



# CANADIAN JURISDICTIONAL GUIDELINES FOR THE SAFE TESTING AND DEPLOYMENT OF HIGHLY AUTOMATED VEHICLES

(AUTOMATED DRIVING SYSTEM LEVELS 3-4-5)

**CCMTA | CCATM**

Canadian Council of Motor Transport Administrators  
Conseil canadien des administrateurs en transport motorisé

AUTOMATED VEHICLES WORKING GROUP

**JUNE 2018**

ISBN: 978-1-927993-31-6

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# ACKNOWLEDGEMENTS

The Canadian Council of Motor Transport Administrators (CCMTA) would like to thank the American Association of Motor Vehicle Administrators (AAMVA) for its generous support and participation in our efforts to draft these Guidelines, sharing expertise, advice and experience from their own work.

CCMTA would also like to acknowledge the complementary work being led by Transport Canada. Its document “*Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*” informs the safe conduct of automated vehicle trials in Canada. It sets out a number of definitions that we have adopted to ensure common, clear and consistent language for the discussion of automated vehicle issues in Canada.

# CONTENTS

<b>Executive Summary</b>	<b>6</b>
<b>Preface: Automated Vehicle Taxonomy, Definitions, Terms and Technologies</b>	<b>8</b>
<b>Chapter 1: Introduction</b>	<b>13</b>
The Rationale for Guidelines	14
Purpose	14
In Scope	15
Out-of-Scope	15
Why is CCMTA preparing the Guidelines?	16
Collaboration among Stakeholders and Partners	17
Guiding Principles	18
<b>Chapter 2: Roles and Responsibilities</b>	<b>19</b>
<b>Chapter 3: Considerations for the Governance of Testing and Deployment of ADS Vehicles</b>	<b>21</b>
3.1 Governance	22
<b>Chapter 4: Guidelines for the Testing of ADS Vehicles</b>	<b>25</b>
<b>Vehicle Credentialing Considerations</b>	<b>26</b>
4.1 Application and Permit for Manufacturers or Other Entities to Test Vehicles on Public Roadways	26
4.2 Vehicle Permitting and Registration	29
4.3 Licence Plates	32
4.4 Financial Responsibility	33
4.5 Compliance of ADS Trial Vehicles with the Motor Vehicle Safety Act (MVSA)	34
<b>Driver Licencing Considerations</b>	<b>35</b>
4.6 Driver and Passenger Roles Defined	35
4.7 Driver Licence Requirements for Testing by Manufacturers and Other Entities	36
<b>Chapter 5: Guidelines for the Deployment of ADS Vehicles</b>	<b>38</b>
<b>Vehicle Credentialing Considerations</b>	<b>39</b>
5.1 Vehicle Permits for Deployed ADS Vehicles	39
5.2 Vehicle Registration	39
5.3 Licence Plates	41
5.4 ADS Information on the New Vehicle Information Statement (NVIS)	42
5.5 Financial Responsibility	43
5.6 Compliance of deployed ADS vehicles with the Motor Vehicle Safety Act (MVSA)	44
<b>Driver Licencing Considerations</b>	<b>45</b>
5.7 Driver and Passenger Roles Defined	45
5.8 Driver Training for Consumers for Deployed Vehicles	46
5.9 ADS Driver Training for Motor Vehicle Agency Examiners, Driver Education Programs and Private Instructors	48
5.10 Driver Licence Skills Testing with ADS	51
5.11 Endorsements and Restrictions for Deployed Vehicles	53

<b>Chapter 6: Law Enforcement and Transportation Safety Considerations</b>	<b>55</b>
6.1 Crash/Incident Reporting	56
6.2 Criminal Activity	59
6.3 Distracted Driving and Fatigue	62
6.4 Establishing Operational Responsibility and Law Enforcement Implications	64
6.5 First Responder Safety	66
6.6 Assisting First Responders and Transportation Safety Investigators through Vehicle Identification	69
6.7 Law Enforcement/First Responder Training	71
6.8 Vehicle Response to Emergency Vehicles, Manual Traffic Controls and Atypical Road Conditions	73
6.9 System Misuse and Abuse	74
6.10 Adherence to Traffic Laws	76
<b>Chapter 7. Next Steps</b>	<b>78</b>
<b>Appendix</b>	<b>80</b>
Appendix A: SAE's Surface Vehicle Recommended Practice	81
Appendix B: Acronyms	82
Appendix C: Summary of Recommendations for Jurisdictions	83
Appendix D: Summary of Recommendations for Manufacturers and Other Entities	90
Appendix E: Automated Vehicles Working Group	94

# EXECUTIVE SUMMARY

Automated Driving Systems (ADS) hold potential for significant new benefits for Canada and Canadians. Most importantly, there is hope that these technologies will lead to a significant reduction in traffic collisions and thereby result in a corresponding reduction in fatalities and injuries. This document, *Canadian Jurisdictional Guidelines for the Safe Testing and Deployment of Highly Automated Vehicles (Automated Driving Systems Levels 3, 4 and 5)*, is focused on ensuring that we can work towards achieving these potential benefits and, at the same time, maintain road safety during testing and deployment of ADS vehicles on public roads.

In order to achieve the dual goals of reaping benefits and maintaining road safety, the membership of CCMTA has recognized that there is a need for a well-planned approach to manage ADS vehicles' integration within the transportation system. CCMTA has therefore taken a leadership role in crafting new voluntary guidelines for the motor transport administrative and law enforcement communities.

This Guidelines Document provides a series of considerations and recommendations that will support Canadian jurisdictions in their planning and roll-out of ADS vehicles. Overall, it delves into the various disciplines of vehicle registration, driver licensing and law enforcement with the purpose of providing a **point-in-time set of voluntary recommendations** for Canadian jurisdictions to use in developing testing programs (if desired) and preparing for the deployment of the technology.

The development of this document was guided by the following Principles:

- Create a pathway to consistency across jurisdictions
- Encourage and enable the earliest safe introduction of the technology
- Confirm and clarify roles and responsibilities of each level of government
- Demonstrate jurisdictional awareness and understanding of the technology and promote public acceptance, confidence, and adoption
- Create common language and terms
- Work towards interoperability

## The Structure of this Document

Like all domains having a technology focus, there is a very important need to ensure that everyone having an interest in the subject matter has a common understanding and associated vernacular to describe systems, technologies, processes, etc. As such, the Preface to this Guidelines Document is critically important as it provides internationally-accepted vehicle classifications and definitions of the terms commonly used to identify and differentiate various automated driving system capabilities on the market or being tested at the time of publishing. These are foundational terms and concepts used throughout the Guidelines Document.

**Chapter 1: Introduction**, is a context setter. It sets out the origins of the Document, who was involved in its creation, the scope of the Document, and explains how it complements another key document, “*Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*”, work completed under the leadership of Transport Canada to inform the safe conduct of automated vehicle trials in Canada. The chapter concludes with a full explanation of the guiding principles that have framed the approach that underlies the guidelines and recommendations that follow.

**Chapter 2: Roles and Responsibilities**, clarifies each level of government’s (federal, provincial/territorial and municipal/local) involvement vis-à-vis automated vehicles.

**Chapter 3: Considerations for the Governance of Testing and Deployment of ADS Vehicles**, recognizes that, to successfully address the safe integration of ADS vehicles within the transportation system, a collaborative approach should be taken among jurisdictions and stakeholders to gain an understanding of emerging vehicle technologies and the impact on roadway safety, jurisdictional programs and infrastructure. It recommends the creation of an ADS Committee comprised of a wide range of both public and private sector members having an interest in automated driving systems. The ADS Committee will perform a variety of functions, chief among them to develop strategies for addressing testing and deployment of ADS in their jurisdiction, balancing the protection of road safety with enabling technological innovation.

**Chapter 4: Guidelines for Testing of ADS Vehicles** and **Chapter 5: Guidelines for Deployment of ADS Vehicles**, contain detailed guidelines and recommendations for jurisdictions, manufacturers and other entities in two main categories: Vehicle Credentialing and Driver Licencing. The main issues covered include vehicle permitting and registration, licence plates, financial responsibility (i.e., liability for collisions/incidents), driver training for consumers and examiners, and driver licence skills testing.

**Chapter 6: Law Enforcement and Transportation Safety Considerations**, provides guidelines and recommendations to jurisdictions on: how and what data should be maintained in crash reports; suggested background checks for persons involved in testing to limit criminal activity; managing distracted driving and fatigue; establishing that the registered owner of the ADS vehicle is responsible for its safe operation; law enforcement/first responder safety and training; and limiting misuse and abuse of ADS technologies.

**Chapter 7: Next Steps**, commits CCMTA to continue to work closely and coordinate ADS initiatives with government entities, industry and Canadian researchers. To keep this report relevant and to provide the best possible guidance to the ADS stakeholder community in Canada, it is expected CCMTA will update this report annually for the foreseeable future.

CCMTA and its members are committed to keeping pace with the evolution of vehicle technology, providing timely information, and sharing their expertise.

# AUTOMATED VEHICLE TAXONOMY, DEFINITIONS, TERMS AND TECHNOLOGIES

An important goal of this Guidelines Document is to establish common, clear and consistent language for the discussion of Automated Driving Systems in Canada. CCMTA has, therefore, chosen to set the stage for the Guidelines with the Preface that provides internationally-accepted vehicle classifications and definitions of the terms commonly used to identify and differentiate various automated driving system capabilities on the market or being tested at the time of publishing.

We have also supplemented these definitions with some terms that help explain in more detail how the systems will be described in the Canadian context, such as legislation, regulations and guidelines for automated driving

systems. Readers are therefore encouraged to familiarize themselves with the terminology commonly used herein. See Appendix B for a list of related acronyms.

A wide variety of new vehicle technologies called Advanced Driver Assist Systems (ADAS), are currently available in the marketplace and others are continually under development (e.g., Forward Collision Warning, Lane Departure Warning). This report does not attempt to define these specific vehicle technologies. While there are technologies of a similar nature, some manufacturers utilize proprietary terms for these. There are various resources that provide information and videos of these specific vehicle technologies such as [www.mycardoeswhat.org](http://www.mycardoeswhat.org).

## AUTOMATED DRIVING SYSTEMS TAXONOMY AND DEFINITIONS

CCMTA strongly encourages the adoption of terminology developed by SAE International<sup>1</sup> outlined in the *Surface Vehicle Recommended Practice: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles J3016, 2016*<sup>2</sup> which is utilized throughout this report. Adoption of common, clear and consistent language is an important foundation to support discussion among participants and stakeholders, the creation of standards for technology developers, and the development of supporting programs by regulators. Full descriptions of each of the levels of automation may be found in Appendix A. Jurisdictions are encouraged to refer to the SAE J3016

taxonomy for additional information on each level of automation. The document can be downloaded for free from the SAE website at the following link:

[www.sae.org/standards/content/j3016\\_201609](http://www.sae.org/standards/content/j3016_201609)

In some instances, however, we have used additional terms not included in the SAE J3016 standard to supplement key concepts and to ensure accessibility of the text for non-technical audiences. For example, in some instances we use the term “Highly Automated Vehicle”, which can be considered in this document to refer to the same vehicles as those that meet the description of the SAE J3016 standard term “Automated Driving System.”

<sup>1</sup> SAE International, is a global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries. Its core competencies are life-long learning and voluntary consensus standards development. Source: SAE International, April 1, 2018 ([www.sae.org/about](http://www.sae.org/about)).

<sup>2</sup> SAE International's *Surface Vehicle Recommended Practice: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles, J3016 (2016)* and were reprinted with SAE International's permission.

## DEFINITIONS

The following two sets of definitions are provided to establish a baseline for commonly used terms and are also utilized throughout this report. The first set has been devised by SAE in its taxonomy, the SAE J3016 standard, while the second set of key terms and definitions supplement the SAE terms. The second set has been provided by CCMTA, AAMVA or other external sources.

### 1. Definitions adopted from SAE J3016 Standard<sup>3</sup>

**Automated Driving System (ADS):** the hardware and software that are collectively capable of performing the entire DDT on a sustained basis, regardless of whether it is limited to a specific ODD; this term is used specifically to describe a level 3, 4, or 5 driving automation system. For greater clarity, the rest of this Guidelines Document will use the term “ADS” to refer to these three specific levels of automation. It will also use the term “ADS vehicle” to capture those vehicles with ADS level 3, 4, or 5 technology.

**Driver:** a user who performs in real-time part or all of the Dynamic Driving Task (DDT) and/or DDT fallback for a particular vehicle. NOTE: In a vehicle equipped with a driving automation system, a driver may in some vehicles assume or resume performance of part or all of the DDT from the driving automation system during a given trip.



**Driving Mode:** type of vehicle operation with characteristic DDT requirements (e.g., expressway merging, high speed cruising, low speed traffic jam, etc.). Previously the term driving mode was used. Operational Design Domain (ODD) is now the preferred term for many of these uses.

**Dynamic Driving Task (DDT):** all the real-time operational and tactical functions required to operate a vehicle in on-road traffic, excluding the strategic functions such as trip scheduling and selection of destinations and waypoints, and including without limitation:

1. Lateral vehicle motion control via steering (operational);
2. Longitudinal vehicle motion control via acceleration and deceleration (operational);
3. Monitoring the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical);
4. Object and event response execution (operational and tactical);
5. Maneuver planning (tactical); and
6. Enhancing conspicuity via lighting, signaling and gesturing, etc. (tactical).

**Dynamic Driving Task (DDT) Fallback:** the response by the user or by an ADS to either perform the DDT or achieve a minimal risk condition after occurrence of a DDT performance-relevant system failure(s) or upon ODD exit.

**(Human) User:** a general term referencing the human role in driving automation.

<sup>3</sup> SAE J3016 is a standard that will continue to evolve over time. Changes will be made in an iterative fashion. In order to ensure readers of this document have the latest version of this standard, CCMTA suggests visiting the following website: [www.sae.org/standards/content/j3016\\_201401](http://www.sae.org/standards/content/j3016_201401)

**Minimal Risk Condition:** a condition to which a user or an ADS may bring a vehicle after performing the DDT fallback in order to reduce the risk of a crash when a given trip cannot or should not be completed.

**Object and Event Detection and Response (OEDR):** the subtasks of the DDT that include monitoring the driving environment (detecting, recognizing, and classifying objects and events and preparing to respond as needed) and executing an appropriate response to such objects and events (i.e., as needed to complete the DDT and/or DDT fallback).

**Operate (A Motor Vehicle):** collectively, the activities performed by a (human) driver (with or without support from one or more Level 1 or 2 driving automation features) or by an ADS (Level 3-5) to perform the entire DDT for a given vehicle during a trip.

**Operational Design Domain (ODD):** the specific conditions under which a given driving automation system or feature is designed to function, including, but not limited to, driving modes. An ODD may include geographic, roadway, environmental, traffic, speed, and/or temporal limitations. Previously the term driving mode was used. ODD is now the preferred term for many of these uses.

**Passenger:** a user in a vehicle who has no role in the operation of that vehicle.

**Request to Intervene:** notification by the ADS to a driver indicating that they should promptly perform the DDT fallback.



## 2. Supplemental Definitions and Key Terms

**Automated Mode:** the mode that is set in the vehicle for the automated actions to take over and the driver/user does not control the functions of the vehicle.

**Automated Vehicles (AV):** any vehicle equipped with automated technology that has been integrated into that vehicle.

**Automated Vehicle Technology:** technology that has the capability to operate a vehicle without the active physical control, or in some cases, monitoring by a driver.

**Automated Vehicle Testing:** testing of highly automated vehicles on public roadways.

**Automation:** the use of electronic or mechanical devices to replace a DDT.

**Background Check:** investigation of a candidate's background based on criteria determined by their prospective or current employer which may include employment, education, criminal records, credit history, motor vehicle and licence record checks.

**Connected Vehicle:** connected vehicles (CVs) are those that include personal, transit, and freight vehicles that have the capability of communicating electronically with each other and with the various elements of the modern surface transportation system (e.g., pedestrians, bicyclists, roadside infrastructure, transportation management centers, etc.) on a rapid and continuous basis.

**Crash (reportable crash):** a collision resulting in a person's injury or death or property damage that reaches the jurisdiction's threshold.

**Crash Report:** a report completed by a law enforcement officer who investigates a motor vehicle crash.

**Deploy/Deployment/Deployed:** the operation of a vehicle on public roads by members of the public who are not employees, contractors or designers or a manufacturer or other testing entity.

**Disengagement:** a deactivation of the automated mode when a failure of the ADS is detected or when the safe operation of the highly automated vehicle requires that the driver or remote driver assume immediate operation of the vehicle or, in the case of ADS vehicles, that the ADS system be deactivated for the safety of the vehicle, its occupants, or other road users.

**Driver History:** record containing all convictions and other licensing actions of each driver maintained by the licensing jurisdiction.

**Driver Testing:** the examination of an applicant to determine if they possess the knowledge, skills and ability to safely operate a vehicle on public roadways.

**Driver Training:** instructing an individual to operate a vehicle safely.

**Endorsements:** an authorization to an individual's driver licence permitting the individual to operate certain types of vehicles.

**Event Data Recorder (EDR):** a function or device installed in a motor vehicle to record technical information about the status and operation related to vehicle crashes or incidents.

**Highly Automated Vehicle (HAV):** the hardware and software that are collectively capable of performing the entire DDT on a sustained basis, regardless of whether it is limited to a specific ODD; this term is used specifically to describe a level 3, 4, or 5 driving automation system. For greater clarity, the rest of this Guidelines Document will use the term "ADS" to refer to these three specific levels of automation. It will also use the term "ADS vehicle" to capture those vehicles with ADS level 3, 4, or 5 technology.

**Incident:** an occurrence involving one or more vehicles in which a hazard is involved but not classified as a crash due to extent of damage.

**Jurisdiction:** any province or territory of Canada, or state, district or territory of the United States (US).

**Manufacturer:** an individual or company who designs, produces or constructs vehicles or equipment. Manufacturers include original equipment manufacturers (OEMs), multiple and final stage manufacturers, alterers (individuals or companies making changes to a completed vehicle prior to first retail sale or deployment), and modifiers (individuals or companies making changes to existing vehicles after first retail sale or deployment).

**Manufacturer's Safety Plan:** a clearly stated policy to help all employees understand the priority of developing safe and healthy working conditions, and appropriate goals and objectives for the program.

**Motor Transport Administrator (MTA):** the jurisdiction's agency responsible for the administration of vehicle registration and driver licencing. In many Canadian jurisdictions this is the Registrar of Motor Vehicles.

**NHTSA:** the National Highway Traffic Safety Administration, part of the United States Department of Transportation. Its mission is to save lives, prevent injuries, and reduce economic costs due to road traffic crashes, through education, research, safety standards, and enforcement.

**Non-Drivers:** a user of an automated vehicle who normally would not be able to operate a vehicle (i.e. age limitations, disabilities).

**Occupant:** a human in the vehicle, regardless of role or responsibility.

**Other Entities and Educational Institutes:** any individual or company, who is not a manufacturer, involved with helping to design, supply, test, operate or deploy automated vehicles or equipment.

**Product Liability:** a manufacturer or seller being held liable for placing a defective product into the hands of a consumer. Responsibility for a product defect which causes injury lies with all sellers of the product who are in the distribution chain.

**Rules of the Road:** phrase used to describe jurisdictional traffic laws.

**Society of Automotive Engineers (SAE) International:** an automotive and aerospace standard setting body that coordinates development of voluntary consensus standards. See [www.sae.org/about](http://www.sae.org/about).

**Skills Test:** a test to determine if the driver has a minimum level of skills to drive in most traffic situations within a jurisdiction's traffic laws.

**Suspension:** the temporary withholding of the licence to drive, usually for a specified period of time.

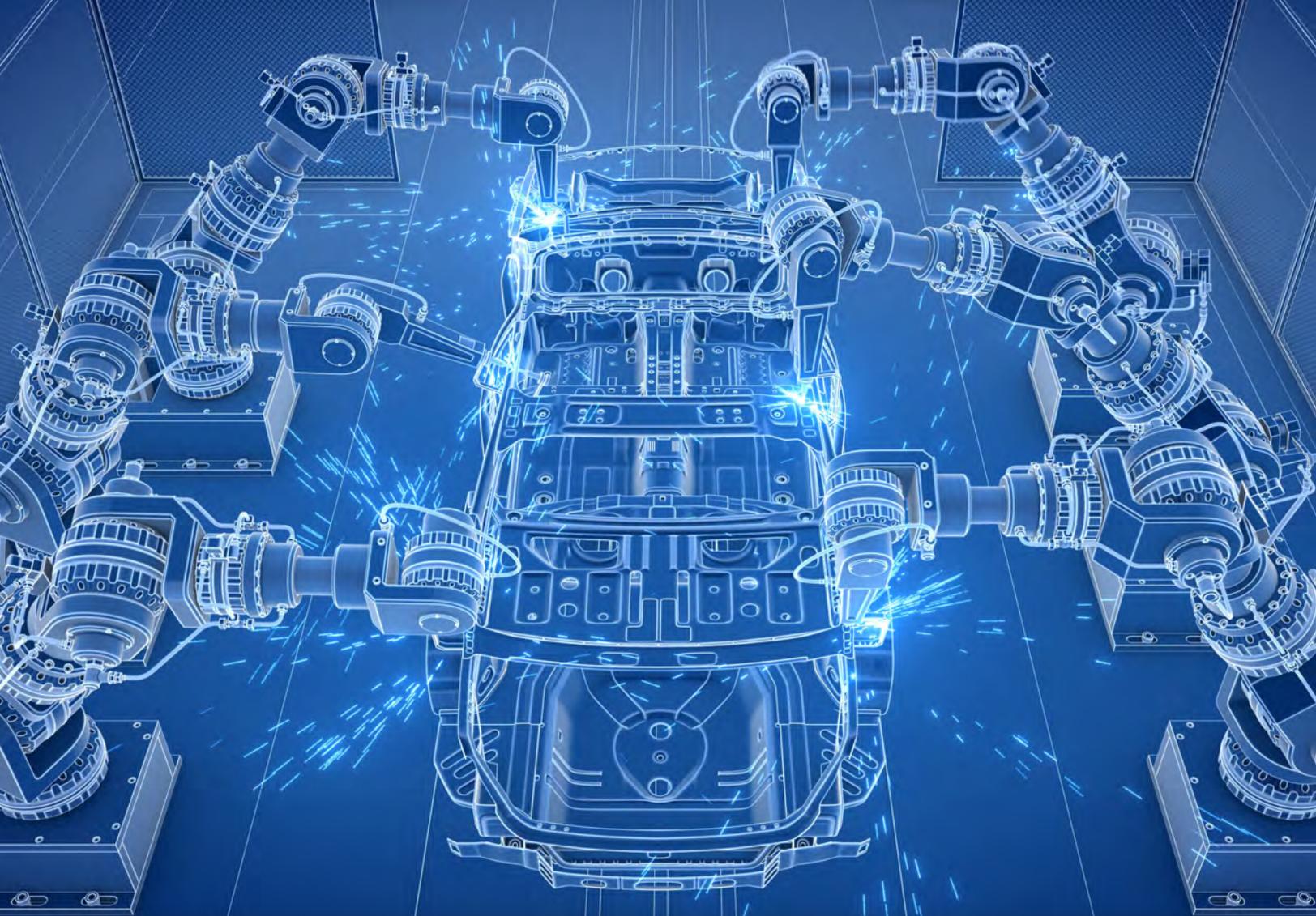
**Tier 1 Supplier:** direct suppliers to the original equipment manufacturer (OEM).

