beyond, governments will need to continue to better understand the infrastructure and mobility needs of today and the future. This includes looking at how transformative technologies such as AV/CVs will change the way we design infrastructure and use mobility services.

Governments and stakeholders should also prepare for a range of uncertainties associated with the deployment and adoption of AV/CV technologies. For example, once AV/CVs are deployed, vehicles may broadcast real-time travel data, which potentially raise a number of privacy and security concerns.

AV/CVs also have the potential to affect labour markets. A report released by the Information Communication Technology Council (ICTC) “Autonomous Vehicles and the Future of Work in Canada” describes how occupations that depend on human drivers will be increasingly phased out and eventually displaced, while jobs with some automotive-related tasks – such as mechanic trades – will require upskilling and/or retraining services for AV/CVs.

Substantial and multifaceted education and training efforts will be needed to transition the workforce for AV/CVs. Governments will need to work with automotive and technology industries to identify the specific skillsets we need for the creation and adoption of AV/CVs, and to help universities and colleges create training programs that meet those needs.

In preparing for AV/CVs, governments will have to rethink traditional forms of mobility and urban planning. We need to monitor potential impacts of AV/CV technologies to help us plan in the long term. Being proactive will help governments do their part to prepare the public domain for the promises of AV/CVs.



06

CONTINUOUS COLLABORATION IS ESSENTIAL

Canada must foster a culture of cooperation and collaboration among everyone in the AV/CV sector.

Currently, many players are involved in the testing and development of AV/CVs. Key industry partners include automobile manufacturers, auto parts manufacturers and technology developers, all with vested interests in the technology's success. Partners are those who will be involved in the deployment and implementation of AV/CV technology once it has been developed, while stakeholders are people who will be affected by the technology, such as members of the general public. Meeting the needs and interests of these groups will be a challenge for government to balance.

The input of stakeholders and partners to inform and validate government policies and actions will support strategies that reflect Canadians' interests. Collaboration with groups that are affected by different phases of AV/CV testing and deployment will ensure we incorporate diverse perspectives in our policy and program development – ones that accurately reflect public use and priorities. Decisions informed in this way could reduce the duplication of efforts and improve the positive impact of government policies and practices. We will also need ways for the public to provide feedback.

At all phases, government should collaborate with expert stakeholders and partners to inform and validate foundational policies for AV/CVs, while also consulting, engaging and collaborating with members of the public who want their voices heard. Harnessing the expertise of the public and private sectors to help plan and coordinate will continue to be essential to ongoing AV/CV testing, deployment and adoption. Continued government collaboration across jurisdictions, in both Canada and North America, could prove useful in the policy-making process.

AV/CVs could fundamentally alter how Canadians move through their everyday lives. Continued collaboration between governments, industry, academia, and other domestic and international stakeholders will allow for the better development and deployment of AV/CVs to meet the needs of all citizens.

We need clear communication to show ongoing, coordinated government action, and to raise awareness of the ways Canada's federal, provincial/territorial and municipal jurisdictions are ensuring the safe deployment of AV/CVs.

Ongoing changes in AV/CV technologies necessitates that all levels of government, industry, and academia work together to learn how we can best anticipate and use them. Working together will provide insight into key issues associated with this move towards increasing levels of automation and connectivity in transportation.

SUMMARY

The AV/CV Policy Framework for Canada sets out guiding principles for current and future initiatives and policies related to the safe testing and deployment of AV/CVs on public roads. Key to the Framework is providing an aligned approach nationwide and building better public and user confidence in AV/CVs.

Governments and industry have a crucial role to play in promoting the technologies, while informing Canadians of the benefits and limitations of AV/CVs. The future impacts of AV/CVs depend on governments, industry and academia working together to realize the safety, social and economic benefits that these technologies promise.

To properly prepare for the deployment and adoption of AV/CVs, this Framework highlights the following considerations for governments, industry and academia:

SAFETY IS OUR NUMBER ONE PRIORITY.

- Governments will need to update their policy and regulatory frameworks for the safe testing and deployment of AV/CVs as the technology evolves.
- The Framework is currently supported, through a number of current guidance materials that aim to provide a consistent Canada-wide approach for safe testing and deploying AV/CVs on public roads in Canada.
 - Transport Canada's *Testing HAVs in Canada – Guidelines for Trial Organizations* and;
 - CCMTA's *Canadian Jurisdictional Guidelines for Safe Testing and Deployment of HAVs*.
- As safety continues to be our number one priority, this framework will also be supported by other upcoming non-regulatory safety tools such as: Canada's Safety Framework for AV/CVs and the Safety Assessment for Automated Driving Vehicles.

To ensure that AV/CVs are safe and secure, we need to exchange information.