**Up-Fitter:** an individual or company that specializes in the design or installation of aftermarket products.

**Vehicle Status:** adding words or phrases to a vehicle registration document which describe an event that has impacted the value or safety aspects of a vehicle. This process may also be referred to as "branding".

**Violation:** failure to follow jurisdictional laws or regulations.

**Vulnerable Road Users:** pedestrians, motorcyclists, cyclists and persons in personal mobilized devices (e.g., motorized wheelchairs and scooters) that use the roadway.



## CHAPTER 1

# INTRODUCTION

The rapid pace of technological innovation and advancements in the field of roadway transportation is leading to breathtaking new opportunities for change in the way we get around. As we move into a new era of higher levels of automation in our vehicles, their guiding systems will increasingly reduce the role for today's driver.

Automated Driving Systems (ADS) hold potential for significant new benefits for Canada and Canadians. Most importantly, there is hope that these technologies will lead to a significant reduction in traffic collisions

and thereby result in a corresponding reduction in fatalities and injuries. Some of the other transformative impacts on today's society and economy may include: reduced traffic congestion; fuel cost savings; cost savings from fewer collisions; better allocation of medical and enforcement resources to other priorities; greater efficiency of vehicle and roadway operations, as well as improved mobility and accessibility.

## THE RATIONALE FOR GUIDELINES

At the same time, there are other important considerations and concerns to be addressed as the technology evolves.

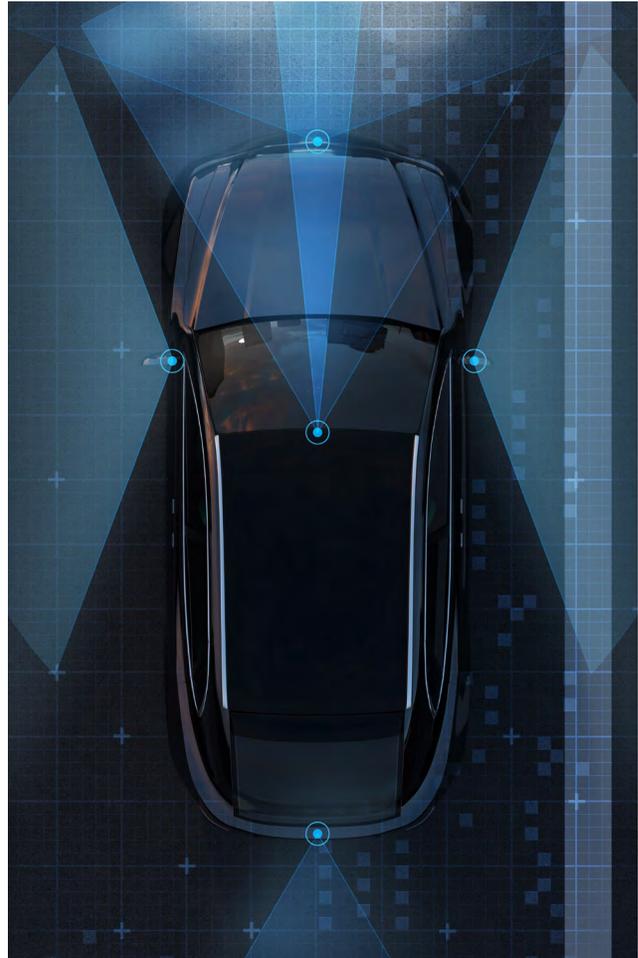
First among these is the realization that automated and non-automated vehicles will share the roadway, creating challenges for safe integration of ADS into the general transportation system. This reality has prompted jurisdictions to explore ways to regulate this emerging technology to ensure the safety of the motoring public. A pressing challenge, therefore, is how best to maintain road safety while allowing for the safe testing and deployment of ADS on public roads.

A second consideration is the recognition that driving safety will be improved if the rules and regulations governing the operation of automated vehicles are consistent within a jurisdiction and, ideally, from jurisdiction to jurisdiction. Ensuring a consistent regulatory framework is in place to address public safety concerns is, therefore, critical for all levels of government.

In addition, introduction of ADS vehicles into the existing roadway transportation system requires a transformation that requires collaboration and input from industry, partners, and other community members. A regulatory framework can set out when and where interactions among these various players will need to occur to ensure the safest transition to this higher level of automation.

Some of the key considerations for governments and regulators are:

- How manufacturers should demonstrate vehicle safety;
- How existing driver and vehicles licensing regimes will address ADS vehicles;
- What type of regulatory framework will ensure safe operations of ADS vehicles on public roads;
- How government/enforcement/police will address issues of liability, data privacy and cybersecurity; and
- How enforcement regulations (commercial and non-commercial) will be applied to ADS vehicles.



## PURPOSE

ADS technology is moving swiftly, yet we know legislation takes time and can be a highly consultative process. Being nimble enough to adapt to the technology without unnecessarily delaying testing and deployment is essential. It is clear that there is a need for a well-planned approach to manage ADS vehicles' integration within the transportation system.

This Guidelines Document is, therefore, intended to provide a series of considerations and recommendations that will support Canadian jurisdictions in their planning and roll-out of ADS vehicles.



## IN SCOPE

This document addresses how automated vehicle technology will directly affect:

- Vehicle registration and permitting programs;
- Driver training, testing and licensing programs;
- Enforcement of traffic laws; and
- First response to traffic related incidents.

This document sets out voluntary guidelines and recommendations for those Canadian jurisdictions choosing to regulate testing and deployment of ADS. Jurisdictions adopting the recommendations will facilitate a consistent regulatory framework which balances current public safety with the advancement of vehicle innovations having the potential to reduce crashes, fatalities, injuries and property damage. Jurisdictions will continue to develop guidance on ADS as the technology and safety needs evolve; this process will involve updates to this document.

## OUT-OF-SCOPE

Some of the topics related to testing and deployment of ADS noted above are not covered in this document. These include, but are not limited to:

- Commercial motor vehicles as defined by the National Safety Code for Motor Carriers;
- Training for Motor Transport Administrator (MTA) staff;
- Jurisdictional safety inspection programs and criteria;
- Data privacy and security, including personally identifiable information;
- Cybersecurity;
- Enabling infrastructure;
- Socio-economic implications;
- Economic development guidance; and
- Environmental impacts.<sup>4</sup>

<sup>4</sup> Some of these topics may be addressed in future versions of this document.

## WHY IS CCMTA PREPARING THE GUIDELINES?

The Canadian Council of Motor Transport Administrators (CCMTA) coordinates all matters dealing with the administration, regulation and control of motor vehicle transportation and highway safety. Membership includes representation from provincial and territorial governments as well as the federal government of Canada.

CCMTA supports its members' vision to have the safest and most efficient movement of people and goods by road in the world. We are the custodians of the National Safety Code for Motor Carriers and provide collaborative leadership in the areas of Road Safety Research and Policies, Drivers and Vehicles, and Compliance and Regulatory Affairs.

CCMTA Members are elected from provincial, territorial and federal governments. CCMTA is accountable to:

- the Councils of Ministers and Deputy Ministers of Transportation and Highway Safety for:
  - providing advice and making recommendations on matters relating to transportation and highway safety
- the provinces, territories and the federal government for:
  - promoting a better understanding and cooperation in all matters related to transportation and highway safety among each other, as well as other organizations where there exists a mutual interest
- its stakeholders for:
  - maintaining an ongoing dialogue and consultation to ensure CCMTA is responsive and informative



The Standing Senate Committee on Transport and Communications in its report entitled: “Driving Change: Technology and the Future of the Automated Vehicle”, studied the regulatory and technical issues related to the deployment of automated and connected vehicles. In recognition of CCMTA’s mandate on transportation safety, the report recommended that:

*“Transport Canada engage with provincial and territorial governments, through the Canadian Council of Motor Transport Administrators, to develop a model provincial policy for the use of automated and connected vehicles on public roads. The department should also involve municipalities in this engagement process.”<sup>5</sup>*

CCMTA is, therefore, well-positioned to take on a leadership role in crafting new guidelines for the motor transport administrative and law enforcement communities.

CCMTA established an Automated Vehicle Working Group (AVWG) in 2013 and in 2014 was given approval to examine the potential impacts of testing and deployment of ADS. The Senate Committee’s recommendation gave further impetus to the AVWG’s work to develop guidelines for Canadian jurisdictions.

The AVWG included representatives from Transport Canada, six provinces, the Canadian Association of Chiefs of Police (CACCP) and CCMTA. It also included a representative from CCMTA’s American-equivalent organization, the American Association of Motor Vehicle Administrators (AAMVA). AAMVA has developed similar Guidelines for its member jurisdictions from which much has been gained by CCMTA. These may be found at: [www.aamva.org](http://www.aamva.org).

Specifically, the AVWG has covered the various disciplines of vehicle registration, driver licensing and law enforcement with the purpose of providing a point-in-time set of recommendations for Canadian jurisdictions to use in developing testing programs (if desired) and preparing for the deployment of the technology.

<sup>5</sup> Senate of Canada, “Driving Change: Technology and the Future of the Automated Vehicle”, Report of the Standing Senate Committee on Transport and Communications, January 2018.

It should be noted that guidelines respecting the temporary trials of highly automated vehicles in Canada have also been developed. The document, entitled “Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations”, is complementary with these testing and deployment Guidelines. Similarities and

differences are outlined in Table 1. *Canadian Guideline Documents*. Provinces and territories are encouraged to consult the *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*, in conjunction with this document, to inform the development of their testing and deployment regulations.

Table 1. Canadian Guideline Documents

Key Elements	<i>Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations</i>	<i>Canadian Jurisdictional Guidelines for the Safe Testing and Deployment of Highly Automated Vehicles</i>
<b>Purpose</b>	<ul style="list-style-type: none"> <li>• Highlight Canada as a destination for research and development of ADS;</li> <li>• Clarify roles and responsibilities of each level of government for ADS trials; and</li> <li>• Establish a set of consistent minimum safety requirements for trial organizations operating in Canada.</li> </ul>	Provide a series of considerations and recommendations that will support Canadian jurisdictions in their planning and roll-out of ADS vehicles.
<b>Scope</b>	Temporary trials of ADS vehicles, not deployment.	<ul style="list-style-type: none"> <li>• Governance</li> <li>• Testing</li> <li>• Deployment</li> <li>• Law Enforcement &amp; Transportation Safety</li> </ul>
<b>ADS Taxonomy and Definitions</b>	From SAE International	From SAE International
<b>Vehicle Types Included</b>	All vehicles intended for use on public roads.	All vehicles intended for use on public roads.
<b>Target Audience</b>	Trial Organizations (i.e. manufacturers, academia, technology firms)	<ul style="list-style-type: none"> <li>• Provincial, Territorial, Municipal jurisdictions</li> <li>• Manufacturers and Other Entities</li> </ul>

## COLLABORATION AMONG STAKEHOLDERS AND PARTNERS

Another important element of a well-managed roll-out of ADS is the inclusion of a broad range of key stakeholders from government organizations, government support associations, industry, research institutes and advocacy groups in discussions of these new technologies and their potentially far-reaching impacts. Partnerships and

collaboration among these interests will be needed to ensure the safest integration of ADS into the Canadian transportation system.

CCMTA, its members, and the AVWG have participated in several consultative efforts to help form the development of this document.

## GUIDING PRINCIPLES

Part of the AVWG's mandate was to define a clear set of guiding principles that would influence the development of this Guidelines Document for the safe testing and deployment of ADS. Accordingly, the AVWG drafted guiding principles that reflect the vision, strategic interests, and core values of CCMTA members.

The Guiding Principles are as follows:

### 1. Create a pathway to consistency across jurisdictions

Consistency in regulatory requirements across jurisdictions will lead to greater certainty and reduced costs for manufacturers and technology developers thereby providing optimum conditions for the efficient and effective testing and deployment of the technology throughout Canada.

### 2. Encourage and enable the earliest safe introduction of the technology

This principle includes two important concepts. First, the Guidelines are meant to be implemented in a manner that is in line with our primary road safety mandate. Second, they are not meant to present unnecessary obstacles or barriers to testing and deployment, nor to the innovative processes that will be required to achieve full automation over time. The goal is to permit the earliest possible receipt of the associated benefits of the technology in the safest way possible.

### 3. Confirm and clarify roles and responsibilities of each level of government

Given that federal/provincial/territorial and municipal governments all have responsibilities related to the safety of vehicles and their operation, these Guidelines will provide clear explanation of the roles of each. It is important that these are well understood by all, including industry and technology developers.

### 4. Demonstrate jurisdictional awareness and understanding of the technology and promote public acceptance, confidence, and adoption

Key to enabling the safe and early deployment of ADS are public acceptance of and confidence in the technologies i.e., that they will perform safely, and that there are significant economic and societal benefits in adopting them for everyday use.

Jurisdictions have an important role to play in building that public confidence and ultimately adoption. They must show that they:

- are knowledgeable of the technologies and how they operate in both test and real-world circumstances;
- are understanding of the benefits and limitations of the technologies;
- are understanding of public concerns about the technologies;
- are aware that early or preemptive regulation can risk stifling innovation of the industry;
- demonstrate that safety is a top priority and that any guidelines introduced on testing and deployment in Canada are transparent and accompanied by a fact-based rationale; and
- will actively promote these technologies for safety, economic and societal benefits.

These Guidelines are crafted to incorporate these concepts.

### 5. Create common language and terms

There are a wide range of players involved in all stages of research, development, testing and deployment of automated vehicle technologies. Within this environment, we have noted that there are numerous terms, expressions and language being used that describe similar functions and operations of the technology.

Our goal is to be clear in the Guidelines and recommendations so there is a foundation for discussion and for consistent dialogue of these issues in Canada. These Guidelines will, therefore, set out definitions for key terms and will then apply these terms consistently throughout the text to ensure clarity of meaning.

### 6. Work towards interoperability

Align approaches with international best practices and ensure interoperability in cross-jurisdictional testing and deployment of ADS vehicles with key partners in Canada and the US.



## CHAPTER 2

# ROLES AND RESPONSIBILITIES

In Canada, motor vehicle transportation is a shared responsibility between federal, provincial and territorial governments. Transport Canada, under the *Motor Vehicle Safety Act* (MVSA), establishes safety regulations for the manufacture and importation of motor vehicles (including vehicles that may be imported for trial purposes) as well as designated motor vehicle equipment (tires and child seats), to reduce the risk of death, injury, and damage to property and the environment.

Innovation, Science and Economic Development Canada is responsible for setting and enforcing compliance with technical standards and licensing requirements related to wireless technologies integrated in vehicles and road side infrastructure. These standards and licensing requirements are for addressing related data,

intellectual property, and privacy considerations, as well as for investing in and fostering innovation and skills in the Canadian automotive, transportation and digital technology sectors. For more information, please visit [www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01742.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01742.html).

Provinces and territories are responsible for the licensing of drivers, vehicle registration and insurance, as well as laws and regulations regarding the safe operation of vehicles on public roads. As such, provinces and territories are also responsible for approving and overseeing trials of automated vehicles that take place within their jurisdiction. These jurisdictions may choose to engage Transport Canada in this process to seek input and views on applications and trial practices.

Constitutionally, municipal governments in Canada fall under the jurisdiction of provinces and territories. Their responsibilities regarding roadways vary to some degree across the country, but generally can include creating and enforcing by-laws concerning vehicle movement, as well as use of local infrastructure, and public transportation in their respective jurisdictions. Manufacturers and other entities are encouraged to engage municipal authorities, in conjunction with the relevant provincial/territorial road transport agency, to ensure local traffic and infrastructure considerations are addressed and that local law enforcement and emergency response personnel are appropriately informed about testing operations.

To align with Canada’s international commitments with respect to transportation safety, Canadian jurisdictions are also encouraged to monitor and follow guidance provided by the Global Forum for Road Traffic Safety (Working Party 1) with respect to safe ADS uses. WP 1 is the United Nations body responsible for supporting international road safety and the harmonization of international traffic rules. It also oversees the 1949 and 1968 Conventions on Road Traffic, the former to which Canada is a party. Transport Canada represents Canadian jurisdictions at WP 1 proceedings. Jurisdictions are encouraged to work with Transport Canada to ensure their laws and regulations align with WP1 guidance, and that Canadian perspectives are incorporated into these guidelines as they are further developed by WP 1 parties.

Table 2. Summary of Jurisdictional Roles and Responsibilities<sup>6</sup>

Federal Areas of Responsibility	Provincial/Territorial Areas of Responsibility
<p><b>Transport Canada:</b></p> <ul style="list-style-type: none"> <li>• Setting and enforcing compliance with safety standards for manufactured and imported vehicles (including the import of trial vehicles) as well as motor vehicle equipment (tires and child car seats);</li> <li>• Investigating and managing the recall and remedy of non-compliances and safety-related motor vehicle defects;</li> <li>• Motor vehicle safety research; and</li> <li>• Public education on motor vehicle safety issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Driver licensing;</li> <li>• Vehicle registration;</li> <li>• Enacting and enforcing traffic laws and regulations (including trials);</li> <li>• Conducting safety inspections;</li> <li>• Regulating motor vehicle insurance and liability;</li> <li>• Public education on motor vehicle safety issues; and</li> <li>• Adapting infrastructure to support AV deployment.</li> </ul>
<p><b>Innovation, Science and Economic Development Canada:</b></p> <ul style="list-style-type: none"> <li>• Setting and enforcing compliance with technical standards and licensing requirements related to wireless technologies integrated in vehicles and road side infrastructure (for trials involving the testing of connectivity technologies)</li> <li>• Addressing related data, intellectual property, and privacy considerations in federal policy and programming; and</li> <li>• Investing in and fostering innovation and skills through programming, research, policy and engagement with the Canadian automotive, transportation and digital technology sectors.</li> </ul>	<p><b>Municipalities:</b></p> <ul style="list-style-type: none"> <li>• Enacting and enforcing bylaws for local roadways and parking;</li> <li>• Enforcing traffic laws and regulations;</li> <li>• Advocating for and accommodating testing;</li> <li>• Adapting infrastructure to support AV deployment</li> <li>• Managing passenger transportation (including public transit and taxi cabs);</li> <li>• Parking;</li> <li>• Traffic control; and</li> <li>• Public education and motor vehicle safety issues.</li> </ul>

<sup>6</sup> Source: Transport Canada: "Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations", 2018.



## CHAPTER 3

# CONSIDERATIONS FOR THE GOVERNANCE OF TESTING AND DEPLOYMENT OF ADS VEHICLES

## 3.1 GOVERNANCE

### Background

To successfully address the safe integration of ADS vehicles within the transportation system, a collaborative approach should be taken among jurisdictions and stakeholders to gain an understanding of emerging vehicle technologies and the impact to roadway safety, jurisdictional programs and infrastructure.

### Guidelines for the Governance of Testing and Deployment of ADS Vehicles

A lead agency should be identified within each jurisdiction to address ADS testing and deployment within their borders. The lead agency should be charged with establishing a jurisdictional ADS Committee. The ADS Committee should include, but not be limited to:

- Representatives from the jurisdiction's office of the Transportation Minister/Deputy Minister;
- The legislature;
- The law enforcement agencies;
- The office of highway safety;
- The office of information technology;
- The insurance regulator;
- The jurisdictional office(s) representing vulnerable road users;
- Toll authorities;
- Transit authorities; and
- Local governing bodies.

Other stakeholders such as transportation research centers located within the jurisdiction and other road safety stakeholders should be consulted as appropriate. Communication with the ADS manufacturing industry is encouraged.

The ADS Committee should develop strategies for addressing the testing and deployment of ADS in their jurisdiction. There are a range of strategies to consider from addressing testing without active regulation; to testing with regulation by policy or statute.



Jurisdictions will need to examine their laws and regulations to address unnecessary barriers to safe testing, deployment and operation of ADS in the areas of:

- Licensing/registration;
- Driver education/training;
- Insurance and liability;
- Development and enforcement of appropriate traffic laws/regulations; and
- Administration of motor vehicle inspections.

Jurisdictions which regulate the testing of ADS are encouraged to take necessary steps to establish statutory authority, and to utilize the document *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations* as a minimum baseline for these regulations.

The designated lead agency should keep its ADS Committee informed of the requests from manufacturers or other entities to test in their jurisdiction and the status of the designated agency's response.

Several national associations are engaged in the discussion on ADS and are available for additional support to jurisdictional government officials. These include, but are not limited to: CCMTA, the Transportation Association of Canada (TAC), the Federation of Canadian Municipalities (FCM), and the Canadian Association of Chiefs of Police (CACCP).

As technologies emerge, regulators and legislators will need to constantly advance their knowledge to stay current. To do so, policy makers should be informed of relevant reports and studies, attend ADS fora and be engaged with the industry and Transport Canada. Jurisdictions may wish to establish an advisory committee. As government officials continue to become informed, they will have a better understanding of

the technology. This knowledge will help officials to recognize when laws, rules and policies are either outdated or proposed prematurely.

Jurisdictions should also review their laws, regulations and rules, if applicable, regarding vehicle operation to ensure the testing and deployment of ADS vehicles is permitted on public roads.

### RECOMMENDATIONS FOR JURISDICTIONS

- 3.1.1** Establish an ADS Committee to address ADS testing and deployment. The Committee should include members from a broad range of governmental and private sector stakeholders having interest in and/or responsibilities related to ADS.
- 3.1.2** Identify a Lead Agency to manage the ADS Committee and its work. The ADS Committee should develop strategies for addressing testing and deployment of ADS in their jurisdiction, balancing the protection of road safety with enabling technological innovation.
- 3.1.3** Jurisdictions should review their laws, regulations and rules, if applicable, regarding vehicle operation to ensure:
  - a)** the testing and deployment of ADS vehicles is permitted on public roads; and
  - b)** that they do not create unnecessary barriers to the safe testing, deployment and operation of ADS vehicles in Canada.
- 3.1.4** Jurisdictions which regulate the testing of ADS are encouraged to take necessary steps to establish statutory authority and to consult the document *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations* published by Transport Canada in collaboration with CCMTA in June 2018 as a minimum baseline to frame the regulations.
- 3.1.5** Jurisdictions should encourage their regulating bodies and legislators to engage in regular reviews of ADS technologies and to engage with industry to stay current with advancements. This will help officials recognize when laws, rules and policies are either outdated or proposed prematurely.

### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 1.** Manufacturers and other entities should interact cooperatively with and respond to jurisdictional ADS Committee questions and requests.

## Benefits to Implementation

By establishing a lead agency and an ADS Committee, jurisdictions provide an opportunity for collaboration among stakeholders as they become informed of the technologies and as they explore options for the safe testing and deployment of ADS vehicles. Awareness will assist officials to recognize when and how regulations will need to be developed and updated.

A lead agency can provide the appropriate level of government oversight with flexibility to quickly modify regulations, if needed. A flexible and consistent regulatory approach is beneficial to regulators and supports innovation within the industry.

Establishing a lead agency offers an additional benefit to stakeholders in that it may act as a single point of contact for inquiries, comments and dialogue.

## Challenges to Implementation

Creative thinking and approaches may be necessary to ensure roadway safety while, at the same time, supporting technological advancements through the development and testing phases of ADS.

Review of jurisdictional laws and rules to ensure the safe testing and deployment of ADS will need to be thorough, and include as many situations as possible, (e.g., enable testing without a driver; examine impaired driving, distracted driving and careless driving laws for deployment). Another dimension that will need to be considered when contemplating regulatory action is the fact that ADS Levels 3, 4 and 5 will be constantly changing – technological innovation is expected to continue. Jurisdictions will need to be nimble to ensure new developments are covered, where appropriate.

Ensuring interoperability of the technologies in cross-border testing and deployment situations will also need to be taken into consideration.



CHAPTER 4

# **GUIDELINES FOR THE TESTING OF ADS VEHICLES**

# VEHICLE CREDENTIALING CONSIDERATIONS

## 4.1

### APPLICATION AND PERMIT FOR MANUFACTURERS OR OTHER ENTITIES TO TEST VEHICLES ON PUBLIC ROADWAYS

#### Background

Statutes and requirements enacted by several jurisdictions give qualifying manufacturers and other entities authority to test automated vehicles on public roadways.

Jurisdictions may establish a permitting process to promote safety in the testing of automated vehicle technologies on public roads. For example, jurisdictions may require that test drivers meet certain qualifications or prohibit testing in work zones or school zones. Although provisions of the permitting process may vary significantly between jurisdictions, public trust and the integrity of the permitting process require a means to enforce any conditions imposed on the testing entity.

#### Guidelines for Testing Vehicles

An internal jurisdictional process should be developed that includes an application for manufacturers to test on public roadways within the jurisdiction. The jurisdiction's Motor Transport Administrator (MTA) or relevant agency should oversee this internal development process, as well as the administration of the application process.<sup>7</sup>

The application process should include provisions for suspension or revocation of any permit to test on public roads if permit holders violate permit conditions. The jurisdictions should also consider the imposition of penalties should the testing entity continue to operate/test in violation of that suspension or revocation order. Test users should be held responsible for violations of existing traffic laws subject to existing legal processes.

Manufacturers and other entities testing ADS vehicles should apply for and be issued vehicle specific test permits/approvals prior to testing on public roadways.

The application process for test permits that is established should not create unnecessary barriers for manufacturers or other entities. The application information is intended to provide sufficient background material, providing

jurisdiction and law enforcement personnel the opportunity to interact with the manufacturer and their vehicle(s). It is vital for jurisdictions and law enforcement to know who, how, where and what testing is being conducted. The permit application process should require the completion or attachment of the following information:

- Name of manufacturer or other entity
- Corporate physical and mailing addresses of manufacturer or other entity
- In-jurisdiction physical and mailing addresses of manufacturer or other entity, if different than corporate address, and if applicable
- Program administrator/director
- Contact information for program administrator/director
- Vehicle specific information for all vehicles to be permitted including:
  - Vehicle Identification Number (VIN)
  - Year (if assigned by the manufacturer)
  - Make (if assigned by the manufacturer)
  - Model (if assigned by the manufacturer)
  - Licence plate number and jurisdiction of issuance (if applicable)
  - Indication of intention for testing with or without a human controlling the vehicle from within the vehicle and
  - Indication of the SAE level of the vehicle
  - Vehicle type (e.g., passenger car, truck, low-speed, etc.)
- List of all drivers of Level 3, 4 and 5 vehicles including:
  - Full name
  - Date of Birth
  - Driver licence number and jurisdiction of issuance
- Summary of training provided to employees, contractors, or other persons designated by the manufacturer or other entity as drivers of test vehicles

<sup>7</sup> It is expected that requirements developed to ensure safety during testing would not be applicable to deployed vehicles since these vehicles will be subject to the CMVSS and other potential federal safety guidance.

- Criminal background checks of employees, contractors or other persons designated by the manufacturer or other entity as drivers of test vehicles. The costs for such background checks are to be borne by the applicant
- Disclosure of all jurisdictions where application or issuance of testing registration permits has occurred or been denied
- Declaration from the manufacturer or other entity stating that they have given due consideration, and where necessary, incorporated appropriate measures, protocols, and equipment redundancies, to address various safety issues<sup>8</sup>
- Confirms compliance with the requirements of the *Motor Vehicle Safety Act*
- Copy of manufacturer’s safety plan for testing vehicles including the minimal risk condition component
- Routes to be used when testing ADS vehicles with a remote driver.
- Intended Operational Design Domain
- Evidence of the manufacturer’s ability to respond to judgments for damages for personal injury, death or property damage caused by a vehicle during testing. Evidence may be in the form of an instrument of insurance, a surety bond, or proof of self-insurance (for more detail on this refer to Section 4.4 – Financial Responsibility)
- Notice to the jurisdiction if there are any changes in SAE levels of the vehicle being tested

The application process should provide for a manufacturer or other entity to submit a single umbrella application for any number of identically equipped vehicles.

Such permits should be valid in the jurisdiction of issuance only. Each permit, subject to periodic renewal, should contain the following information:

- Owner name
- Mailing and physical addresses
- Jurisdiction specific limitations (e.g. geographic, environmental, etc.)
- Vehicle Identification Number (VIN)
- Year of vehicle (if assigned by the manufacturer)
- Make of vehicle (if assigned by the manufacturer)
- Model of vehicle (if assigned by the manufacturer)
- Vehicle type (e.g., passenger car, truck, low-speed vehicle)
- Indication of permit holder’s intention for testing with or without a human controlling the vehicle from within the vehicle
- Indication of the ADS level being tested

In those jurisdictions where manufacturer or other entity-owned vehicles are required to be individually registered, the permit information should be available for verification at time of vehicle registration issuance (new and renewal) either by presentation from the holder or through electronic means. If at any time such a permit is no longer valid, the associated vehicle registration should become void.

Permits should be carried in the test vehicle while present on public roadways. Permit information should be made readily available to law enforcement via electronic means by the issuing jurisdiction.

Jurisdictions may choose to recognize other jurisdictions’ testing programs. This would facilitate those programs that test across jurisdictional borders within Canada or with the United States.

<sup>8</sup> See *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations* for a list potential safety considerations that could be addressed in the declaration.

## RECOMMENDATIONS FOR JURISDICTIONS

- 4.1.1** Develop an internal process that includes an application for manufacturers to test on public roadways within the jurisdiction and include provisions for suspension or revocation of any permit to test on public roads should permit holders violate permit conditions.
- 4.1.2** Consider the imposition of penalties should the testing entity continue to operate/test in violation of a suspension or revocation order.
- 4.1.3** Hold test users responsible for violations of existing traffic laws subject to existing legal processes.
- 4.1.4** Require all manufacturers and other entities testing all ADS vehicles to apply for and be issued vehicle specific permits prior to testing on public roadways.
- 4.1.5** Establish a test permit application process for ADS vehicles that does not create unnecessary barriers for manufacturers or other entities and includes the information listed in Section 4.1 - Guidelines above.
- 4.1.6** Require test permit information be available for verification at the time of vehicle registration issuance (new and renewal) either by presentation from the holder or through electronic means in those jurisdictions where manufacturer or other entity-owned vehicles are required to be individually registered.
- 4.1.7** Require test permits/approvals to be carried in the test vehicle while present on public roadways within their jurisdiction. Permit information should be made readily available to law enforcement via electronic means by the issuing jurisdiction.
- 4.1.8** Jurisdictions should not utilize regulations developed for testing for deployed vehicles since these vehicles will be subject to the *Canada Motor Vehicle Safety Standards* (CMVSS) and other potential federal safety guidance.

### Benefits of Implementation

Ensuring sufficient oversight promotes and upholds road safety in jurisdictions. Automated vehicles tested on public roadways will meet minimum testing requirements prior to authorized operation on public roadways. In addition, authority granted for on-road testing will be identifiable to law enforcement and MTAs.

The purpose of the permitting process is to ensure safety during development. But issuing a permit alone does not do that if a permit holder is not held accountable to the conditions of the permit, i.e., background checks, operating in school zones, etc. Ramifications for violating the conditions of the permit are necessary to ensure integrity in the permitting process and in maintaining public safety.

### Challenges to Implementation

Manufacturers and other entities may view any permitting process as an impediment to their ability to test and develop ADS technology. Some manufacturers may resist these recommendations and may indicate regulations or permit issuance are not necessary if vehicles being operated are properly registered or plated. In addition, jurisdictions may lack the resources to monitor and enforce provisions of its permitting process.

## 4.2 VEHICLE PERMITTING AND REGISTRATION

### Background

Vehicle permitting, registration credentials and records are basic tools which enable identification of a vehicle and its owner. As testing and deployment of ADS vehicles expand, the need for owner and vehicle information becomes more necessary. Several jurisdictions already require the use of special registrations for the testing of ADS technologies by a vehicle manufacturer or other entity in their jurisdictions.

### Guidelines for Testing Vehicles

While numerous jurisdictions have considered regulating ADS vehicles, only a few have ventured into the field of allowing the testing of such vehicles. Generally, jurisdictions do not require registration of a motor vehicle until it has been sold. There is no reason to change this practice for ADS vehicles.

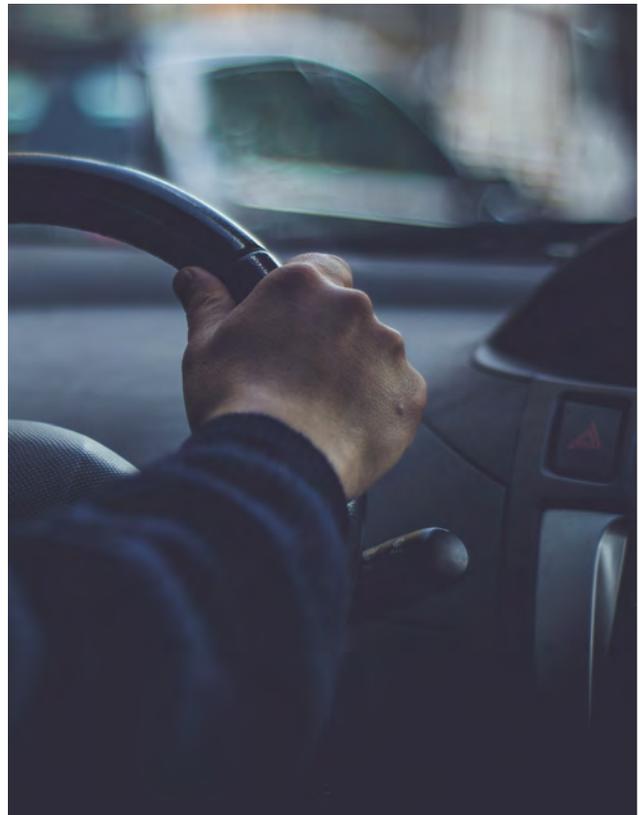
Even though a jurisdiction may not require a permit for test vehicles, the jurisdiction should record and maintain the vehicle information in its vehicle record database either through the normal process, through a permitting/registration exception process unique to ADS vehicles or recording vital information in the registration record without permitting.

Storing information, such as the VIN and the ADS level:

- provides pertinent information to stakeholders in case of a crash;
- ensures ownership transfer of the vehicle (if permitted) will be within its laws or policies<sup>9</sup>, depending on how a jurisdiction wants to treat a post test vehicle;
- provides information to the Interprovincial Records Exchange (IRE) so the status of the vehicle is readily available to other jurisdictions; and
- provides pertinent information to law enforcement.

Uniform language should be established which will benefit law enforcement, the MTA and other stakeholders. This uniform language includes the use of the acronyms and terms such as “ADS” and “ADS vehicle”.

For the benefit of law enforcement, the MTA and other stakeholder’s, the uniform notation “ADS Level” for “Automated Driving System Level” should be displayed on the testing permit and/or registration, if issued, and reflected on the jurisdiction’s electronic record (i.e. vehicle database). It is recommended that jurisdictions introduce an ADS “flag” on their registration database and have a supplemental corresponding data field indicating the ADS level (either 3, 4, or 5).



<sup>9</sup> Unless information is accessible to all DMV employees, a post-test vehicle may be transferred contrary to the jurisdiction’s laws or policies.

For vehicles not equipped with automated technologies by the original equipment manufacturer (OEM), placing and identifying status on vehicles with aftermarket-altered automated technologies is recommended. In some jurisdictions, when a vehicle is significantly altered with aftermarket components or the vehicle no longer physically represents the manufacturer’s vehicle, a vehicle record may be given an Altered status. An ADS status could also be added to a vehicle record if aftermarket ADS technology is added to the vehicle. Vehicles which have had a Tier 1 supplier, or an aftermarket company significantly alter the vehicle with automated technologies enabling ADS functionalities, should be identified for law

enforcement and MTAs. This may be accomplished by placing an “A” in the vehicle’s status field.

Additionally, it has been suggested vehicles with lower AV functionality (Levels 2 and 3) may have the ability to have their ADS upgraded to higher levels of functionality (move to Levels 3, 4 or 5). In these scenarios, capturing this increased functionality will be necessary. Jurisdictions should utilize the process described in Section 5.2 - Vehicle Registration to record this information.

The registration permit and plate issued by the permitting jurisdiction for purposes of testing should be recognized by other jurisdictions.

**RECOMMENDATIONS FOR JURISDICTIONS**

- 4.2.1** Establish uniform language that will benefit law enforcement, the MTA and other stakeholders for testing ADS vehicles. This uniform language should include the use of the acronyms and terms such as “ADS” for “Automated Driving System”, and “ADS vehicle”.
- 4.2.2** Place a notation on the permit, registration credential and/or electronic record, if applicable, by means of an ADS flag and an additional corresponding ADS level field for vehicles that have the capability to operate at Levels 3, 4 or 5.
- 4.2.3** Recognize the permit issued by another jurisdiction for purposes of testing.
- 4.2.4** Jurisdictions should not begin the process of registering test vehicles if the jurisdiction does not already require this protocol for other technology testing scenarios (i.e., alternate fuel test vehicles).
- 4.2.5** Test vehicles may not necessarily be approved to stay in Canada indefinitely. Vehicles should be plated through a means that allows the jurisdiction to prevent the transfer of ownership of the vehicle unless it receives approval for permanent importation into Canada.
- 4.2.6** If the jurisdiction does issue a registration record/credential, it should consider placing an “Altered” or “A” status on vehicles not equipped with automated technologies by the OEM but have aftermarket automated components.
- 4.2.7** Require manufacturers and other entities to notify the jurisdiction in the case of:
  - a)** any change to the SAE level of the vehicle or vehicles being tested; or
  - b)** the addition of another vehicle or vehicles to the testing program.

In the case of such notification, the manufacturers and other entities should be required to provide details on these vehicles to be tested.
- 4.2.8** When changes to the SAE level have been made or additional vehicles are added to the testing program, the jurisdiction should update its records, accordingly, and issue a new permit for the test vehicle or vehicles reflecting the changes/additions made.



#### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

**MOE 2.** Testing entities should be required to notify the jurisdiction of any change in the SAE level of vehicles being tested and/or the addition of any vehicles to the testing program.

### Benefits of Implementation

Disclosure of a vehicle as an ADS vehicle on the registration credential allows law enforcement and MTA personnel the ability to better identify vehicles with automated functionality. As the technology becomes more prominent, law enforcement and first responders will need to approach situations including traffic stops or vehicle crash scenes differently (this is addressed in Section 6.5 – First Responder Safety); readily available vehicle record information will benefit law enforcement. Additionally, this information will ensure the ADS Level 3, 4, or 5 notation is maintained until a national solution, such as, a VIN check digit or indicator is common in the industry (see Section 5.4 - ADS Vehicle Information on the New Vehicle Information Statement).

### Challenges to Implementation

When jurisdictions are considering how to manage registrations, they should also review their registration/vehicle status change process, as these recommendations will add complexity. Additionally, there may be inaccuracies in the recording of this data due to the reliability of human entry and the potential for error.

## 4.3 LICENCE PLATES

### Background

Unlike the case for non-automated vehicles, or fully deployed ADS vehicles, special licence plates for the specific purpose of testing ADS vehicles are not recommended.

Identification of the ADS test vehicle in a specific or recognizable manner, through licence plates or other markings, may cause drivers to behave differently around those vehicles, which may have an impact on the testing itself. Other reasons for not creating special licence plates for the testing of ADS vehicles include: the costs of new plate design; complications related to the identification of the jurisdiction of issuance of the plate; and discernibility of the plate design from the other plates issued by the jurisdiction.

In spite of these challenges, a jurisdiction may still opt for special plates. It may be their view that the ability

for motor vehicle agency employees, police officers, tolling authorities and citizens to quickly and easily identify licence plate numbers is fundamental to the safe operation of road networks, as well as being able to respond quickly and effectively in emergency situations.

### Guidelines for Testing Vehicles

Special licence plates for the specific purpose of testing ADS vehicles are not recommended. If a jurisdiction does, however, opt for special plates, consideration could be given to adopting the administrative, design and manufacturing specifications contained in the *AAMVA License Plate Standard*. Other means of identification are also suggested in Chapter 6 - Law Enforcement and Transportation Safety Considerations, to support law enforcement's efforts to identify vehicles involved in crashes.

#### RECOMMENDATIONS FOR JURISDICTIONS

- 4.3.1** Jurisdictions should not require a special licence plate for ADS vehicles. If a jurisdiction does, however, choose to require a special licence plate for ADS vehicles, the jurisdiction may consider adopting the administrative, design and manufacturing specifications contained in the *AAMVA License Plate Standard*.

### Benefits of Implementation

There is limited benefit for implementing a special licence plate for ADS vehicles, as long as the jurisdiction follows the recommendation on registration documents from Section 4.2 Vehicle Permitting and Registration.

### Challenges to Implementation

Challenges in implementing a new licence plate design for testing include: adverse impacts on the testing of ADS vehicles; the identification of the jurisdiction of issuance; discernibility of the plate design from others the jurisdiction issues; and cost if there is special significance to the licence plate design – as in the design for an ADS vehicle licence plate. In addition, law enforcement may prefer to have special plates for ADS vehicles to assist them in the case of a vehicle crash.

## 4.4 FINANCIAL RESPONSIBILITY

### Background

An important element of the administration and regulation of ADS vehicles is ensuring adequate insurance is in place to protect not only the occupants of an ADS vehicle but also other road users. All jurisdictions require a minimum financial responsibility requirement for each vehicle operating on public roads.

Vehicle insurance regulators should monitor the legal trends ensuring limits stay relevant and appropriate. It

would also be advisable that there is sufficient coverage available for third party liability, in jurisdictional scenarios where there is no explicit distinction in property damage versus personal injury.

### Guidelines for Testing Vehicles

All ADS vehicles permitted for on road testing should be required to have minimum liability insurance, in the form and manner required by the MTA authority.

#### RECOMMENDATIONS FOR JURISDICTIONS

- 4.4.1** Require all ADS vehicles permitted for on road testing to have a minimum of \$5 million in liability insurance, in the form and manner required by the MTA authority or other relevant agency.
- 4.4.2** Jurisdictions should consider requiring additional liability insurance, beyond the \$5 million minimum, for vehicles with a large seating capacity (e.g. for 8 or more passengers).
- 4.4.3** For the testing of driverless ADS vehicles, jurisdictions should consider including a requirement that stipulates, as part of the application process, that;
  - a)** testing entities must accept full liability/responsibility for damages caused by their vehicles or drivers, and;
  - b)** their insurers must agree to respond to damage claims whether the driver or vehicle deemed to be at fault.

### Benefits of Implementation

Requiring a minimum of \$5 million liability insurance level for ADS testing provides consistency between jurisdictions. This prevents prospective companies from seeking out jurisdictional testing locations which have lower minimum liability coverage limits. Furthermore, the public will be given some assurance that companies, interacting on the public roadways, are testing in a responsible manner.

### Challenges to Implementation

Different liability limits between jurisdictions can create incentives for ADS testing where the liability level is the lowest, placing the public at risk and possibly dissuading adoption of this technology by the public. Although not in scope for these recommendations, the increase in commercial motor vehicle ADS testing interest has many jurisdictions considering if the potential for greater damage in a crash necessitates a higher minimum insurance liability limit.

## 4.5 COMPLIANCE OF ADS TRIAL VEHICLES WITH THE MOTOR VEHICLE SAFETY ACT (MVSA)

### Background

Transport Canada, under the *Motor Vehicle Safety Act* (MVSA), establishes regulations for the manufacture and importation of motor vehicles as well as prescribed motor vehicle equipment (e.g., tires and child car seats). The objective of this Act is to reduce the risk of death, injury, and damage to property and the environment.

Paragraph 7(1)(a) of the MVSA allows persons or companies to temporarily import a vehicle that does not meet the *Canada Motor Vehicle Safety Standards* (CMVSS) if, at the time of importation, the person importing the vehicle declares that the purpose for importing the vehicle is for exhibition, demonstration, evaluation or testing.

To import a vehicle for one of these purposes, the applicant must complete and submit the necessary declaration forms (Schedule VII of the *Motor Vehicle Safety Regulations* (MVSR)) to Transport Canada for review prior to importation. If the information is accurate and complete, the vehicle will be permitted entry into the country for the purpose stated by the applicant.