- Governments should continually provide the most up-to-date road information to industry, while industry and academia involved in pilot testing should share data that could assist government in developing policies, regulations and future infrastructure investments.
- Governments should continue to leverage industry and academic insights to ensure guidelines for AV/CV testing and conduct are kept up to date.

Policy alignment is vital.

- Continued engagement with international partners in a policy dialogue around AV/CVs through multilateral forums will remain important in order to share best practices.
- Maintaining an active international presence will benefit Canadian efforts to influence regulatory standards development and identify global leadership opportunities.
- Over the next few years, Canadian jurisdictions need to start including AV/CVs as part of their planning processes for any new digital or physical infrastructure investments, and to make sure that they are aligned with other provinces and territories.
- Currently *Transport Canada's Motor Vehicle Safety Act* and Regulations are closely aligned with the United States legislation and standards. As the technology evolves, governments should continue to work proactively to align regulatory frameworks.

We need to raise public awareness of what AV/CVs can and cannot do.

- As vehicles get closer to full automation, all levels of governments and industry have a role to play in public outreach. Public awareness campaigns should inform people about the safety benefits and limitations, as well as the vulnerabilities and risks of AV/CVs.

We need to proactively plan for the introduction of AV/CVs on public roads.

- Jurisdictions across Canada should continue to conduct pilot programs, pursue research, and collect and share data to understand the impacts of AV/CVs and the needs of their users.
- We will need substantial education and training efforts to transition the workforce for AV/CVs. Automotive and technology industries will need to identify specific skillsets needed to service and operate AV/CVs. Industry and governments will also need to help universities and colleges establish education and training programs to meet those specific needs.
- We need to monitor the potential impacts of AV/CV technology to assist with long-term decision-making.

Continuous collaboration is essential.

- The public and private sectors each have expertise to share as we plan and coordinate AV/CV testing, deployment and adoption.
- All levels of government, industry, and academia must work together to find ways that we can anticipate and leverage ongoing AV/CV advancements, and gain insight into issues associated with their rapid integration.

APPENDIX 1

JURISDICTIONAL RESPONSIBILITIES FOR AV/CVs IN CANADA

AV/CV ROLES AND RESPONSIBILITIES		
FEDERAL	PROVINCIAL/TERRITORIAL	MUNICIPAL
<ul style="list-style-type: none"> • Setting and enforcing Motor Vehicle Safety Standards for new or imported motor vehicles and motor vehicle equipment • Investigating and managing the recall and remedy of non-compliances and safety-related motor vehicle defects nationwide • Public education on motor vehicle safety issues • Monitoring and developing rules on privacy and cyber security • Setting and enforcing compliance with technical standards related to wireless technologies integrated in vehicles and roadside infrastructure 	<ul style="list-style-type: none"> • Testing and licensing human drivers and registering motor vehicles in their jurisdictions • Enacting and enforcing traffic laws and regulations (including trials) • Conducting safety inspections • Regulating motor vehicle insurance and liability • Public education on motor vehicle safety issues • Adapting provincially-owned infrastructure to support AV/CV deployment • Planning for future transportation projects (e.g., highway management, transit) 	<ul style="list-style-type: none"> • Enacting and enforcing bylaws • Advocating for and accommodating testing • Enforcing traffic laws and regulations • Adapting infrastructure to support AV/CV deployment • Managing passenger transportation (including public transit, taxis and ridesharing services) • Managing and creating new logistics for traffic control and parking enforcement • Public education on motor vehicle safety issues

APPENDIX 2

ACTIONS TAKEN BY CANADIAN JURISDICTIONS

Canada is currently taking steps in the right directions to promote safety, embrace innovative technologies and advance our work on AV/CVs. Below are some examples of work that Canadian jurisdictions are conducting in this area.⁵

TRANSPORT CANADA	<p>Bill S-2, the <i>Strengthening Motor Vehicle Safety for Canadians Act</i>, received Royal Assent on March 1, 2018, and introduced extensive amendments to the federal <i>Motor Vehicle Safety Act</i> since it came into force in 1971. The amendments strengthens the Minister of Transport’s enforcement and compliance authorities in the area of road safety, affording greater flexibility to keep pace with the development of new safety features or new kinds of vehicles, technologies, systems or components.</p> <p>Testing Highly Automated Vehicles in Canada – Guidelines for Trial Organizations: A series of guidelines to direct the safe conduct of Highly Automated Vehicle (HAV)¹ trials in Canada, agreed upon by federal, provincial and territorial representatives of CCMTA. Organizations in Canada are expected to follow.</p> <p>Program to Advance Connectivity and Automation in the Transportation System (ACATS) helps Canadian jurisdictions prepare for the array of technical, regulatory and policy issues that will emerge as a result of the introduction of AV/CVs.</p> <p>Canada’s Safety Framework for AV/CVs and the Safety Assessment for Automated Driving Vehicles: Guidance materials for industry to support the safe development, testing and deployment of AV/CVs in Canada.</p>
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⁵ This list should be taken as an illustration of the efforts undertaken by Canadian jurisdictions in advancing the development of AV/CVs at the time of publication. This is by no means an exhaustive list, as many other efforts are underway.