The MVSA prohibits a company from shipping from one province to another, or delivering to any person for the purpose of being so shipped, any vehicle of a prescribed class manufactured in Canada unless it has a national safety mark (NSM) applied to it.<sup>10</sup>

Section 5.1 of the MVSR provides a means for vehicle manufactured in Canada that does not have a NSM applied to it to be shipped from one province to another for the purpose of exhibition, demonstration, and evaluation or testing. A declaration must be filed with the Minister and must include prescribed information outlined in subsection 5.2(2) of the regulation, including whether and when the vehicle will be returned to the province of origin or destroyed after the trial/demonstration, etc.

It is important to note that vehicles that enter a province or territory under a Schedule VII or MVSR 5.1 declaration have not been assessed by Transport Canada to determine what level of safety they provide. See recommendation 4.5.2 for measures to address this.

### RECOMMENDATIONS FOR JURISDICTIONS

- 4.5.1** Consider requiring manufacturers or other entities that seek to conduct trials for ADS within their jurisdictions to confirm compliance with the MVSA including the submission of any declarations that may be applicable as per section 7(1)(a) of the MVSA and Section 5.1(1) of the MVSR as applicable.
- 4.5.2** As part of their trial permitting process, jurisdictions are encouraged to require a declaration from the manufacturer or other entity stating that they have given due consideration, and where necessary, incorporated appropriate measures, protocols, and equipment redundancies, to address various safety issues associated with their trial vehicles<sup>11</sup>. Jurisdictions are encouraged to consult with Transport Canada when reviewing the information, they receive as part of this declaration.

### Benefits of Implementation

Jurisdictions will have confirmation that ADS vehicles tested on public roadways comply with applicable federal laws.

<sup>10</sup> The National Safety Mark (NSM) is used to indicate the compliance of a vehicle with the Act and attendant regulations and safety standards.

<sup>11</sup> See *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations* for a list of potential safety considerations that could be addressed in the declaration

# DRIVER LICENCING CONSIDERATIONS

## 4.6 DRIVER AND PASSENGER ROLES DEFINED

### Background

As described in the Preface, this report utilizes the SAE International's definitions. Universal terms and definitions are critical for jurisdictions, manufacturers and other entities when discussing automated vehicle technologies and ADS. It should be noted this report utilizes the terms

“driver” or “user”. Although use of the term operate/operating implies the existence of an “operator,” this term is not defined or used in this document, consistent with SAE International definitions and use of terms.

#### RECOMMENDATIONS FOR JURISDICTIONS

**4.6.1** Utilize the SAE International definitions provided in the Preface.

#### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

**MOE 3.** Manufacturers and other entities should utilize the SAE International definitions provided in the Preface.

### Benefits of Implementation

Universal definitions of these terms will facilitate communication, understanding and standardization of roles and responsibilities for ADS.

### Challenges to Implementation

Educating all entities on the need for acceptance and implementation of these universal terms and definitions will be an implementation challenge.

Jurisdictions will need to review jurisdiction laws and regulations ensuring motor vehicle laws permit the testing of Level 4 and 5 vehicles without a driver. Legislative action amending statutory and regulatory definitions of “driver” and related terms and reviewing and adapting existing rules regarding vehicle operation may pose challenges until more policy makers are versed in the subject matter.

## 4.7 DRIVERS LICENCE REQUIREMENTS FOR TESTING BY MANUFACTURERS AND OTHER ENTITIES

### Background

Currently there are numerous manufacturers and other entities testing ADS vehicles in multiple jurisdictions. It is anticipated testing will be expanded to include most jurisdictions. This section provides guidelines for testing ADS vehicles by manufacturers and other entities.

### Guidelines for Testing by Manufacturers and Other Entities

ADS vehicles should be operated solely by employees, contractors, or other persons designated by the ADS vehicle manufacturer or other entities, such as universities involved in the testing.

Test drivers should have the appropriate class of licence associated with the particular vehicle being tested (e.g., a driver in a Quebec trial holds a Class 5 licence to test passenger vehicles). Test drivers should receive training and instruction related to, but not limited to, the capabilities and limitations of the vehicle and undergo a background check as described in Section 6.2 - Criminal Activity. Manufacturers are in the best position to determine what is appropriate training. As



further guidance on this question, MOE's may wish to consider the information on "driver training" provided in SAE standard J3018. Training provided should be documented and submitted to the jurisdiction's ADS lead agency along with other required information. Jurisdictions may need to develop or review and adapt their existing rules for submission of such information and background checks.

Since the design of some Level 4 and 5 vehicles may not include a driver's seat or equipment that enables in-vehicle physical control of the vehicle's operations, jurisdictions will need to ensure their testing program supports the safe testing with a remote driver. In this case, the jurisdiction should require that the manufacturer of the ADS technology, or any such entity involved in the driverless testing of the ADS vehicle, ensure that ADS is capable of performing the DDT fallback and where necessary, achieve a minimal risk condition or that there is a remote driver capable of assuming control of the vehicle's operations and performing these tasks.

Mandating in-vehicle control features (e.g., driver's seat or equipment) may entail changes to the design of those vehicles that simply are not possible; even if possible, equipping these vehicles with the additional features will result in test vehicles being configured differently than those ultimately sold to or used by consumers. The safe testing of ADS vehicles without a driver's seat or other equipment is essential to the continued research and design leading to the eventual deployment of ADS Level 4 and 5 vehicles.

Jurisdictions will need to take the appropriate steps to ensure that their motor vehicle laws/regulations allow for the testing of ADS Levels 4 and 5 vehicles by someone who is not a driver and who is not licenced as a driver. This may require amending statutory and regulatory definitions of "driver" and other related terms.

Jurisdictions will also need to review and adapt their existing rules regarding vehicle operation to ensure ADS testing is permitted.

RECOMMENDATIONS FOR JURISDICTIONS

For ADS vehicles, the following guidelines are provided:

- 4.7.1** Require test ADS vehicles be operated solely by employees, contractors, or other persons designated by the manufacturer of the ADS vehicle or any such entity involved in the testing of the ADS vehicle.
- 4.7.2** Require the test driver to have the appropriate and valid class of licence associated with the particular vehicle being tested (e.g., Class 5 licence to test a passenger vehicle).
- 4.7.3** Require test drivers to receive training and instruction regarding, but not limited to, the capabilities and limitations of the vehicle and be subject to a background check as described in Section 6.2 - Criminal Activity.
- 4.7.4** Require training provided to the employees, contractors, or other persons designated by the manufacturer or entity be documented and submitted to the jurisdiction’s lead agency along with other required information.
- 4.7.5** Support the safe testing without a human driver inside of the vehicle, by requiring a remote driver designated by the manufacturer of the ADS technology or any such entity involved in the driverless testing of the ADS Level 4 or 5 vehicle, to be capable of assuming control of the vehicle’s operations or have the ability to achieve a minimal risk condition where the ADS is not capable of so doing.
- 4.7.6** Take steps to ensure their motor vehicle laws allow for the manufacturer testing of ADS Levels 4 and 5 vehicles without a licenced driver.

RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 4.** Manufacturers and other entities should complete a background check and provide/ensure appropriate training for ADS test drivers. See Section 6.2 - Criminal Activity in the Law Enforcement Considerations section on background checks. Manufacturers are in the best position to determine what is “appropriate” training. As further guidance on this question, MOE’s may wish to consider the information on “driver training” provided in SAE J3018 standard.

**Benefits of Implementation**

The review of jurisdictional laws and rules regarding vehicle operation to ensure ADS testing is permitted will benefit the safe testing and deployment of ADS Levels 3, 4 and 5. Test driver training is a key element for the safe testing of ADS. Thorough testing of ADS by manufacturers and other entities in as many situations as possible will support the safe deployment of ADS to consumers.

**Challenges to Implementation**

Challenges to implementation include the review of jurisdictional laws and rules regarding vehicle operation for the testing of ADS and educating manufacturers on the process for submitting required documentation.



CHAPTER 5

# **GUIDELINES FOR THE DEPLOYMENT OF ADS VEHICLES**

# VEHICLE CREDENTIALING CONSIDERATIONS

## 5.1 VEHICLE PERMITS FOR DEPLOYED ADS VEHICLES

### Guidelines for Deployed Vehicles

Deployed vehicles are not subject to permit issuance.

## 5.2 VEHICLE REGISTRATION

### Background

Vehicle registration and supporting records enable identification of a vehicle and its owner. With deployment of ADS vehicles, the need for accurate owner and vehicle information becomes more necessary.

### Guidelines for Deployed Vehicles

Jurisdictions should record and maintain the vehicle information in its vehicle record database through the normal process of registration the fact that a vehicle has ADS functionality.

Storing information, such as the VIN and the ADS level:

- provides pertinent information to stakeholders in case of a crash;
- provides information to the Interprovincial Records Exchange (IRE) so the status of the vehicle is readily available to other jurisdictions; and
- provides pertinent information to law enforcement.

Uniform language should be established which will benefit law enforcement, the MTA and other stakeholders. This uniform language includes the use of the acronyms and terms such as “ADS” and “ADS vehicle”.

For the benefit of law enforcement, the MTA and other stakeholder’s, the uniform notation “ADS Level” for “Automated Driving System Level” should be displayed on registration and reflected on the jurisdiction’s electronic record (i.e. vehicle database). It is recommended that jurisdictions introduce an ADS “flag” on their registration database and have a supplemental corresponding data field indicating the ADS level (either 3, 4 or 5).

For vehicles not equipped with automated technologies by the original equipment manufacturer (OEM), placing and identifying status on vehicles with aftermarket-altered automated technologies is recommended. In some jurisdictions, when a vehicle is significantly altered with aftermarket components or the vehicle no longer physically represents the manufacturer’s vehicle, a vehicle record may be given an “Altered” status. Vehicles which have had a Tier 1 supplier, or an aftermarket company significantly alter the vehicle with automated technologies enabling ADS functionalities, should be identified for law enforcement and MTAs. This may be accomplished by placing an “A” in the vehicle’s status field.

Additionally, it has been suggested vehicles with lower AV functionality (Levels 2 or 3) may have the ability to have their ADS upgraded to higher levels of functionality (move to Levels 3, 4 or 5). In these scenarios, capturing this increased functionality will be necessary.

RECOMMENDATIONS FOR JURISDICTIONS

- 5.2.1** Establish uniform language which will benefit law enforcement, the MTA and other stakeholders for testing ADS vehicles. This uniform language should include the use of the acronyms and terms such as “ADS” for “Automated Driving System”, and “ADS vehicle”.
- 5.2.2** Place a notation on the registration and electronic record by means of an ADS flag and an additional corresponding ADS level field for vehicles that have the capability to operate at Levels 3, 4 or 5.
- 5.2.3** Place an “Altered” or “A” status on vehicles not equipped with automated technologies by the OEM but have aftermarket automated components.
- 5.2.4** If a jurisdiction receives a notification from a manufacturer or other entity (as in MOE 5), it should update its records, accordingly, and issue a new registration for the vehicle reflecting the change in ADS level.

RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 5.** Manufacturers and other entities should notify the jurisdiction of any change in the ADS level of the vehicles.

**Benefits of Implementation**

Disclosure of a vehicle as an ADS vehicle on the registration credential allows law enforcement and MTA personnel the ability to better identify vehicles with automated functionality. As the technology becomes more prominent, law enforcement will need to approach situations including traffic stops or vehicle crash scenes differently; readily available vehicle record information will benefit law enforcement. Additionally, this information will ensure the ADS Level 3, 4 or 5 notation is maintained until a national solution, such as, a VIN check digit or indicator is common in the industry (see Section 5.4 -ADS Information on the New Vehicle Information Statement).

**Challenges to Implementation**

When jurisdictions are considering how to manage registrations, they should also review their registration/vehicle status changes process, as these recommendations will add complexity. Additionally, there may be inaccuracies in the recording of this data due to the reliability of human entry and the potential for error.

## 5.3 LICENCE PLATES

### Background

Licence plates serve a common purpose, to identify motor vehicles. Any jurisdiction that adopts a licence plate design specifically for ADS vehicles, should design those plates for automated licence plate readers (ALPR) and optimal legibility to the human eye. The ability for motor vehicle agency employees, police officers, tolling authorities and citizens to quickly and easily identify licence plate numbers is fundamental to accurate vehicle registration data creation, maintenance and retrieval.

It should be noted, however, that identification of the ADS vehicle in a specific or recognizable manner, through special licence plates or other markings, may have certain challenges: increased costs of new plate design; complications related to the identification of the jurisdiction of issuance of the plate; and discernibility of the plate design from the other plates issued by the jurisdiction.

In spite of these challenges, a jurisdiction may still opt for special plates. It may be their view that the ability for motor vehicle agency employees, police officers, tolling authorities and citizens to quickly and easily identify licence plate numbers is fundamental to the safe operation of road networks, as well as being able to respond quickly and effectively in emergency situations.

### Guidelines for Deployed Vehicles

Special licence plates for ADS vehicles are not necessary. However, if a jurisdiction opts to issue special plates, consideration could be given to adopting the administrative, design and manufacturing specifications contained in the *AAMVA License Plate Standard*, if applicable.

While it is not recommended to require special plates for ADS vehicles, other means of identification are suggested in Chapter 6 Law Enforcement and Transportation Safety Considerations, to support law enforcement's efforts to identify vehicles involved in crashes.

#### RECOMMENDATIONS FOR JURISDICTIONS

- 5.3.1** Jurisdictions should not require a special licence plate for ADS vehicles. However, if a jurisdiction chooses to require a special licence plate for ADS vehicle, the jurisdiction may choose to adopt the administrative, design and manufacturing specifications contained in the *AAMVA License Plate Standard*.

### Benefits of Implementation

There is limited benefit for implementing a special licence plate for ADS vehicles, as long as the jurisdiction follows the recommendation on registration documents from Section 5.2 -Vehicle Registration.

### Challenges to Implementation

Challenges in implementing a new licence plate design include: the identification of the jurisdiction of issuance; discernibility of the plate design from others it issues; and cost if there is special significance to the licence plate design - as in the design for an ADS vehicle licence plate. Law enforcement may prefer to have special plates for ADS vehicles to assist them in the case of a vehicle crash.

## 5.4 ADS INFORMATION ON THE NEW VEHICLE INFORMATION STATEMENT (NVIS)

### Background

The New Vehicle Information Statement (NVIS) is a manufacturer-produced document that is used by Canadian jurisdictions for the registration process of a new motor vehicle. The NVIS format is not governed by federal statute or rule; however, most jurisdictions have statutes or rules governing their appearance, content and acceptance. CCMTA provides jurisdictions and manufacturers with general guidance through CCMTA's *New Vehicle Information Statement and Partial Electronic New Vehicle Information Statement (eNVIS) Policy Manual* to promote uniformity between jurisdictions.

Typically, the NVIS contains, at a minimum, issue date of certificate, control/certificate number, VIN, model, make, series/model and body style. Furthermore, the NVIS lists engine horse power, engine displacement and/or number of cylinders, gross vehicle weight rating (GVWR) and shipping weight, as well as the manufacturer's

name, address and the dealership name and address where the vehicle was initially delivered. The back of the document contains sales reassignment areas for the purchaser (whether a retail customer or a subsequent dealer). The NVIS is generated on security paper similar to jurisdictional registration stock.

### Guidelines for Deployed Vehicles

It is recommended that various levels of government and private industry continue to collaborate and cooperate in meeting identification goals for ADS vehicles entering the marketplace. It is also recommended that vehicle manufacturers list automated capabilities on the NVIS. This information should be listed in a new field on the NVIS to avoid confusion with existing content.

Developing a process for potentially identifying ADS Level 3, 4 or 5 functionality through the VIN should also be examined in conjunction with U.S. counterparts.

#### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 6.** Vehicle manufacturers should reference the SAE Level 3, 4, or 5 in a new field on the NVIS to avoid confusion with existing information.

### Benefits of Implementation

Utilizing information from a NVIS provides each MTA with certainty that the manufacturer has certified the vehicle's ADS Level 3, 4 or 5 functionality level. Additionally, this information would be available to every jurisdiction in the same format.

### Challenges to Implementation

Increasing the number of VIN digits would involve regulatory changes that would need to be conducted in conjunction with the United States. Some jurisdictions will require software changes to accommodate the added digits.

## 5.5 FINANCIAL RESPONSIBILITY

### Background

An important element of the administration and regulation of ADS vehicle is ensuring adequate insurance is in place to protect not only the occupants of an ADS vehicle but also other road users. For example, all jurisdictions require a minimum financial responsibility requirement for each vehicle operating on public roads.

Vehicle insurance regulators should monitor the legal trends ensuring limits stay relevant and appropriate. It would also be advisable that there is sufficient coverage available for third party liability, in jurisdictional scenarios where there is no explicit distinction in property damage versus personal injury.

The AVWG recognizes this is a complex and emerging issue and CCMTA will be consulting with the insurance industry to ensure appropriate guidance is provided to jurisdictions in the future.

### Guidelines for Deployed Vehicles

Minimum liability insurance should follow current jurisdictional requirements.

#### RECOMMENDATIONS FOR JURISDICTIONS

- 5.5.1 Follow current requirements for minimum liability insurance for deployed vehicles.



## 5.6 COMPLIANCE OF DEPLOYED ADS VEHICLES WITH THE MOTOR VEHICLE SAFETY ACT (MVSA)

### Background

Transport Canada, under the *Motor Vehicle Safety Act* (MVSA), establishes regulations for the manufacture and importation of motor vehicles as well as prescribed motor vehicle equipment (e.g. tires and child car seats). The objective of these regulations is to reduce the risk of death, injury, and damage to property and the environment.

A company, as defined in the MVSA, may seek an exemption from a standard under section 9 of the MVSA. Such an exemption could be used for example, when an incompatibility exists between existing standards and a newly manufactured or imported ADS-equipped vehicle that is planned for deployment. As part of this process, an exemption must only be granted for a model if the exemption would not substantially diminish the overall safety performance of the model. The exemption could

be used to manufacture or import vehicles only for the period specified by the Minister of Transport. Vehicles which are subject to the exemption order under Section 9 of the MVSA could remain in Canada indefinitely. However, a Transport Canada assessment and approval of the exemption request would be necessary.

### Guidelines for Deployed Vehicles

Companies, as defined in the MVSA, that seek to apply the national safety mark to an ADS vehicle must conform to all relevant MVSA requirements unless specifically exempted by Transport Canada, as established under section 9. An exemption will only be granted for a model if the exemption does not substantially diminish the overall safety performance of the model.

### RECOMMENDATIONS FOR JURISDICTIONS

- 5.6.1** Require all ADS vehicles, available to the public, to conform to all applicable Canada Motor Vehicle Safety Standards, unless specifically exempted by Transport Canada.

### Benefits of Implementation

Jurisdictions will have confirmation that ADS vehicles deployed on public roadways comply with applicable federal laws and regulations.

# DRIVER LICENCING CONSIDERATIONS

## 5.7 DRIVER AND PASSENGER ROLES DEFINED

### Background

It is imperative that all stakeholders utilize universal terminology and definitions for ADS Levels 3, 4 and 5 to better facilitate discussions. As described in the Preface, this report utilizes the SAE International's definitions. Universal terms and definitions are critical for jurisdictions, manufacturers and other entities when discussing

automated vehicle technologies and ADS Levels 3, 4 and 5. It should be noted this report utilizes the terms “driver” or “user”. Although use of the term operate/operating implies the existence of an “operator,” this term is not defined or used in this document, consistent with SAE International definitions and use of terms.

### RECOMMENDATIONS FOR JURISDICTIONS

**5.7.1** Utilize the SAE International definitions provided in the Preface.

### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

**MOE 7.** Manufacturers and other entities should utilize the SAE International definitions provided in the Preface.

### Benefits of Implementation

Universal definitions of these terms will facilitate communication, understanding and standardization of roles and responsibilities for vehicles.

### Challenges to Implementation

Educating all entities on the need for acceptance and implementation of these universal terms and definitions will be an implementation challenge.

Jurisdictions will need to review jurisdiction laws and regulations ensuring motor vehicle laws permit the operation of Level 4 and vehicles without a driver. Legislative action amending statutory and regulatory definitions of “driver” and related terms and reviewing and adapting existing rules regarding vehicle operation may pose challenges until more policy makers are versed in the subject matter.

## 5.8 DRIVER TRAINING FOR CONSUMERS FOR DEPLOYED VEHICLES

### Background

The operation of ADS Level 3 and 4 vehicles by consumers will have significant implications for driver training. As ADS 3 and 4 vehicles are deployed and become available to the public, drivers will need to receive proper training on the operation and limitations of their ADS vehicle.

It needs to be determined who has the responsibility for training the consumer. Consumer training may be achieved by one or more of the following:

- Consumer to seek the appropriate ADS driver training from a recognized professional;
- Manufacturers, dealers, rental agencies and other appropriate entities to provide adequate ADS driver training and education/information to the consumer; and
- Jurisdictions to regulate ADS driver training for consumers. Some options that can be considered are:
  - Potential for mandatory training for beginner drivers
  - Motor vehicle dealers act (MVDA) – mandate dealers to provide information or training to buyers.

In the case of a private vehicle sale, it is the responsibility of the purchaser to ensure they are familiar with the technology with which the vehicle is equipped and be able to operate the vehicle safely. Privately offered training would be an option for increased proficiency with the technology.

The appropriate entities need to develop quality ADS driver training programs that will effectively train consumers to operate ADS 3 and 4 vehicles safely and reasonably. The training should educate consumers on the limitations and capabilities of ADS 3 and 4 vehicles, how to engage and disengage the system functions,

risks of misuse and how to deal with emergency situations related to the ADS vehicle. The training should encompass all other safety features to ensure consumers will use the products within the established parameters.

### Guidelines for Deployed Vehicles

Communication and education between new, used and aftermarket dealers, manufacturers, and consumers on ADS functions is a critical element for the safe operation of the vehicle. Manufacturers and other entities should ensure that an “owner’s manual” is fully available and reviewed with consumers. However, familiarity of the information and content is not sufficient and should not replace applicable driver training on ADS functions.

Jurisdictions will need to encourage the provision of proper training to the fullest extent for consumers. The training should be provided by all sellers of ADS vehicles (including manufacturers, dealers, and used vehicle resellers), as well as transportation service providers that use ADS vehicles (including rental car agencies, and car-sharing).

Jurisdictions may also need to encourage manufacturers and dealers to offer incentives to consumers to seek training from a fully qualified driving instructor. Insurance companies may also provide discount incentives.

Agreement upon a minimum set of training requirements, outside of the normal owner’s manual, will have a direct impact on the success of ADS technology. Many dealerships already provide personal training classes on features of the vehicle for their customers. Standardized training should be available to everyone who purchases or has the technology installed on their vehicle. In addition to these jurisdictional guidelines, stakeholder consultation is highly recommended.

RECOMMENDATIONS FOR JURISDICTIONS

- 5.8.1** Promote consumer training on the use of ADS functions.
- 5.8.2** Encourage communication between dealers and consumers including, but not limited to, acknowledgement of the sections in the vehicle “owner’s manual” that relate to ADS functions. The owner’s manual and/or other consumer education resources should contain easy to understand information for the consumer.
- 5.8.3** Encourage manufacturers, dealers and insurance companies to provide incentives for consumers to receive proper training on the use of ADS functions.

RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 8.** Manufacturers and other entities should notify the jurisdiction of any change in the ADS level of the vehicles.

### Benefits of Implementation

Consumers who are properly educated on ADS functions, limitations and capabilities of their vehicle, including how to engage and disengage the system functions, risks of misuse and how to deal with emergency situations related to an ADS vehicle will support the safe deployment of ADS vehicles.

### Challenges to Implementation

Challenges to implementation include educating consumers on the importance of obtaining training on their ADS functions and buy-in from manufacturers, dealers and insurance companies to provide training or to offer incentives to consumers to seek training.

Educating the public on the safety and services that ADS technology provides will be critical to public acceptance of ADS Level 4 and 5 vehicles and the idea that a vehicle user need not be a driver.

## 5.9 ADS DRIVER TRAINING FOR MOTOR VEHICLE AGENCY EXAMINERS, DRIVER EDUCATION PROGRAMS AND PRIVATE INSTRUCTORS

### Background

ADS technologies have developed at a rapid pace. The training of driver licence examiners on these technologies should keep pace with this evolution. ADS technologies have many implications for the driver licence testing process.

Additionally, the training of driver education teachers and instructors, as well as driver education curricula, should evolve with ADS technologies. Most driver training in Canada is provided by private driver training schools and community colleges.

CCMTA and AAMVA play a key role in the development of driver training curricula and driver instructor training standards in Canada:

- CCMTA's *National Safety Code Standard 2 Knowledge and Performance Tests (Drivers)* sets out the process for standardized testing of all drivers, including commercial drivers in Canada. It is recommended that CCMTA work in collaboration with the AAMVA Test Maintenance Subcommittee of the AAMVA Driver Standing Committee, responsible for the development and maintenance of all AAMVA model licensing test systems including model driver manuals, knowledge and skill tests to address the use of vehicle technology during driver testing. Changes to the driver licence examiner training requirements would need to be considered by CCMTA for possible inclusion in NSC 2.
- CCMTA's *National Safety Code Standard 3 Driver Examiner Training Program* is designed to upgrade the skills and knowledge of driver examiners and ensure they are consistent across Canada. AAMVA's International Driver Examiner Certification Program establishes standards for driver examiner training and helps to ensure that examiners have met the minimum knowledge and skills training requirements

for conducting licensing tests. It is recommended that CCMTA will work in collaboration with the AAMVA International Driver Examiner Certification (IDEC) Board with updating the driver licence examiner training materials to address vehicle technology as it emerges. Changes to the driver licence examiner training requirements would need to be considered by CCMTA for possible inclusion in NSC 3.

The Canada Safety Council publishes and disseminates educational programs and information relating to driver safety. The Canadian Automobile Association promotes driver education programs.

American organizations that play a role in the development and dissemination of driver training curricula include the:

- American Automobile Association (AAA),
- American Driver and Traffic Safety Association (ADTSEA), and
- Driving School Association of the Americas (DSAA).



## Guidelines for Deployed Vehicles

### Jurisdictional Examiners

It is important that jurisdictions ensure driver licence examiners are familiar with vehicle technologies. As automated vehicle technologies continue to advance, the training of driver licence examiners will need to keep pace with these advancements. This training will need to be updated on a regular basis as the technologies

continue to evolve. Refer to AAMVA's International Driver Examiner Certification (IDEC) model training materials which will be updated in the future to include ADS technologies. Changes to the driver licence examiner training requirements would need to be considered by CCMTA for possible inclusion in NSC 2 and 3.

### RECOMMENDATIONS FOR JURISDICTIONS

- 5.9.1** Provide training to driver licence examiners on vehicle technologies including the operation of ADS vehicles.
- 5.9.2** Align with future iterations of AAMVA's International Driver Examiner Certification model training materials that include ADS vehicles. Changes to the driver licence examiner training requirements would need to be considered by CCMTA for possible inclusion in NSC 2 and 3, to continue alignment with AAMVA.

### Driver Education and Private Instructors

Driver education instructors should play a key role in educating students/consumers on the functions of all ADS Levels. Additionally, driver education materials will need to be updated to include information on the use of and interaction with ADS vehicles; and for programs to provide hands on training in the use of ADS vehicle.

Standards for curricula and instructor training will need to be developed and updated on a regular basis as ADS technologies continue to evolve.

### RECOMMENDATIONS FOR JURISDICTIONS

- 5.9.3** Require driver education curricula to contain information on ADS and to provide hands-on training in the utilization of ADS technologies.
- 5.9.4** Establish standards for the conduct and training of driver educators and private instructors for the training of drivers on the use of ADS vehicles.



### Benefits of Implementation

Training for driver licence examiners will ensure they are familiar with ADS technologies. Standardization of content in driver education curricula and training for driver education instructors will ensure consistent information on automated vehicle technologies is delivered to new and experienced drivers.

### Challenges to Implementation

There are inconsistencies between jurisdictions on standardized curricula content and instructor training standards. Some MTA staff and some driver licence examiners have not received sufficient training on new vehicle technologies and the impacts it has on driver education and testing.

Another challenge facing driver training and driver training instructor providers is the cost of adding an ADS vehicle to the fleet, and the differences or lack of consistency in the user interfaces with the technology.

## 5.10 DRIVER LICENCE SKILLS TESTING WITH ADS

### Background

While most of this report addresses ADS vehicles, technology in SAE Level 2 vehicles also has implications for the driver licence testing process. This includes a determination of what technologies are permitted during the driver testing procedures. These technologies can be grouped into the following categories:

- **Convenience Technologies** – for purposes of this Guidelines Document are technologies that provide conveniences for the driver (e.g., parking assist feature or adaptive cruise control, lane keeping assistance) and do not require the applicant to demonstrate a required skill set.
- **Safety Critical Technologies** – for purposes of this Guidelines Document are technologies that may prevent or reduce the severity of a crash. These technologies (e.g., backup or other cameras, alerts, lane departure warning, automatic emergency braking) should be permissible and not be disengaged for testing.

### Guidelines for Driver Testing Using Deployed Vehicles

The purpose of the driver licence skills test is to determine an applicant's proficiency in operating a motor vehicle in most road situations. The applicant should not be assisted by vehicle convenience technologies. Skills testing evaluates the applicant's abilities; not the vehicle's technology.

Applicants should only use a vehicle that requires them to exhibit proper driving behaviours (driven in manual mode) and proficiency in operating a motor vehicle. Even though a vehicle has technology features, the applicant must demonstrate the ability to operate the vehicle should the technologies require the driver to engage them manually or they become inoperable.

As technologies evolve, there may be a need to test drivers on their ability to operate specific vehicle technologies. Guidance in this area will be considered in future iterations of this report.

Some technologies cannot be disengaged and should be permissible during the testing process (e.g., lane departure warnings). The applicant should demonstrate proper responses to the technologies, while ensuring all required skills for a test component/maneuver are demonstrated.

The use of safety critical technologies for off-road skills tests or parking maneuvers during the road test should be permitted. These technologies, such as backup or other cameras should not be disengaged for off-road testing. Transport Canada will require all new vehicles produced after May 2018 to have rear view video systems (RVS) also known as backup cameras.

The off-road skills test or parking during the road test should be reviewed to evaluate the incorporation of these technologies. In the case of backup cameras or other cameras, the criteria for checking mirrors and blind spots should be reviewed to evaluate the applicant's behavior to utilize cameras in conjunction with mirrors and head-checks, as an example.

The use of safety critical technologies should be permitted during the road skills test. In some cases, safety critical technologies cannot be deactivated. Safety critical technologies include, but are not limited to:

- Cameras
- Blind spot warnings
- Lane departure warnings
- Automatic Emergency braking

The road test scoring standards should be updated to reflect the proper procedures for examiners to follow when a safety critical function activates during the testing process.

A licenced driver is required for ADS Level 3 vehicles since the technology has the ability to switch between an automated mode to a non-automated mode allowing the driver to operate the vehicle. A licenced driver is also required in a Level 4 vehicle with driver controls that allow a person to assume control of the vehicle. In these situations, the driver would be required to perform the examination in non-automated mode to ensure they can safely operate the vehicle.

A driver's licence, and thus driver testing, should be required for any person to drive or operate an ADS vehicle with driver controls, as a driver may be required to take control or be allowed to take control of the vehicle.

A person should not be required to have a driver's licence to be an occupant in an ADS Level 4 or 5 vehicles with no driver controls.

MTA driver manuals do not currently contain information on ADS technologies. These manuals will need to be updated to include pertinent information on ADS Levels 3, 4 and 5.

CCMTA in collaboration with AAMVA will need to continue to play a role in assisting jurisdictions with driver testing practices and driver licence examiner training. The AAMVA Test Maintenance Subcommittee (TMS) is responsible for maintaining and updating AAMVA's model driver testing systems including the AAMVA Non-commercial Model Driver Testing System (NMDTS).

### RECOMMENDATIONS FOR JURISDICTIONS

- 5.10.1** Include information on vehicle technologies and ADS in the jurisdiction's driver's manual, when provided by the AAMVA TMS.
- 5.10.2** Include questions addressing ADS in the jurisdictional knowledge test, when provided by the AAMVA TMS.
- 5.10.3** Jurisdictions should not allow the applicant to utilize convenience technologies, such as the parking assist feature, for off-road skills tests or parking maneuvers during the road test. For example, the applicant should be required to demonstrate the ability to park the vehicle.
- 5.10.4** Allow the applicant to utilize safety critical technologies for skills tests or parking maneuvers during the road test. These technologies, such as backup or other cameras should not be disengaged for off-road testing.
- 5.10.5** Jurisdictions should not require applicants to deactivate safety critical technologies during the testing process.

### Benefits of Implementation

Standardized testing procedures and driver's manual language will ensure consistent driver testing practices for ADS technologies, where applicable. AAMVA's NMDTS and the AAMVA TMS may facilitate this standardization.

### Challenges to Implementation

Agreement between jurisdictions on standardized procedures for testing drivers in vehicles with technologies will be essential to achieve consistency across Canada and internationally. Additionally,

agreement on standardized information to be included in jurisdictional driver manuals on the operation of vehicle technologies will be a challenge.

With the technology benefits of ADS vehicles, many in our communities who cannot obtain a licence to drive will have the ability to be transported by an ADS Level 4 and 5 vehicles. However, if the manufacturer provides the user the technical ability to switch to a non-automated operation mode, then our citizens will be placed in an unsafe situation if the user of the vehicle could not legally obtain a driving privilege under normal circumstances.

## 5.11 ENDORSEMENTS AND RESTRICTIONS FOR DEPLOYED VEHICLES

### Background

Since vehicles with SAE Level 0 - 3 technology are expected to remain in the care and control of the driver, most current driver licence qualifications will apply to their operation. Therefore, existing driver licence qualifications will remain applicable.

Vehicles with Level 4 functionality that may be operated in non-automated mode will continue to require a qualified, licenced driver.

It is expected that vehicles with ADS Level 5 functionality will have the ability to enhance the mobility of those unable to drive or to be licenced due to physical disability, age or some other condition. Permitting passengers without a licenced driver in these vehicles, while the ADS is performing the DDT within its ODD, would allow these populations to reap the benefits of the technology. It is also expected that ADS Level 5 vehicles may operate without a driver or passengers (e.g., empty vehicle or cargo).

### Guidelines for Endorsements/Restrictions

The full implication of endorsements or restrictions for ADS vehicles is not yet fully understood, particularly for ADS Level 4 and 5 vehicles. Until these technologies have completely developed, driver licence endorsements and restrictions are not recommended.

Additionally, there is a risk of creating conflicting jurisdictional endorsements and restrictions should jurisdictions consider this licensure regime. This will complicate the exchange of driver's licences from jurisdiction to jurisdiction in translating the driver licensing codes. CCMTA and the jurisdictions will need to examine the development of standardized codes for endorsements and restrictions should they be warranted.

Jurisdictions should not impose any other requirements such as licencing and clean driving history, etc., for non-drivers to be passengers in a level 4 or 5 ADS dedicated vehicle. Assuming ADS Level 4 or 5 dedicated vehicles may require the passenger only to provide destination or navigation input, no special training or qualification should be required. The operation of an ADS dedicated Level 4 or 5 vehicle is comparable to taking a taxi, riding a bus or riding the subway, none of which requires special training or licensure.

Jurisdictions will need to review their laws and regulations related to persons with physical or mental disabilities and unsupervised children in motor vehicles and adopt appropriate laws and regulations to ensure safety for this population at each level of automation.



RECOMMENDATIONS FOR JURISDICTIONS

- 5.11.1** Jurisdictions should not establish endorsements and/or restrictions on the driver licence at this time.
- 5.11.2** Take steps to ensure their motor vehicle laws allow for the operation of ADS Level 5 vehicles without a human driver, as the vehicle cannot be operated in non-automated mode.
- 5.11.3** Take steps to ensure a licenced human driver is prepared and capable of taking control of an ADS Level 3 or 4 vehicle if the vehicle requires a human driver to perform the DDT fallback.
- 5.11.4** Review laws and regulations related to occupants of a motor vehicle, such as unsupervised children, or persons with physical or mental disabilities and adopt appropriate laws and regulations to ensure safety at each level of automation.

### Benefits of Implementation

By not creating endorsements and restrictions, conflicting jurisdictional driver licensing codes and the complications in translating codes when exchanging driver's licences from jurisdiction to jurisdiction is eliminated.

### Challenges to Implementation

If a jurisdiction implements ADS endorsements and restrictions, it will create challenges for other jurisdictions for the exchange of driving privileges and enforcement.



CHAPTER 6

**LAW ENFORCEMENT  
AND TRANSPORTATION  
SAFETY CONSIDERATIONS**

## 6.1 CRASH/INCIDENT REPORTING

### Background

For the purposes of this guidance document, crash reporting should occur when there are crashes or incidents between ADS vehicles and other vehicles, persons, animals or objects whether or not the ADS vehicle is responsible.

Safety and crash avoidance are priorities of all vehicle manufacturers. But regardless of the level of safety engineering, crashes are inevitable during testing and deployment on public roads. Crash and incident reporting are important for purposes of establishing liability and identifying and documenting safety concerns. Crash report information is not only of importance to manufacturers, emergency management personnel, insurers and the engineering community but to a variety of public constituencies, including regulators and legislators. Full disclosure of information concerning how a crash occurred and why, will be essential to future development, regulation, subrogation of damages and public acceptance of ADS vehicles.

### Guidelines for Testing Vehicles

ADS vehicle manufacturers or other entities should submit to the jurisdiction incident and crash related information to expand ADS data and research upon request by the jurisdiction. The information should include instances of a crash/incident when ADS vehicles are operating in automated mode or disengaged (by the user or by the system). The information should also include incidents in which the users of ADS vehicles are unexpectedly prompted to transition into non-automated mode, due to a failure of the automated system or the ADS vehicle contravenes a law that poses significant risk to safety. Examples of these types of situations could include excessive speeding or a red-light violation. The information should also include details of the circumstances or testing conditions of the disengagement, including the location, time of day, as

well as the weather, traffic, and road surface conditions. Manufacturers and other entities should be required to submit a summary analysis of the incident. There is also value in collecting data that captures events in which the automated function correctly detected and identified an unsafe maneuver by another road user and executed an appropriate response that successfully avoided a crash.

Requiring manufacturers or other entities to report unexpected incident failures and crashes to the jurisdiction provides transparency between agencies and manufacturers or other entities throughout the testing phase. Sharing this data and their analysis of the incident would be beneficial to jurisdictional policy makers.

When an ADS vehicle is involved in a collision, the information obtained from the ADS recorded data could prove important to determine whether or not an ADS malfunction caused the collision, or if the collision could otherwise have been avoided. Additionally, the data collected from the vehicle(s) involved could potentially provide insight into how ADS vehicles react to given scenarios. The data recorded should include, but not



be limited to, the mode of operation (automated vs. non-automated control), speed, throttle, brake, steering input and camera images of the vehicle surroundings if so designed/equipped. The recorded data should also include information on ADS sensors and any degraded behavior and/or malfunctions of these sensors. Law enforcement and regulating entities should be provided with access to this information as well as a minimum of 30-seconds of pre-crash/incident and post-crash/incident data in order to complete a proper investigation.

Consistent with the directions found in the national trial guidelines document “*Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*”,

testing entities should submit a preliminary report to the provincial/territorial road transport agency that provided the permit within 24 hours of the collision (or as otherwise required under provincial law or regulations) and immediately postpone trial activities involving any of the persons or vehicles involved until further direction is provided from the road transport agency.

Jurisdictions are encouraged to share collision/incident reports with Transport Canada. Transport Canada, as the federal regulator, will act as a central repository for the ADS disengagement and/or incident reports. Transport Canada will work with jurisdictions to develop best practices for crash/incident reporting involving ADS.

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.1.1** Jurisdictions should require ADS vehicle manufacturers or other entities to:
- a)** provide to jurisdictions, within 24 hours of the collision, a preliminary report on the on the incident and any relevant information that the manufacturer may be able to share at the time, regarding potential causes of the collision; and
  - b)** postpone immediately any testing activities involving any of the persons or vehicles involved until further direction is provided from the MTA or relevant agency.

## Guidelines for Deployed Vehicles

Large amounts of data are captured by the vehicle Event Data Recorder (EDR). In certain instances, the EDR information would aid a crash investigation by revealing pre-and post-crash causative factors and actions. This information may include both the driver and automated system actions when the users of automated vehicles are prompted to transition into non-automated mode due to a failure or dysfunction of the automated system.

The U.S. Department of Transportation (USDOT) Model Minimum Uniform Crash Criteria (MMUCC), 5<sup>th</sup> Edition (August 2017) includes guidance on the capturing of automated vehicle data on crash reports to assist in crash causation determination and support further automated

vehicle development and safety. Transport Canada will explore options to update the National Collision Database Dictionary (Version 2), or its successor, to support similar data collection practices in Canada.

Manufacturers should ensure ADS record vehicle behavior sensor data and the driver/vehicle interface and should also include time stamping and Global Positioning System (GPS) location in the EDR data. In addition, to ensure effective crash investigation and safety analysis, manufacturers should make EDR information retrievable in a standard, non-proprietary format for ready access by those duly authorized in accordance with laws protecting data privacy.

## RECOMMENDATIONS FOR JURISDICTIONS

- 6.1.2** Transport Canada should explore options to update the National Collision Database Dictionary (NCDB2) to support the identification and collection of ADS Level vehicle information in Canada. Canadian jurisdictions should adopt the NCDB2 or its successor, as soon as practical.
- 6.1.3** Jurisdictions should develop and standardize the reporting process to document ADS crashes/incidents beyond the Provincial Highway Traffic Act and Motor Vehicle Collision Report. The ADS crash/incident report should identify if the ADS vehicle is being operated in autonomous mode or non-autonomous mode.
- 6.1.4** Transport Canada and jurisdictions should explore additional options to collect and/or link the NCDB collision data with other data sources that may contain the ADS level vehicle information, including working together to build such data sources where they do not already exist.

## RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 9.** Manufacturers should design ADS to record vehicle behaviour sensor data and the driver/vehicle interface, keep a documented process for the collection of ADS crash/incident data elements, and have the technical capability to retrieve and share the relevant recorded information.
- MOE 10.** Manufacturers should provide law enforcement and regulating entities with access to pre-crash/incident and post-crash/incident data for their completion of a proper investigation.
- MOE 11.** Manufacturers should include time stamping and GPS location in EDR data.

## Benefits of Implementation

Collection of crash and incident data would be beneficial to manufacturers and developers during the developmental process. Once deployed, in addition to manufacturers and developers, law enforcement and other applicable agencies would also benefit from data samples provided in the event of a crash to aid in determining fault and vital pre-crash data.

## Challenges to Implementation

Since much of the ADS industry is proprietary, manufacturers may object to part or all of this recommended guideline.

## 6.2 CRIMINAL ACTIVITY

### Background

There are both substantial opportunities and risks presented by automated driving. Turning over certain physical tasks of driving to the ADS will improve driving safety and make mobility more efficient.

New technologies that will be available in ADS vehicles present opportunities to prevent certain vehicle related crimes from being committed, and/or assisting law enforcement in interdicting crimes. They also present an opportunity to aid in the investigation of crimes that have been committed. For example, the data stored in the vehicle data event recorder on GPS location will provide routing and other information.

Although ADS Level 5 vehicles will substantially reduce the risk of in-vehicle distractions leading to crashes, there are possible down-sides. There is a risk that the ADS could be used to further criminal enterprises, or worse, be used as a tool for terrorist activities. These can include criminals being able to conduct tasks that require use of both hands or to take one's eyes off the road. Aiming and firing a weapon at a pursuing patrol vehicle is the most obvious example of a multi-tasking threat.

Another example is the potential for criminals using unoccupied vehicles as weapons. In this latter case, it will be very important to introduce cybersecurity measures to ensure the safe operation of the vehicle. Testing agencies and manufacturers and other entities should ensure that cybersecurity best practices are incorporated into test vehicles since these vehicles may be operated both in a closed facility and on public roads.

### Guidelines for Testing Vehicles

Prior to being authorized to operate a test vehicle, the employees, contractors and other persons designated by the manufacturer or other entities, should be required to pass a background check including, but not limited to, a driver history review and a criminal history check. In the interest of safety, it may be prudent to disqualify persons with poor driving records or relevant criminal records from operating an ADS vehicle as an agent or contractor of a manufacturer or other entity in a test environment. The cost of the background check should be borne by the applicant.