<p>ONTARIO</p>	<p>On January 1, 2016, Ontario Regulation 306/15: Pilot Project – Automated Vehicles took effect which allows for the testing of AVs on Ontario roads under certain conditions. Currently there are a total of nine participants testing a total of ten vehicles.</p> <p>To respond to advances in technology and ensure economic competitiveness, Ontario has made three key enhancements to its Automated Vehicle Pilot Regulation effective January 1st, 2019. These enhancements will now (a) permit the public registration and use of conditionally automated vehicles (vehicles designated as Society of Automotive Engineers – Level 3) on Ontario roads, approved by the federal government and eligible for sale; (b) permit driverless vehicle testing on public roads under strict conditions; and (c) permit cooperative truck platoon testing under strict conditions.</p> <p>Also, as of June 2018, Ontario has enhanced the AV pilot program requirements to expand data reporting and to better ensure that testing is done safely.</p> <p>Launched in 2017, the Autonomous Vehicle Innovation Network (AVIN) helps Ontario become AV/CV-ready by bridging the rapidly evolving and converging technology and automotive sectors, supporting research and testing, and stimulating the economy through investment. AVIN brings together industry, academia and government to leverage the economic opportunities of AV/CVs, and to support the ability of Ontario’s transportation systems and infrastructure to adapt to changes to the automotive landscape.</p>
<p>QUEBEC</p>	<p>On December 8, 2017, Bill 165 was introduced, which includes a measure to allow pilot projects for AV/CV testing, as well as numerous amendments relating to road safety.</p> <p>With financial support from the Government of Quebec, Keolis Canada, the City of Candiac, Propulsion Quebec, NAVYA and the Cluster for Electric and Smart Transportation and the Technopôle, IVÉO will pilot a 100% electric and autonomous shuttle on public roads. The route will span 2 kilometers in Candiac, Quebec, and will serve locals with stops at city hall and local businesses. Testing began in the summer of 2018 and will continue for 12 months.</p>
<p>MANITOBA</p>	<p>Manitoba Infrastructure is working to draft amendments to the <i>Highway Traffic Act</i> that enable the Minister to enact regulations establishing a testing system for AVs and AV technologies (levels 3 to 5) on Manitoba’s roads.</p> <p>Testing of a self-driving snowplow is set to begin in early 2019 at the Winnipeg Richardson International Airport. After testing, it will begin operation away from runways. This is the first automated snowplow in North America.</p>
<p>SASKATCHEWAN</p>	<p>The cities of Saskatoon and Regina have started initial discussions with SaskTech, a group of Saskatchewan technology companies that hope to create a test bed for AV/CVs operating under extreme weather conditions in rural and small urban environments.</p> <p>The City of Saskatoon was awarded funding under Transport Canada’s Program Advance Connectivity and Automation in the Transportation System to study capacity-building on AV/CVs.</p>

ALBERTA	<p>The Government of Alberta is a partner in ACTIVE-AURORA, an innovative research project that will shape future investments in intelligent transportation systems in Alberta. The ACTIVE-AURORA project consists of four test-beds and two laboratory test environments, with ACTIVE representing the Edmonton component and AURORA representing the Vancouver component.</p> <p>The City of Calgary was awarded funding under Transport Canada’s Program to Advance Connectivity and Automation in the Transportation System to establish a connected vehicle test-bed on 16th Avenue North.</p>
BRITISH COLUMBIA	<p>In November 2018, University of British Columbia engineers, together with the BC Ministry of Transportation and Infrastructure, Transport Canada and industry partners launched AURORA, a new initiative for safe, smart transportation in B.C. that leverages a network of connected cameras and roadside monitors. The Natural Sciences and Engineering Research Council of Canada awarded \$31 000 to this initiative.</p>
CCMTA	<p>CCMTA published Canadian Jurisdictional Guidelines for Safe Testing and Deployment of Highly Automated Vehicles, in collaboration with Transport Canada, in October 2018. These guidelines, provide a series of considerations and recommendations that will support Canadian jurisdictions in developing testing programs, and preparing for the deployment of the technology.</p>
TRANSPORTATION ASSOCIATION OF CANADA	<p>In October 2018, the Transportation Association of Canada (TAC) created the Connected and Automated Vehicles Task Force (CAV Task Force), a forum for dialogue and collaboration among transportation system owner-operators, regulatory bodies, private businesses, industry organizations and academia. Its overarching purpose is to help TAC members respond to and benefit from the development and application of AV/CV technologies, with an emphasis on optimizing outcomes for public health and safety, mobility, economic prosperity and environmental sustainability in urban and rural communities.</p>