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.2.1** Jurisdictions that have ADS permitting requirements as described in Section 4.2 - Vehicle Permitting and Registration should require the designated test users (employees, contractors and other persons) to pass a police-conducted background check, including, but not limited to, a driver history review and a criminal history check, prior to being authorized to operate a test ADS vehicle. The cost of the background check should be borne by the applicant.
- 6.2.2** Jurisdictions that have ADS vehicle permitting requirements as described in Section 4.2 - Vehicle Permitting and Registration should establish provisions which disqualify an agent or contractor of a manufacturer or other entity who have criminal records or a driving history that includes impaired driving, careless driving, or other significant conviction history from operating an ADS vehicle in a test environment.

## RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 12.** The manufacturer or other entities, operating in jurisdictions not requiring ADS permits should require the designated test users (employees, contractors and other persons) to pass a background check, including, but not limited to, a driver history review and a criminal history check, prior to being authorized to operate a test vehicle.
- MOE 13.** The manufacturer or other entities, operating in jurisdictions not requiring ADS vehicle permits should disqualify an agent or contractor of a manufacturer or other entity who have a relevant criminal record or a criminal code driving violation from operating an ADS vehicle in a test environment.
- MOE 14.** Manufacturers and other entities should ensure that cybersecurity best practices are incorporated into test vehicles since these vehicles may be operated both in a closed facility and on public roads.

## Guidelines for Deployed Vehicles

It should also be noted that ADS vehicles, (most likely levels 4 and 5) may also be a target for criminal activity, such as car-jacking since they may not be capable of intuitive reaction or evasive maneuvers as a human user could employ.

To assist law enforcement in investigating criminal activity where a vehicle with automation was implicitly involved as a tool for committing a crime, manufacturers should ensure ADS Level 3, 4 and 5 vehicles with a remote driver leave an electronic fingerprint that can

allow tracing of input data. CCMTA recognizes that while privacy of personal information, data ownership and legal liability must be considered, it will also be important to ensure that collision investigators can appropriately identify the origin of all data inputs involved in an ADS equipped vehicle collision. Key information for crash investigators is the origin of the command (i.e., driver or ADS), the nature of the command, and when the command was given.

## RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 15.** Manufacturers and other entities should ensure ADS leave an electronic fingerprint that can allow tracing of input data to whoever initiated them. Key information in the fingerprint should include the origin of the command (i.e., driver or ADS), the nature of the command, and when the command was given.



### Benefits of Implementation

Requiring manufacturers to program software that leaves an electronic fingerprint will mitigate the risk of an automated vehicle being used as a tool to assist in the commission of or escape from a crime.

### Challenges to Implementation

Legislative action or administrative rule making will be required to implement the recommended guideline.

There may be challenges related to the costs of implementing the recommended software changes that would create an electronic fingerprint. There may also be complexities in determining the amount and extent of information sharing that would be appropriate while without compromising personal privacy.

## 6.3 DISTRACTED DRIVING AND FATIGUE

### Background

The potential for reducing or eliminating distracted driving is a common topic when discussing ADS. The term distraction, as used by NHTSA, is a specific type of inattention that occurs when drivers divert their attention away from the driving task to focus on another activity. These distracting tasks can affect drivers in different ways, and can be categorized into the following types:

- **Visual distraction:** Tasks that require the driver to look away from the roadway to visually obtain information.
- **Manual distraction:** Tasks that require the driver to take one or both hands off the steering wheel to manipulate a control, device, or other non-driving-related item.
- **Cognitive distraction:** Tasks that require the driver to avert their mental attention away from the driving task.

The impact of distractions on driving is determined not just by the type of distraction but also the frequency and duration of the task. Because drivers often have a choice regarding when and, depending on vehicle design, how often they will multitask when driving, their exposure to risk is typically within their control. Some research has shown, however, that drivers underestimate the overall risk of various tasks<sup>12</sup>. While drivers may regulate their distractions according to the situation, critical events are often unexpected and a driver's ability to safely react to an emerging risk is impaired by distraction. The longer a driver is inattentive, the more likely they will encounter a situation that requires their attention.

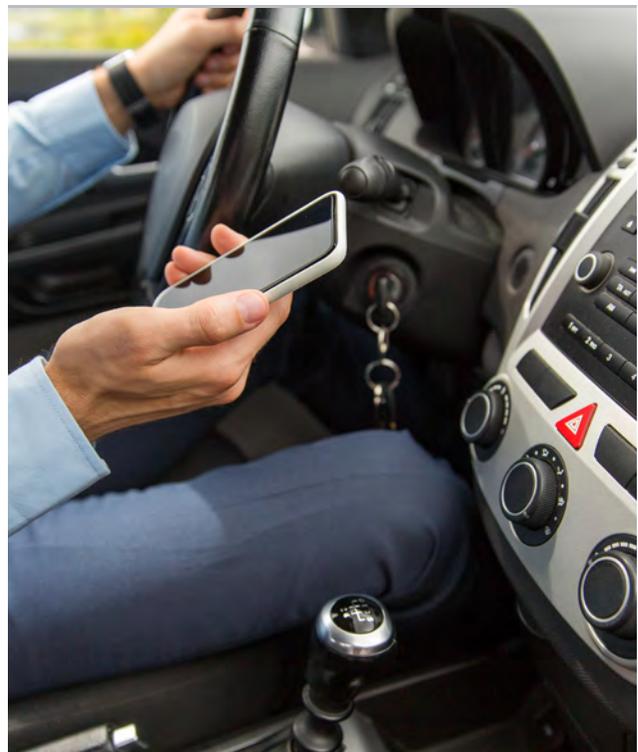
### Driver Fatigue

There is evidence from fatigue science and studies in fatigue in transportation that the nature of the driving task has an impact on a driver's vigilance and level of alertness. A monotonous and low demanding driving environment has been shown to generate decreases in brain alertness which in turn can significantly impact a driver's ability to remain vigilant whilst driving. Low vigilance leads to slower reaction time, lack of visual scanning behaviors and loss of situational awareness, which in turn significantly impacts traffic safety. If the monotony of the driving task is significant and occurs

over a prolonged period of time, it can generate drowsiness, microsleeps and eventual falling asleep at the wheel.

There is evidence that automated driving systems that still require the driver to remain alert and vigilant may also generate task-induced (passive) fatigue.

Accordingly, it is recommended that safe driver distraction and fatigue management practices be applied in the context of deploying automated vehicles, especially in situations where drivers are still expected to remain alert and vigilant.



### Guidelines for Testing Vehicles

When testing any ADS vehicle, the user is an active participant in the testing process; therefore, all distracting activities should be prohibited, and measures taken to limit driver fatigue.

<sup>12</sup> Overview of the National Highway Traffic Safety Administration's Driver Distraction Program, DOT HS 811 299, April 2010.

## RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 16.** Manufacturers or other entities should prohibit users from all distracting activities when testing any ADS vehicle.
- MOE 17.** Manufacturers or other entities should not design ADS information displays that may significantly increase driver distraction.
- MOE 18.** Manufacturers or other entities should educate test drivers on the effect of task monotony on vigilance and alertness, especially if they are expected to remain alert during the testing.
- MOE 19.** Manufacturers and other entities should ensure test drivers are provided with frequent breaks to interrupt the monotony (e.g. every 60, 90 minutes).
- MOE 20.** Manufacturers and other entities should limit the amount of hours required for testing, particularly at night and during mid-afternoon to limit test driver fatigue.
- MOE 21.** Manufacturers and other entities should ensure drivers are medically fit to conduct tests and are not taking medication that can impact vigilance and alertness when conducting tests.

## Guidelines for Deployed Vehicles

Jurisdictions should consider at what level of autonomy their distracted driving laws continue to apply. When a vehicle is in automated mode, the user may still need to maintain a level of awareness should they need to re-

engage with the driving function if prompted by the vehicle. Since the operation of some ADS vehicles may require no participation by the driver, distracting activities may not be relevant and/or distracted driving laws may not apply.

## RECOMMENDATIONS FOR JURISDICTIONS

- 6.3.1** Consider the level of automation to which their careless and/or distracted driving laws will apply.

## Benefits of Implementation

A reduction in crashes caused by driver distraction or driver fatigue.

## Challenges to Implementation

Many jurisdictions have laws prohibiting the use of an electronic device while driving. A challenge to any law enforcement officer will be knowing the level of ADS and what mode the vehicle is in when they observe a user interacting with an electronic device.

## 6.4 ESTABLISHING OPERATIONAL RESPONSIBILITY AND LAW ENFORCEMENT IMPLICATIONS

### Background

Jurisdictions have legal authority to regulate vehicle operation by humans but may not have established authority over the ADS/remote driver (i.e. non-human operation). This void presents significant challenges to enforcement of traffic laws and to establishing legal responsibility when ADS vehicles are involved in motor vehicle crashes on public roads. Jurisdictions will need to address the following issues:

- Is the driver of a vehicle with automated features engaged still responsible for the operation of that vehicle even if they are not performing the DDT?
- In such instances, how will law enforcement officers know when the human is actively driving or the “driving system” is in control?

While this may appear to be less of an issue as vehicle technologies approach Level 5, from an enforcement perspective, the issue is still confounding as many jurisdictions lack any procedural enforcement mechanism against any entity other than the human driver operating the vehicle at the time of the offense or crash. Traffic tickets or violation notices usually cannot be issued to registered owners or corporate entities and with the exception of parked vehicles, crash reports require a human driver for each involved vehicle (This may not apply to automated enforcement). Jurisdictions may need to define what enforcement actions can be taken and who or what is responsible when there is no human onboard.

### Guidelines for Testing Vehicles

Jurisdictions will need to clearly establish legal responsibility for every vehicle operating on the public roads. If a licenced driver is required to be onboard the vehicle during testing, that driver is responsible for the safe operation of the vehicle at all times and should be accountable for any violations of law and be considered the “driver” of the vehicle regardless of their degree of actual control of the DDT.

When ADS Level 4 and 5 vehicles, with or without a human onboard, are tested on public roads, the permitting process, described in Section 4.1 - Application and Permit for Manufacturers or Other Entities to Test Vehicles on Public Roadways, should clearly identify the person or entity legally responsible for the safe operation of the vehicle at all times. Before any testing permits are issued, the legal mechanism and authority to hold the responsible entity accountable for violations of laws and crashes that may occur during testing should be clearly established in statute. It is recognized, however, that this issue may be further informed and clarified through legal processes relating to determination of responsibility for incidents occurring during testing.

As previously mentioned, when testing any ADS vehicle, the user is an active participant in the testing process; therefore, all distracting activities should be prohibited.

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.4.1** Define what enforcement actions can be taken and who or what is responsible when there is no human onboard an automated test vehicle.

## Guidelines for Deployed Vehicles

Legal responsibility for every vehicle operated on public roads should be clearly established. Currently, the licenced driver of Level 0-2 vehicles is responsible for its safe operation at all times and is held legally responsible for any violation of law that may occur during operation. The same should be the case with Level 3 vehicles. Although the licenced driver of a Level 3 vehicle may cede control of the DDT to the vehicle under certain circumstances or driving conditions, such vehicle by definition still requires the operator to monitor the DDT and to take control as necessary. A licenced driver, therefore, is still responsible for the safe operation and liable for violations of law during operation.

For vehicles classified as Level 4 or 5, which may be operated without a licenced driver onboard and where the DDT may be performed independent of human control, new statutes or regulations may be required to establish similar responsibility and liability for violations of traffic laws. Registered owners of such vehicles should be responsible for properly maintaining all vehicle

equipment and systems, including, but not limited to, the prompt completion of any required updates impacting its operation. It is anticipated therefore, that registered owners of such vehicles, as the agents of the operation of such vehicles on public roads, should be responsible for their adherence to applicable laws and subject to legal process as determined by the jurisdiction. Product liability issues arising from such cases may be matters of civil process *ex post facto* but should not impact the enforcement of laws contemporaneously with operation.

Manufacturers or other entities should design ADS vehicles with a means of identifying when a vehicle is in automated mode to facilitate effective enforcement of laws such as distracted driving (i.e., so an officer knows if using a hand-held device is legal at the time of observation). Manufacturers or other entities, in collaboration with each other, should determine how best to determine this type of identification (e.g., a signal emitted by the vehicle and detectable by law enforcement).

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.4.2** Clearly establish legal responsibility for every vehicle operating on public roads.
- 6.4.3** For vehicles classified as ADS Levels 4 or 5, which may be operated without a licenced driver and where the driverless vehicle performs the DDT independent of human input, the registered owner should be responsible for its safe operation (N.B. this issue will continue to be discussed and may evolve over time).

### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 22.** Manufacturers or other entities should design ADS Level 4 and 5 vehicles with a means of identifying when a vehicle is in automated mode to facilitate effective enforcement of distracted driving behaviours (i.e., so an officer knows if using a hand-held device is legal at the time of observation).

## Benefits of Implementation

This guideline ensures there is a clearly identified party who is legally responsible for the operation of all vehicles at all times and provides law enforcement with a mechanism to enforce traffic safety laws. This will provide clarity to manufacturers, technology developers, law enforcement officers and vehicle owners of legal responsibility for vehicles of varying automated capabilities.

## Challenges to Implementation

The insurance industry may oppose holding registered owners responsible for the operation of the vehicle as opposed to the manufacturer or technology up-fitter. The industry may oppose this guideline as unnecessary regulation that may hinder development and public acceptance of technology adoption.

## 6.5 FIRST RESPONDER SAFETY

### Background

Although ADS vehicles may provide significant safety benefits by reducing human errors, they will inevitably be involved in traffic crashes, especially during the years of initial introduction and integration with the existing motoring population. Due to the potential for unique operational characteristics of ADS vehicles, responders to these crashes may be placed at risk if they are not trained for the hazards they may encounter. These hazards include, but may not be limited to silent operation, self-initiated or remote ignition, high voltage and unexpected movement. In the interest of safety, it is essential that first responders, including those in police, fire, emergency medical services (EMS) and tow and recovery services, receive information regarding the potential hazards they may face.

Identification of the vehicle at a safe distance is essential and best accomplished through manufacturer labeling (also known as badging) and familiarity with component designs, such as high voltage orange cabling. Immobilization involves knowing how to place the vehicle transmission in park, set parking brakes and if appropriate, chocking the wheels to restrict movement. Disabling techniques involve ensuring the vehicle is turned off, moving potential re-ignition sources, such as proximity keys, from the vicinity of the vehicle and cutting 12-volt power supplies to prevent ignition and depower airbags and seat belt tensioners.

Some or all of these procedures may be applicable to varying degrees to automated vehicles. The importance of labeling to assist in vehicle identification is discussed at length in Section 6.6 – Assisting First Responders and Transportation Safety Investigators Through Vehicle Identification. Identification strategies that are integrated into the vehicle design will likely be most effective, rather than post-manufacture strategies, such as licence plates that lack redundancies and can easily be removed or obscured in a crash. Immobilization and disabling issues





may be unique to automated vehicles, which have the potential for remote or self-initiation of ignition or movement. Immobilizing and disabling automated vehicles may require switches or components designed specifically for this purpose, and these functions should be considered in the development of vehicle systems by the OEMs.

In the United States, the National Fire Protection Association (NFPA) developed training programs for both fire service and law enforcement to help them safely respond to crashes involving electric and hybrid electric vehicles. NFPA also provides ongoing training for the fire service on hazards involving a variety of alternative fuel vehicles. The training focuses on three main functions to render the vehicles safe:

1. the ability of the responder to identify the vehicle (and its propulsion system);
2. immobilize it; and
3. permanently disable it.

The Council of Canadian Fire Marshals Fire Commissioners (CCFMFC) and the National Fire Protection Association (NFPA) signed a licence agreement on May 10, 2016 to deliver an Electric, Hybrid and Fuel Cell Vehicle Safety Training Program for Emergency Responders throughout Canada based on materials originally developed by NFPA for U.S. first responders.

Canadian fire, police, emergency medical services, tow truck operators and other first responders will have access to a variety of relevant materials, including train-the-trainer and in-classroom sessions, resources,

and emergency field guides that provide responders with a quick reference on how to handle alternative fuel vehicle (AFV) incidents on-scene. These materials are being made available to career and volunteer firefighters as a result of licence agreements between CCFMFC and NFPA.

Although NFPA training is provided to most fire services in the U.S. and is leveraged in Canada, information has not been well distributed to law enforcement and other responders, resulting in significant vulnerabilities.

First responder safety information specific to automated vehicles should be identified and disseminated prior to public use/deployment.

### Guidelines for Testing Vehicles

As the test environment of ADS vehicles includes public roadways, there will be crashes involving ADS vehicles that may put first responders or the general public at risk. For the safety of first responders, manufacturers should permanently label ADS vehicles that will be tested on public roadways, at a minimum, on the rear and sides of the vehicle. For the safety of vehicle occupants and first responders, manufacturers should ensure ADS vehicles have safety systems or procedures which allow first responders to immobilize or otherwise disable the vehicle post-crash, to prevent movement or subsequent ignition of the vehicle. Information regarding these systems and procedures should be made available to the first responder community in the jurisdiction where the vehicle will be tested.

### Guidelines for Deployed Vehicles

For the safety of first responders, manufacturers are encouraged to permanently identify ADS vehicles, at a minimum, on the rear and sides of the vehicle. For the safety of vehicle occupants and first responders, manufacturers should ensure ADS vehicles have safety systems or procedures which allow first responders to immobilize or otherwise disable the vehicle post-crash, to prevent movement or subsequent ignition of the vehicle. Information regarding these systems and procedures should be made available to the first responder community in the jurisdiction where the vehicle will be operated.

RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 23.** Manufacturers are encouraged to permanently identify ADS vehicles for the safety of first responders.
- MOE 24.** Manufacturers should ensure ADS vehicles have safety systems or procedures which allow first responders to immobilize or otherwise disable the vehicle post-crash, to prevent movement or subsequent ignition of the vehicle for the safety of vehicle occupants and first responders.
- MOE 25.** Manufacturers should make the information and procedures regarding ADS vehicles available to the first responder community in the jurisdiction where the vehicle will be operated.

### Benefits of Implementation

Prevention of unnecessary injuries or deaths to emergency personnel who respond to crash scenes and the public at large involved in or near crash scenes.

### Challenges to Implementation

Vehicle identification is linked to brand and has been traditionally considered highly proprietary. OEMs may oppose any regulation they perceive impacts the aesthetics of their product.

OEMs may be reluctant to disclose any information relative to vehicles under development, which places the public and first responders at risk if test vehicles are involved in crashes.

Furthermore, some manufacturers and other entities who have identified their test ADS vehicles have reported incidents of other road users attempting to engage with the vehicles to test their capabilities.

## 6.6 ASSISTING FIRST RESPONDERS AND TRANSPORTATION SAFETY INVESTIGATORS THROUGH VEHICLE IDENTIFICATION

### Background

Identification of a motor vehicle as an ADS is necessary for law enforcement officers and other first responders to fulfill their duties. These duties include ensuring that the user/driver is properly credentialed (if required), ensuring the safety at the scene if the user/driver is incapacitated in a crash and aiding the in the recovery of a stolen vehicle.

From a law enforcement perspective, licence plates alone may not be the optimal means to identify the vehicle as an ADS since licence plates are susceptible to theft. Licence plates only allow identification from the rear in one plate jurisdictions, and since most crashes involve front or rear damage, will frequently be obscured. In addition, many jurisdictions currently issue a vast array of unique plate designs; one more plate design will not likely improve identification of the vehicle if a similar model vehicle exists in the marketplace.

In contrast, vehicle labeling or permanent marking to identify the vehicle as an ADS allows for redundant marking in multiple locations (exterior and interior), improving conspicuity from multiple vantage points. SAE and the International Organization for Standardization (ISO) have developed guidelines for labelling of alternative fuel vehicles that may inform guidance on acceptable labeling practices.

SAE and ISO provide guidance for OEMs relative to first and second responder safety to vehicle crashes involving electric and hydrogen fueled vehicles (xEVs) and includes reference to labeling to assist emergency responders to identify the drive system of the vehicle at a safe distance. This is important as many of these vehicles have virtually silent motors or drive systems that can result in unexpected vehicle movements. Though the SAE recommended practices (J2990 and J2990/1) and ISO recognized symbol usage are non-binding, they already have a certain level of acceptance among

the OEMs. However, to date, no unique symbols or identification for ADS vehicles have been standardized by either organization.

ISO symbols are unique to the particular drive system, i.e., a different symbol for hybrid electric, plug in electric, hydrogen fuel cell, etc. In contrast, SAE J2990 and 2990/1 provide consensus standards for a variety of labeling strategies and designs. By following J2990, OEMs may adopt the ISO symbols, but to date, few have done so. Vehicle drive systems may also be identified by badges indicating “hybrid” or a unique descriptive term, such as “CH2.” Alternatively, J2990 and 2990/1 provides as an alternative that manufacturers may use a unique brand name, such as Chevrolet’s “Volt” or Nissan’s “Leaf,” which are unique to a single type of drive system that will allow for easy identification by first responders.

Despite such labeling strategies developed to improve safety, OEMs may choose to avoid unique labeling to avoid jeopardizing earned customer loyalty by making these vehicles seem different or less reliable than a similar internal combustion model.

In Canada, the precedence set for labelling vehicles comes from the Canadian Standard Association’s (CSA) requirement for propane vehicles and compressed natural gas (CNG) vehicles be affixed with a diamond shaped label identifying the fuel type (CSA B149.5 and B109 respectively). These standards are referenced at a provincial level for aftermarket conversions and as alternatives to federal crash test requirements. However, provincial and territorial jurisdictions are authorized to make additional requests or restrictions to the standards as deemed necessary.

In addition to vehicle labeling, other vehicle identification strategies should be considered to improve safety and to facilitate motor vehicle administration and law enforcement.

## Guidelines for Testing Vehicles

Whenever an ADS vehicle is operated on a public road, it is susceptible to crash and theft. Therefore, an ADS vehicle should be readily identifiable from other vehicles on the roadway for the safety of law enforcement and other first responders. The optimal means for accomplishing identification is through vehicle labeling by the manufacturer or other entity.

Since jurisdictions have authority over vehicle registration, a unique ADS identifier on the vehicle registration may provide an alternative, albeit less effective, means of identifying ADS Level 3, 4 or 5 vehicles for law enforcement purposes during testing. However, since vehicle labeling will better identify these vehicles and thereby improve safety and regulatory control, manufacturers should ensure ADS vehicles have permanent labeling on the rear and sides of the vehicle. Refer to MOE 23.

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.6.1** Encourage manufacturers to permanently label the rear and sides of an ADS vehicle to better identify vehicles and improve safety and regulatory control.

### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 26.** Manufacturers should develop international consensus standards for a system of permanent labeling of ADS vehicles to ensure consistency of safety information on vehicles with automated features.

## Benefits of Implementation

These recommendations, if adopted, will allow law enforcement and other first and secondary responders to readily identify a vehicle as one with automated capability in order to ensure the safety of crash scenes, identify the credentialing necessary of users and owners, and aide in the recovery of stolen vehicles.

## Challenges to Implementation

The labeling of vehicles has historically been the purview of vehicle manufacturers, which have significant interest in retaining the identity and integrity of their brand. OEMs may oppose efforts to standardize how the capability of their vehicles is conveyed to the motoring public. Historically OEMs have named features in a proprietary manner, to further distinguish their brand or model, or they have chosen not to differentiate model-specific features from other models in their lineup to signify equal levels of quality or reliability across the brand. Federal labeling mandates will standardize terminology across all manufacturers, which could be perceived as overstepping government authority and counter to their marketing strategies. OEMs may also resist uniform labeling fearing other motorists may challenge the capabilities of vehicles that are badged as automated.

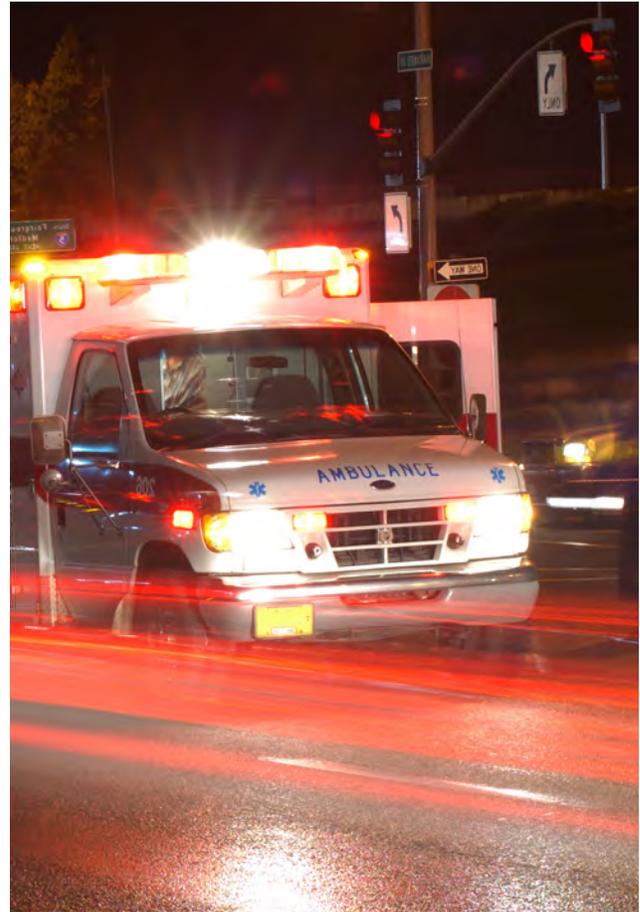
## 6.7 LAW ENFORCEMENT/FIRST RESPONDER TRAINING

### Background

It is important for first responders and law enforcement specifically, to understand how ADS vehicles impact their duties, so there is a growing need for training and education. Training content needs to be identified and officers will need training for safely interacting with vehicles and users in both the testing and deployment of ADS vehicles.

### Guidelines for Testing Vehicles

Training law enforcement personnel based on jurisdictional laws and regulations is essential. The training during the testing of ADS vehicles will likely differ from that when the vehicles are deployed because of regulations and laws which may be enacted. When training and educational tools become available, they should be disseminated through jurisdiction-level established training bodies. The use of approved training allows for uniformity across jurisdictions and their law enforcement agencies. Training should be updated as laws and rules change and/or when manufacturers make design changes. Primary stakeholders to develop and disseminate the training may include associations such as CCFMFC with NFPA and the Canadian Association of Chiefs of Police (CACCP).



#### RECOMMENDATIONS FOR JURISDICTIONS

- 6.7.1** Work with manufacturers' and other entities' consumer training programs to make the ADS training available to first responders at no cost to agencies.

#### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 27.** Manufacturers and other entities in partnership with highway safety stakeholders should develop national or international standardized first responder training on safely interacting with vehicles and users in both the testing and deployment of ADS vehicles.

## Guidelines for Deployed Vehicles

The first responder audience needs access to ADS vehicle training. National or international standardized first responder training on safely interacting with vehicles and users in both the testing and deployment of ADS

vehicles should be developed. Jurisdictions should work with manufacturer's consumer training programs to make them available to first responders at no cost to agencies.

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.7.2** Work with manufacturers' and other entities' consumer training programs to make the ADS vehicle training available to first responders at no cost to agencies.

### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 28.** Manufacturers and other entities in partnership with highway safety stakeholders should develop national or international standardized first responder training on safely interacting with vehicles and users in both the testing and deployment of ADS vehicles.

## Benefits of Implementation

Standardized training will enhance the safety of first responders and the public they serve.

## Challenges to Implementation

Uncertainty of training content that should be included in law enforcement training curricula is exacerbated by the lack of a national standard. Another challenge will be keeping training current as the technology continues to evolve.

## 6.8 VEHICLE RESPONSE TO EMERGENCY VEHICLES, MANUAL TRAFFIC CONTROLS AND ATYPICAL ROAD CONDITIONS

### Background

Traffic safety is often dependent on the ability of a driver to recognize and respond appropriately to a wide variety of hazards in an ever-changing roadway environment. These hazards include but are not limited to: both moving and stopped emergency vehicles; emergency workers and other pedestrians manually directing traffic; changing traffic patterns or conditions in roadway construction and maintenance zones; crash scenes; and road debris or other obstructions.

Object and Event Detection and Response (OEDR) refers to the detection by the driver or ADS system of any circumstance that is relevant to the immediate driving task, as well as the implementation of the appropriate driver or system response to such circumstance.

### Guidelines for Testing and Deployment

Manufacturers should ensure that ADS vehicles being operated on public roads are able to recognize and respond properly to all temporary traffic controls and atypical hazards in the roadway environment. Temporary traffic controls include cone or flare patterns as well as human hand directions and flagging. In addition, vehicles should properly identify, differentiate and respond to both moving and stopped emergency vehicles and hazard vehicles, such as road maintenance vehicles bearing amber lights. Proper response should include compliance with move-over laws.

#### RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

**MOE 29.** Manufacturers should ensure that ADS vehicles being operated on public roads, are able to recognize and properly respond to all temporary traffic controls and atypical hazards in the roadway environment.

### Benefits of Implementation

Safety of first responders, roadway workers, and the public will be improved.

### Challenges to Implementation

It may not be practicable to replicate every possible road restriction or hazard that can be encountered during testing in the real world, and under extraordinary circumstances it may be necessary to violate laws or rules of the road to safely navigate some hazards, e.g., driving on shoulders or disobeying lane markings, signs, etc. In addition, manual traffic control gestures are not universally consistent and may be performed by professionals or non-professionals alike. Move-over and other traffic laws are not currently uniform among jurisdictions and adherence to these laws may require geographic awareness.

## 6.9 SYSTEM MISUSE AND ABUSE

### Background

Misuse of an ADS vehicle may be defined as operating automated features improperly or inappropriately, such as failure to take affirmative control of a vehicle when directed to do so by the automated system. Issues of misuse may be due to a lack proper training or the inability of current licencing procedures to capture ADS vehicles. Misuse can have a major role in determining crash causation, which distinguishes fault and criminal/civil liability. It is the responsibility of law enforcement to determine crash causation whenever possible, but misuse will be more difficult to discern from other causes or traditional human user errors.

Abuse of an ADS vehicle may be defined as the intentional or malicious use of ADS vehicle capabilities for some unlawful purpose. Issues of abuse (or intentional misuse as defined above) will likely involve criminal behavior and may have vast implications on public safety. Examples of abuse range from criminal transportation, such as drug running, to cybersecurity breaches or terrorism. Strategies to address both misuse and abuse must consider the myriad of ways to perpetrate each.

One issue is whether new laws or regulations are necessary to deter the behaviours or to assist law enforcement in performance of their duties in prevention and/or post incident. The elements of the law violations inherent to misuse or abuse already exist, whether or not vehicle technology was employed in the violation of law. For example, a speeding violation is still a speeding violation whether or not cruise control was active at the time of the offense; and vehicles are widely used in the commission of crimes or to transport goods or proceeds of crimes today. In some foreseeable instances, such as vehicular assault or homicide, culpability may be an issue.

Crash and criminal investigation would be greatly aided by electronic record of the behaviour of the vehicle and human interface. Given the varied end uses of the ADS vehicle crash/incident data (i.e. for research and/or enforcement purposes), access to the data via a commercially available tool would reduce the burden on the manufacturers and other entities to provide this data and would also show transparency and assist in standardizing the reports.

### Guidelines for Testing and Deployed Vehicles

It could be assumed that it is far less likely that misuse or abuse would occur in a test environment where users are intimately familiar with the vehicle capabilities and use is highly controlled, recorded and researched. Nonetheless, since extensive testing occurs on public roads, the public interest demands that researchers and developers record the behavior of the vehicle and the driver/vehicle interface at all times during operation.

In the case of both testing and deployed vehicles, manufacturers should design ADS vehicles to record both vehicle behaviour and the driver/vehicle interface to identify the actions of the vehicle and the actions (or lack thereof) by the driver at all times. This recording mechanism should include GPS and time information to allow investigators to ascertain what occurred, where and when.

The ADS data should be stored and retrievable in some recognized, standard, non-proprietary, format for ready access by those duly authorized.

## RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

- MOE 30.** For the purposes of supporting collision investigations, manufacturers or other entities, such as researchers and developers, should design ADS vehicles to record the behavior of the vehicle and the driver/vehicle interface to identify the actions of the vehicle and the actions (or lack thereof) by the driver at all times during operation.
- MOE 31.** Manufacturers and other entities should apply best practices in human factors design procedures to define intended users, user-needs, use environments and interfaces; identify use-related hazards, identify and categorize critical tasks; and should develop and implement misuse mitigation measures and conduct validation testing on real users.
- MOE 32.** For the purposes of supporting collision investigations, manufacturers should also ensure the design and safety assessment data that accomplishes the recommendations in MOE 30 is stored and retrievable in some recognized, standard, non-proprietary, format for ready access by those duly authorized.

### Benefits of Implementation

These recommendations will aid in crash and criminal investigation by providing behavioral information and vehicle performance information in the most serious cases. Users of vehicles may be deterred from engaging in misuse or abuse knowing their behaviors are being recorded by the vehicle.

### Challenges to Implementation

Such requirements may be perceived as an unwarranted overreach of governmental authority. EDRs have operated and stored data in proprietary formats for proprietary purposes. Manufacturers can be expected to oppose requirements which dictate what information is captured and accessible to the authorized investigator.

These recommendations will assist law enforcement and regulating entities in determining crash causation including, but not limited to whether system misuse or abuse were involved. Users of ADS vehicles may be deterred from engaging in misuse or abuse knowing their behaviours are being recorded by the vehicle and that information is accessible by law enforcement or others duly authorized.

## 6.10 ADHERENCE TO TRAFFIC LAWS

### Background

Traffic laws are the purview of provincial and territorial jurisdictions, although local jurisdictions may enact additional traffic and parking laws. While most traffic laws are similar from jurisdiction to jurisdiction, some are jurisdiction specific. For example, although all jurisdictions have laws regarding speed limits, minimum and maximum speed limits may vary significantly between jurisdictions. Similarly, traffic laws relative to vehicle movements commonly referred to as “rules of the road,” such as lane changes, left and right-hand turns, yielding right of way, stopping, passing, and movements in regard to traffic control devices and pedestrian crossings, etc., also vary between jurisdictions.

Where speed limits are concerned, it is common knowledge that compliance with those limits is often low, and drivers often adjust their vehicle speed to that of the prevailing flow of traffic. Users frequently even set the vehicle cruise control to speeds that exceed the speed limit. In light of this common practice, there is concern that future consumers of ADS Level 3, 4 and 5 vehicles may desire similar discretionary control of the maximum operating speed leading manufacturers to develop ADS vehicles capable of violating speed limits and other traffic laws. This would be legally imprudent and could be unsafe. However, manufacturers should give consideration to emergency circumstances when it may be necessary to perform maneuvers which may otherwise violate traffic laws, such as following the

directions of police officers or flaggers to cross double yellow lines or drive on a sidewalk to avoid hazards such as at a crash scene, a flooded road, or road debris.

*\*Impaired driving, distracted driving and driver fatigue are addressed in other areas of this Guidelines Document.*

### Guidelines for Testing and Deployment

Jurisdictions should ensure that all vehicles under their authority are required to adhere to all traffic laws and rules of the road, except in emergency circumstances. Jurisdictions will need to examine their traffic laws to identify laws that may not be relevant or appropriate for ADS vehicles. In addition, it may be that some of these laws will be appropriate for all SAE levels of vehicles, or for only certain specific SAE levels. When such laws are identified, they should be amended as necessary.

The Transportation Research Board (TRB) has undertaken a project to assist jurisdictions with updating their motor vehicle codes as ADS technology continues to evolve (Transportation Research Board project (NCHRP20-102(07) Implications of Automation for Motor Vehicle Codes).

Additionally, vehicles designed to operate in either automated mode or manual mode should not have the ability to override the ADS Level settings allowing for violation of traffic laws, without transitioning out of automated mode and into manual mode.

### RECOMMENDATIONS FOR JURISDICTIONS

- 6.10.1** Monitor the progress of the Transportation Research Board project (NCHRP20-102(07) *Implications of Automation for Motor Vehicle Codes* to identify traffic and other laws that may need to be repealed or revised to accommodate ADS technology.
- 6.10.2** Jurisdictions should not modify current traffic laws specifically to accommodate ADS vehicles until their development advances to the extent that such amendments and statutes are warranted.

RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES (MOE)

**MOE 33.** Manufacturers or other entities should ensure users of vehicles designed to operate in either automated mode or non-automated mode do not have the ability to override the ADS settings, without transitioning out of automated mode into non-automated mode, unless faced with an emergency circumstance. It should be noted here that this issue continues to be discussed with international stakeholders. As the discussions evolve, this recommendation may be revised in future iterations of this Guidelines Document.

### Benefits of Implementation

Ensuring that ADS are programmed to comply with all jurisdictional and local traffic laws will contribute to the safe operation of ADS vehicles by avoiding the human decision-making process which currently contributes to most crashes.

### Challenges to Implementation

Some consumers may demand more control over the functions of their ADS and manufacturers may seek to accommodate this desire. Additionally, it will be a challenge to ensure the ADS vehicle is updated to comply to new and amended traffic laws from jurisdiction to jurisdiction.



## CHAPTER 7

# NEXT STEPS

The foundation of this report and the recommendations herein are based on a combination of research, experience and knowledge accumulated over the last several years by CCMTA members, the AVWG and material provided by AAMVA. It is also important to highlight that these Guidelines have drawn from and complement those found in the national trial guidelines, “*Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*”,

developed under the leadership of Transport Canada and in collaboration with CCMTA.

Because the technology is rapidly evolving, it is critical for the CCMTA to continue to work in collaboration with stakeholders, learn and share their expertise for the collective benefit of members and the community as a whole.

To advance their knowledge of the progression of ADS technology, CCMTA will continue to work closely with government entities, industry and research stakeholders. In addition, CCMTA will maintain close contact with jurisdictional government officials; and national associations supporting transportation agencies, such as the Policy and Planning Support Committee (PPSC) of the Council of Deputy Ministers of Transportation and Highway Safety. CCMTA will work closely with Transport Canada as it moves forward on future iterations of the guidelines for trial organizations and it will also continue to partner and collaborate with AAMVA to ensure consistency and understand the impacts on government programs and responsibilities on both sides of the border.

CCMTA will continue to work with manufacturers and other stakeholders to discuss the Guidelines and current and emerging factors that the recommendations address. CCMTA will participate in conferences, seminars and other forums focused on technology and public policy as required. It is recommended that CCMTA members of the AVWG continue to play a role in supporting jurisdictions to understand ADS technology and its impact on government programs. They are well placed to provide assistance to jurisdictions with the implementation of the guidelines identified in this report as well as Transport Canada's *Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations*.

The Guidelines will be a living document and revisions will be made as new vehicle technology and information emerges. They will continue to address MTAs and law enforcement concerns related to ADS vehicle testing and deployment. Additional updates are expected to include commercial ADS vehicles and ADS vehicle fleet ownership as well as other topics that emerge such as safety inspections, training for MTA staff, etc. CCMTA will work with and coordinate ADS vehicle initiatives through their partnerships with Transport Canada.

The CCMTA is committed to keeping pace with the evolution of vehicle technology, providing timely information, and sharing their expertise.



# APPENDIX

# SAE'S SURFACE VEHICLE RECOMMENDED PRACTICE

## TAXONOMY AND DEFINITIONS FOR TERMS RELATED TO DRIVING AUTOMATION SYSTEMS FOR ON-ROAD MOTOR VEHICLES J3016, SEPTEMBER 2016<sup>13</sup>

SAE, which devises consensus standards for the engineering industry, established a six-tier classification system ranging from no vehicle automation to full vehicle automation. Each vehicle is expected to be classified within the six levels according to the following:

- **Level 0 – No Driving Automation;** the performance by the driver of the entire dynamic driving task (DDT), even when enhanced by active safety systems.
- **Level 1 – Driver Assistance;** the sustained and operational design domain (ODD) specific execution by a driving automation system of either the lateral or the longitudinal vehicle motion control subtask of the DDT (but not both simultaneously) with the expectation that the driver performs the remainder of the DDT.
- **Level 2 – Partial Driving Automation;** the sustained and ODD specific execution by a driving automation system of both the lateral and longitudinal vehicle motion control subtasks of the DDT with the expectation that the driver completes the object and event detection and response (OEDR) subtask and supervises the driving automation system.
- **Level 3 – Conditional Driving Automation;** the sustained and ODD-specific performance by an automated driving system (ADS) of the entire DDT with the expectation that the DDT fallback-ready user is receptive to ADS issued requests to intervene, as well as to DDT performance-relevant system failures in other vehicle systems and will respond appropriately.
- **Level 4 – High Driving Automation;** the sustained and ODD-specific performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.
- **Level 5 – Full Driving Automation;** the sustained and unconditional (i.e., not ODD-specific) performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.

<sup>13</sup> SAE International's *Surface Vehicle Recommended Practice: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles, J3016 (2016)* and were reprinted with SAE International's permission. This document can be accessed for free from the following SAE webpage: [www.sae.org/standards/content/j3016\\_201609](http://www.sae.org/standards/content/j3016_201609).

# ACRONYMS

American Association of Motor Vehicle Administrators (AAMVA)

American Driver and Traffic Safety Association (ADTSEA)

Automated Driving System (ADS)

Automated licence plate readers (ALPR)

Automated Vehicles (AV)

Automated vehicle testing (AVT)

Canadian Association of Chiefs of Police (CACCP)

Canadian Council of Motor Transport Administrators (CCMTA)

Central Processing Unit (CPU)

Commercial Driver's Licence Information System (CDLIS)

Commercial Motor Vehicle Safety Standards (CMVSS)

Department of Motor Vehicles (DMV)

Department of Transportation (DOT)

Driving School Association of the Americas (DSAA)

Electric and hydrogen fueled vehicles (xEVs)

Event data recorder (EDR)

Emergency Medical Services (EMS)

Global positioning system (GPS)

Highly Automated Vehicle(s) (HAV)

International Driver Examiner Certification (IDEC)

International Organization for Standardization (ISO)

Manufacturer's Certificate of Origin (MCO)

Manufacturer's Statement of Origin (MSO)

Model Minimum Uniform Crash Criteria (MMUCC)

Motor Transport Administrator (MTA)

National Fire Protection Association (NFPA)

National Highway Traffic Safety Administration (NHTSA)

Non-commercial Model Driver Testing System (NMDTS)

Object and Event Detection and Response (OEDR)

Original Equipment Manufacturer (OEM)

Rearview video systems (RVS)

Society of Automotive Engineers International (SAE)

Test Maintenance Subcommittee (TMS)

Transportation Research Board (TRB)

United States Department of Transportation (USDOT)

Vehicle Identification Number (VIN)

# SUMMARY OF RECOMMENDATIONS FOR JURISDICTIONAL GUIDELINES

The following is a summary of the recommended jurisdictional guidelines for the: governance, safe testing, deployment, and law enforcement and transportation safety considerations of ADS vehicles.

These guidelines are intended to ensure a framework of consistent regulation and oversight of ADS vehicles throughout the jurisdictions. Jurisdictions are not required to follow these guidelines. The guidelines are provided for those jurisdictions that choose to regulate ADS vehicles.

## CHAPTER 3: GUIDELINES FOR THE GOVERNANCE OF TESTING AND DEPLOYMENT OF ADS VEHICLES

### 3.1 Governance

- 3.1.1 Establish an ADS Committee to address ADS testing and deployment. The Committee should include members from a broad range of governmental and private sector stakeholders having interest in and/or responsibilities related to ADS.
- 3.1.2 Identify a Lead Agency to manage the ADS Committee and its work. The ADS Committee should develop strategies for addressing testing and deployment of ADS in their jurisdiction, balancing the protection of road safety with enabling technological innovation.
- 3.1.3 Jurisdictions should review their laws, regulations and rules, if applicable, regarding vehicle operation to ensure:
  - a) the testing and deployment of ADS vehicles is permitted on public roads; and
  - b) that they do not create unnecessary barriers to the safe testing, deployment and operation of ADS vehicles in Canada.
- 3.1.4 Jurisdictions which regulate the testing of ADS vehicles are encouraged to take necessary steps to establish statutory authority and to consult the document Testing Highly Automated Vehicles in Canada: Guidelines for Trial Organizations published by CCMTA in June 2018 as a minimum baseline to frame the regulations.
- 3.1.5 Jurisdictions should encourage its regulators and legislators to engage in regular reviews of ADS technologies and to engage with industry to stay current with advancements. This will help officials recognize when laws, rules and policies are either outdated or proposed prematurely.

## CHAPTER 4: GUIDELINES FOR THE TESTING OF ADS VEHICLES

### Vehicle Credentialing Considerations

#### 4.1 Application and Permit for Manufacturers or Other Entities to Test Vehicles on Public Roadways

- 4.1.1 Develop an internal process that includes an application for manufacturers to test on public roadways within the jurisdiction and include provisions for suspension or revocation of any permit to test on public roads should permit holders violate permit conditions.
- 4.1.2 Consider the imposition of penalties should the testing entity continue to operate/test in violation of a suspension or revocation order.
- 4.1.3 Hold test users responsible for violations of existing traffic laws subject to existing legal processes.
- 4.1.4 Require all manufacturers and other entities testing all ADS vehicles to apply for and be issued vehicle specific permits prior to testing on public roadways.

- 4.1.5 Establish a test permit application process for ADS vehicles that does not create unnecessary barriers for manufacturers or other entities and includes the information listed in Section 4.1 – Guidelines, above.
- 4.1.6 Require test permit information be available for verification at the time of vehicle registration issuance (new and renewal) either by presentation from the holder or through electronic means in those jurisdictions where manufacturer or other entity-owned vehicles are required to be individually registered.
- 4.1.7 Require test permits/approvals to be carried in the test vehicle while present on public roadways within their jurisdiction. Permit information should be made readily available to law enforcement via electronic means by the issuing jurisdiction.
- 4.1.8 Jurisdictions should not utilize regulations developed for testing for deployed vehicles since these vehicles will be subject to the CMVSS and other potential federal safety guidance.

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## 4.2 Vehicle Permitting and Registration

- 4.2.1 Establish uniform language that will benefit law enforcement, the MTA and other stakeholders for testing ADS vehicles. This uniform language should include the use of the acronyms and terms such as “ADS” for “Automated Driving System”, and “ADS vehicle”.
- 4.2.2 Place a notation on the permit, registration credential and/or electronic record, if applicable, by means of an ADS flag and an additional corresponding ADS level field for vehicles that have the capability to operate at Levels 3, 4 or 5.
- 4.2.3 Recognize the permit issued by another jurisdiction for purposes of testing.
- 4.2.4 Jurisdictions should not begin the process of registering test vehicles if the jurisdiction does not already require this protocol for other technology testing scenarios (i.e., alternate fuel test vehicles).
- 4.2.5 Test vehicles may not necessarily be approved to stay in Canada indefinitely. Vehicles should be plated through a means that allows the jurisdiction to prevent the transfer of ownership of the vehicle unless it receives approval for permanent importation into Canada.
- 4.2.6 If the jurisdiction does issue a registration record/credential, it should consider placing an “Altered” or “A” status on vehicles not equipped with automated technologies by the OEM but have aftermarket automated components.
- 4.2.7 Require manufacturers and other entities to notify the jurisdiction in the case of:
  - a) any change to the SAE level of the vehicle or vehicles being tested; or
  - b) the addition of another vehicle or vehicles to the testing program.

In the case of such notification, the manufacturers and other entities should be required to provide details on these vehicles to be tested, as outlined above in 4.1.
- 4.2.8 When changes to the SAE level have been made or additional vehicles are added to the testing program, the jurisdiction should update its records, accordingly, and issue a new permit for the test vehicle or vehicles reflecting the changes/additions made.

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## 4.3 Licence Plates

- 4.3.1 Jurisdictions should not require a special licence plate for ADS vehicles. If a jurisdiction does, however, choose to require a special licence plate for ADS vehicles, the jurisdiction may consider adopting the administrative, design and manufacturing specifications contained in the AAMVA License Plate Standard.

#### 4.4 Financial Responsibility

- 4.4.1 Require all ADS vehicles permitted for on road testing to have a minimum of \$5 million in liability insurance, in the form and manner required by the MTA authority or other relevant agency.
- 4.4.2 Jurisdictions should consider requiring additional liability insurance, beyond the \$5 million minimum, for vehicles with a large seating capacity (e.g. for 8 or more passengers).
- 4.4.3 For the testing of driverless ADS vehicles, jurisdictions should consider including a requirement that stipulates, as part of the application process, that:
  - a) testing entities must accept full liability/responsibility for damages caused by their vehicles or drivers, and
  - b) their insurers must agree to respond to damage claims whether the driver or vehicle deemed to be at fault.

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#### 4.5 Compliance of ADS Trial Vehicles with the Motor Vehicle Safety Act (MVSA)

- 4.5.1 Consider requiring manufacturers or other entities that seek to conduct trials for ADS within their jurisdictions to confirm compliance with the MVSA including the submission of any declarations that may be applicable as per section 7(1)(a) of the MVSA and Section 5.1(1) of the MVSR as applicable.
- 4.5.2 As part of their trial permitting process, jurisdictions are encouraged to require a declaration from the manufacturer or other entity stating that they have given due consideration, and where necessary, incorporated appropriate measures, protocols, and equipment redundancies, to address various safety issues associated with their trial vehicles. Jurisdictions are encouraged to consult with Transport Canada when reviewing the information, they receive as part of this declaration.

### Driver Licensing Considerations

#### 4.6 Driver and Passenger Roles Defined

- 4.6.1 Utilize the SAE International definitions provided in the Preface.

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#### 4.7 Driver Licence Requirements for Testing by Manufacturers and Other Entities

- 4.7.1 Require test ADS vehicles be operated solely by employees, contractors, or other persons designated by the manufacturer of the ADS vehicle or any such entity involved in the testing of the ADS vehicle.
- 4.7.2 Require the test driver to have the appropriate and valid class of licence associated with the particular vehicle being tested (e.g., Class 5 licence to test a passenger vehicle).
- 4.7.3 Require test drivers to receive training and instruction regarding, but not limited to, the capabilities and limitations of the vehicle and be subject to a background check as described in Section 6.2 - Criminal Activity.
- 4.7.4 Require training provided to the employees, contractors, or other persons designated by the manufacturer or entity be documented and submitted to the jurisdiction's lead agency along with other required information.
- 4.7.5 Support the safe testing without a human driver inside of the vehicle, by requiring a remote driver designated by the manufacturer of the ADS technology or any such entity involved in the driverless testing of the ADS Level 4 or 5 vehicle, to be capable of assuming control of the vehicle's operations or have the ability to achieve a minimal risk condition where the ADS is not capable of so doing.
- 4.7.6 Take steps to ensure their motor vehicle laws allow for the manufacturer testing of ADS Level 4 and 5 vehicles without a licenced driver.

## CHAPTER 5. DEPLOYMENT OF ADS VEHICLES

### Vehicle Credentialing Considerations

#### 5.1 Vehicle Permits for Deployed ADS Vehicles

No recommendations for jurisdictions. Recommendations in this section relate to Manufacturers and Other Entities.

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#### 5.2 Vehicle Registration

- 5.2.1 Establish uniform language which will benefit law enforcement, the MTA and other stakeholders for testing ADS vehicles. This uniform language should include the use of the acronyms and terms such as “ADS” for “Automated Driving System”, and “ADS vehicle”.
  - 5.2.2 Place a notation on the registration and electronic record by means of an ADS flag and an additional corresponding ADS level field for vehicles that have the capability to operate at Levels 3, 4 or 5.
  - 5.2.3 Place an “Altered” or “A” status on vehicles not equipped with automated technologies by the OEM but have aftermarket components as aftermarket-altered automated technologies.
  - 5.2.4 If a jurisdiction receives a notification from a manufacturer or other entity (as in MOE 5), it should update its records, accordingly, and issue a new registration for the test vehicle reflecting the change in ADS level.
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#### 5.3 Licence Plates

- 5.3.1 Jurisdictions should not require a special licence plate for ADS vehicles. However, if a jurisdiction chooses to require a special licence plate for ADS vehicle, the jurisdiction may choose to adopt the administrative, design and manufacturing specifications contained in the AAMVA License Plate Standard.
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#### 5.4 ADS Vehicle Information on New Vehicle Information Statement (NVIS)

No recommendations for jurisdictions. Recommendations in this section relate to Manufacturers and Other Entities.

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#### 5.5 Financial Responsibility

- 5.5.1 Follow current requirements for minimum liability insurance for deployed vehicles.
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#### 5.6 Compliance of deployed ADS vehicles with the Motor Vehicle Safety Act (MVSA)

- 5.6.1 Require all ADS vehicles, available to the public, to conform to all applicable standards, unless specifically exempted by Transport Canada.

## Driver Licencing Considerations

### 5.7 Driver and Passenger Roles Defined

- 5.7.1 Utilize the SAE International definitions provided in the Preface.
- 

### 5.8 Driver Training for Consumers for Deployed Vehicles

- 5.8.1 Promote consumer training on the use of ADS functions.
  - 5.8.2 Encourage communication between dealers and consumers including, but not limited to, acknowledgement of the sections in the vehicle “owner’s manual” that relate to ADS functions. The owner’s manual should contain easy to understand information for the consumer.
  - 5.8.3 Encourage manufacturers, dealers and insurance companies to provide incentives for consumers to receive proper training on the use of ADS functions.
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### 5.9 ADS Driver Training for Motor Vehicle Agency Examiners, Driver Education Programs and Private Instructors

- 5.9.1 Provide training to driver licence examiners on vehicle technologies including the operation of ADS vehicles.
  - 5.9.2 Align with future iterations of AAMVA’s International Driver Examiner Certification model training materials that include ADS vehicles.
  - 5.9.3 Require driver education curricula to contain information on ADS and to provide hands-on training in the utilization of ADS technologies.
  - 5.9.4 Establish standards for the conduct and training of driver educators and private instructors for the training of drivers on the use of ADS vehicles.
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### 5.10 Driver Licence Skills Testing with ADS

- 5.10.1 Include information on vehicle technologies and ADS in the jurisdiction’s driver’s manual, when provided by the AAMVA TMS.
  - 5.10.2 Include questions addressing ADS in the jurisdictional knowledge test, when provided by the AAMVA TMS.
  - 5.10.3 Jurisdictions should not allow the applicant to utilize convenience technologies, such as the parking assist feature, for off-road skills tests or parking maneuvers during the road test. For example, the applicant should be required to demonstrate the ability to park the vehicle.
  - 5.10.4 Allow the applicant to utilize safety critical technologies for skills tests or parking maneuvers during the road test. These technologies, such as backup or other cameras should not be disengaged for off-road testing.
  - 5.10.5 Jurisdictions should not require applicants to deactivate safety critical technologies during the testing process.
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### 5.11 Endorsements and Restrictions for Deployed Vehicles

- 5.11.1 Jurisdictions should not establish endorsements and/or restrictions on the driver’s licence at this time.
- 5.11.2 Take steps to ensure their motor vehicle laws allow for the operation of ADS Level 5 vehicles without a human driver if the vehicle cannot be operated in non-automated mode.

- 5.11.3 Take steps to ensure a licenced human driver is prepared and capable of taking control of an ADS level 3 or 4 vehicle if the vehicle requires a human driver to perform the DDT fallback.
- 5.11.4 Review their laws and regulations related to occupants of a motor vehicle, such as unsupervised children, or persons with physical or mental disabilities and adopt appropriate laws and regulations to ensure safety at each level of automation.

## CHAPTER 6: LAW ENFORCEMENT AND TRANSPORTATION SAFETY CONSIDERATIONS

### 6.1 Crash/Incident Reporting

- 6.1.1 Jurisdictions should require ADS vehicle manufacturers or other entities to:
  - a) provide to jurisdictions, within 24 hours of the collision, a preliminary report on the on the incident and any relevant information that the manufacturer may be able to share at the time, regarding potential causes of the collision; and
  - b) postpone immediately any testing activities involving any of the persons or vehicles involved until further direction is provided from the MTA or relevant agency.
- 6.1.2 Transport Canada should explore options to update the National Collision Database Dictionary (NCDB2) to support the identification and collection of ADS Level vehicle information in Canada. Canadian jurisdictions should adopt the NCDB2 or its successor, as soon as practicable.
- 6.1.3 Jurisdictions should develop and standardize the reporting process to document ADS crashes/incidents beyond the Provincial Highway Traffic Act and Motor Vehicle Accident Report. The ADS crash/incident report should identify if the ADS vehicle is being operated in autonomous mode or non-autonomous mode.
- 6.1.4 Transport Canada and jurisdictions should explore additional options to collect and/or link the NCDB collision data with other data sources that may contain the ADS Level vehicle information, including working together to build such data sources where they do not already exist.

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### 6.2 Criminal Activity

- 6.2.1 Jurisdictions that have ADS permitting requirements as described in Section 4.2 – Vehicle Permitting and Registration should require the designated test users (employees, contractors and other persons) to pass a police-conducted background check, including, but not limited to, a driver history review and a criminal history check, prior to being authorized to operate a test ADS vehicle. The cost of the background check shall be borne by the applicant.
- 6.2.2 Jurisdictions that have ADS vehicle permitting requirements as described in Section 4.2 – Vehicle Permitting and Registration should establish provisions which disqualify an agent or contractor of a manufacturer or other entity who have criminal records or a driving history that includes impaired driving, careless driving, or other significant conviction history from operating an ADS vehicle in a test environment.

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### 6.3 Distracted Driving and Fatigue

- 6.3.1 Consider the level of automation to which their careless and/or distracted driving laws will apply.

#### **6.4 Establishing Operational Responsibility and Law Enforcement Implications**

- 6.4.1 Define what enforcement actions can be taken and who or what is responsible when there is no human onboard an automated test vehicle.
  - 6.4.2 Clearly establish legal responsibility for every vehicle operating on public roads.
  - 6.4.3 For vehicles classified as ADS Levels 4 or 5, which may be operated without a licenced driver and where the driverless vehicle performs the DDT independent of human input, the registered owner should be responsible for its safe operation (N.B. this issue will continue to be discussed and may evolve over time).
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#### **6.5 First Responder Safety**

No recommendations for jurisdictions. Recommendations in this section relate to Manufacturers and Other Entities.

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#### **6.6 Assisting First Responders and Transportation Safety Investigators through Vehicle Identification**

- 6.6.1 Encourage manufacturers to permanently label the rear and sides of an ADS vehicle to better identify vehicles and improve safety and regulatory control.
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#### **6.7 Law Enforcement/First Responder Training**

- 6.7.1 Work with manufacturers' and other entities' consumer training programs to make the ADS training available to first responders at no cost to agencies.
  - 6.7.2 Work with manufacturers' and other entities' consumer training programs to make the ADS vehicle training available to first responders at no cost to agencies.
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#### **6.8 Vehicle Response to Emergency Vehicles, Manual Traffic Controls and Atypical Road Conditions**

No recommendations for jurisdictions. Recommendations in this section relate to Manufacturers and Other Entities.

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#### **6.9 System Misuse and Abuse**

No recommendations for jurisdictions. Recommendations in this section relate to Manufacturers and Other Entities.

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#### **6.10 Adherence to Traffic Laws**

- 6.10.1 Monitor the progress of the Transportation Research Board project (NCHRP20-102(07) Implications of Automation for Motor Vehicle Codes to identify traffic and other laws that may need to be repealed or revised to accommodate ADS technology.
- 6.10.2 Jurisdictions should not modify current traffic laws specifically to accommodate ADS vehicles until their development advances to the extent that such amendments and statutes are warranted.

# SUMMARY OF RECOMMENDATIONS FOR MANUFACTURERS AND OTHER ENTITIES

Manufacturers or other entities are not required to follow these recommendations, however, CCMTA and its members offer them to manufacturers and other entities to ensure the safe testing and deployment of ADS vehicles. These guidelines come from the recommendations provided in Chapters 3, 4 and 5 of the Guidelines Document.

## CHAPTER 3. CONSIDERATIONS FOR THE GOVERNANCE OF TESTING AND DEPLOYMENT OF ADS

### 3.1 Governance

- MOE 1. Manufacturers and other entities should interact cooperatively with and respond to jurisdictional ADS Committee questions and requests.

## CHAPTER 4. GUIDELINES FOR THE TESTING OF ADS VEHICLES

### Vehicle Credentialing Considerations

#### 4.2 Vehicle Permitting and Registration

- MOE 2. Testing entities should be required to notify the jurisdiction of any change in the SAE level of vehicles being tested and/or the addition of any vehicles to the testing program.

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#### 4.7 Driver and Passenger Roles Defined

- MOE 3. Manufacturers and other entities should utilize the SAE International definitions provided in the Preface.

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#### 4.8 Driver Licence Requirements for Testing by Manufacturers and Other Entities

- MOE 4. Manufacturers and other entities should complete a background check and provide/ensure appropriate training for ADS test drivers. See Section 6.2 Criminal Activity in the Law Enforcement Considerations section on background checks. Manufacturers are in the best position to determine what is “appropriate” training. As further guidance on this question, MOE’s may wish to consider the information on “driver training” provided in SAE J3018.

## CHAPTER 5. DEPLOYMENT OF ADS VEHICLES

### Vehicle Credentialing Considerations

#### 5.2 Vehicle Registration

- MOE 5. Manufacturers and other entities should notify the jurisdiction of any change in the ADS level of the vehicles.

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#### 5.4 ADS Information on New Vehicle Information Statement (NVIS)

- MOE 6. Vehicle manufacturers should reference the SAE Level 3, 4, or 5 in a new field on the NVIS to avoid confusion with existing information.

## Driver Licencing Considerations

### 5.7 Driver and Passenger Roles Defined

MOE 7. Manufacturers and other entities should utilize the SAE International definitions provided in the Preface.

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### 5.8 Driver Training for Consumers for Deployed Vehicles

MOE 8. Manufacturers and Other Entities should consider implementing learning tools, such as online/in-person/in-vehicle tutorials and training programs.

## CHAPTER 6. LAW ENFORCEMENT AND TRANSPORTATION SAFETY CONSIDERATIONS

### 6.1 Crash/Incident Reporting

MOE 9. Manufacturers should design ADS to record vehicle behaviour sensor data and the driver/vehicle interface, keep a documented process for the collection of ADS crash/incident data elements, and have the technical capability to retrieve and share the relevant recorded information.

MOE 10. Manufacturers should provide law enforcement and regulating entities with access to pre-crash/incident and post-crash/incident data for their completion of a proper investigation.

MOE 11. Manufacturers should include time stamping and GPS location in EDR data.

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### 6.2 Criminal Activity

MOE 12. The manufacturer or other entities, operating in jurisdictions not requiring ADS permits should require the designated test users (employees, contractors and other persons) to pass a background check, including, but not limited to, a driver history review and a criminal history check, prior to being authorized to operate a test vehicle.

MOE 13. The manufacturer or other entities, operating in jurisdictions not requiring ADS vehicle permits should disqualify an agent or contractor of a manufacturer or other entity who have a relevant criminal record or a criminal code driving violation from operating an ADS vehicle in a test environment.

MOE 14. Manufacturers and other entities should ensure that cybersecurity best practices are incorporated into test vehicles since these vehicles may be operated both in a closed facility and on public roads.

MOE 15. Manufacturers and other entities should ensure ADS leave an electronic fingerprint that can allow tracing of input data to whoever initiated them.

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### 6.3 Distracted Driving and Fatigue

MOE 16. Manufacturers or other entities should prohibit users from all distracting activities when testing any ADS vehicle.

MOE 17. Manufacturers or other entities should not design ADS information displays that may significantly increase driver distraction.

MOE 18. Manufacturers or other entities should educate test drivers on the effect of task monotony on vigilance and alertness, especially if they are expected to remain alert during the testing.

- MOE 19. Manufacturers and other entities should ensure test drivers are provided with frequent breaks to interrupt the monotony (e.g. every 60, 90 minutes).
- MOE 20. Manufacturers and other entities should limit the amount of hours required for testing, particularly at night and during mid-afternoon to limit test driver fatigue.
- MOE 21. Manufacturers and other entities should ensure drivers are medically fit to conduct tests and are not taking medication that can impact vigilance and alertness when conducting tests.
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#### **6.4 Establishing Operational Responsibility and Law Enforcement Implications**

- MOE 22. Manufacturers or other entities should design ADS Level 4 and 5 vehicles with a means of identifying when a vehicle is in automated mode to facilitate effective enforcement of distracted driving behaviours (i.e., so an officer knows if using a hand-held device is legal at the time of observation).
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#### **6.5 First Responder Safety**

- MOE 23. Manufacturers are encouraged to permanently identify ADS vehicles for the safety of first responders.
- MOE 24. Manufacturers should ensure ADS vehicles have safety systems or procedures which allow first responders to immobilize or otherwise disable the vehicle post-crash, to prevent movement or subsequent ignition of the vehicle for the safety of vehicle occupants and first responders.
- MOE 25. Manufacturers should make the information and procedures regarding ADS vehicles available to the first responder community in the jurisdiction where the vehicle will be operated.
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#### **6.6 Assisting First Responders and Transportation Safety Investigators through Vehicle Identification**

- MOE 26. Manufacturers should develop international consensus standards for a system of permanent labeling of ADS vehicles to ensure consistency of safety information on vehicles with automated features.
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#### **6.7 Law Enforcement/First Responder Training**

- MOE 27. Manufacturers and other entities in partnership with highway safety stakeholders should develop national or international standardized first responder training on safely interacting with vehicles and users in both the testing and deployment of ADS vehicles.
- MOE 28. Manufacturers and other entities in partnership with highway safety stakeholders should develop national or international standardized first responder training on safely interacting with vehicles and users in both the testing and deployment of ADS vehicles.
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#### **6.8 Vehicle Response to Emergency Vehicles, Manual Traffic Controls and Atypical Road Conditions**

- MOE 29. Manufacturers should ensure that ADS vehicles being operated on public roads, are able to recognize and properly respond to all temporary traffic controls and atypical hazards in the roadway environment
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#### **6.9 System Misuse and Abuse**

- MOE 30. For the purposes of supporting collision investigations, manufacturers or other entities, such as researchers and developers, should design ADS vehicles to record the behavior of the vehicle and the

driver/vehicle interface to identify the actions of the vehicle and the actions (or lack thereof) by the driver at all times during operation.

- MOE 31. Manufacturers and other entities should apply best practices human factors design procedures to define intended users, user-needs, use environments and interfaces; identify use-related hazards, identify and categorize critical tasks; and should develop and implement misuse mitigation measures and conduct validation testing on real users.
- MOE 32. For the purposes of supporting collision investigations, manufacturers should ensure the design and safety assessment data that accomplishes the recommendations in MOE 30 is stored and retrievable in some recognized, standard, non-proprietary, format for ready access by those duly authorized.
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### **6.10 Adherence to Traffic Laws**

- MOE 33. Manufacturers or other entities should ensure users of vehicles designed to operate in either automated mode or non-automated mode do not have the ability to override the ADS settings, without transitioning out of automated mode into non-automated mode, unless faced with an emergency circumstance. It should be noted here that this issue continues to be discussed with international stakeholders. As the discussions evolve, this recommendation may be revised in future iterations of this Guidelines Document.

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CCMTA would like to thank the firm of Susan Spencer & Associates Inc. for its support in the development of the Guidelines.

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