Connected and Automated Vehicles: From Testing to Deployment – Is Canada Ready?

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Canada

Outline

1. TC Research
    a) Crash Avoidance Testing
    b) Human Factors – L2 Assessments
    c) Human Factors – Lighting on Automated Vehicles
2. State of CAV operations and testing in Canada
3. Federal efforts to support CAV testing & deployment
4. Canada's participation in Development of Global CAV Regulations

1 a) Video: Crash Avoidance Testing

1 b) Human Factors Testing of SAE Level 2 Driving Automation Features

- **ACC + lane-keeping** (SAE Level 2) features are becoming standard on vehicles in Canada.
- Assistance only, so drivers must remain engaged and ready to act.
- Automation does not fully replace humans – it just changes their roles.
- Many different systems, yet limited consistency in functionality, capability, and operation.
- Intuitive Human Machine Interfaces (HMI) are essential to limiting known risks:
  - Mode confusion (who's driving?)
  - Misguided trust
  - Misuse (distraction/ drowsiness)

Display Design & Interaction

Human Machine Interface (HMI) Concerns:

- Active system status is permanently displayed.
- System mode is indicated at all times.
- Indicators for different modes (e.g. ACC active, lateral control active, L2 active) are distinguishable from each other.
- Controls can be easily reached from normal driving position (e.g. multifunction steering wheel).
- Controls (e.g. buttons) related to the system are grouped together.
- Controls are labelled.
- Messages should be easy to understand (brief, non-technical)

L2 System Interaction:

- Indication of successful system activation is given simultaneously to the driver input.
- Activation of the system out of manual driving is easy to perform (i.e. doesn't require complex driver input (e.g. by using a submenu).

Driver Monitoring & Warning

Assessment Instruction:

Take hands off steering wheel for at least 60s

Timing and escalation of hands-off warning (UNECE R79)

- ❑ Optical warning after 15s
- ❑ Acoustic warning before 30s
- ❑ Deactivation after 60s of hands-off with acoustic warning

Results

- No L2 system fully met basic human factors design requirements
- Results will help to inform guidelines, standards and regulations

1 c) Lighting for CAVs

- CAVs will need to interact safely and be acceptable to other road users.
- Pedestrians, cyclists, and human drivers require clear, unambiguous signals from vehicles at times to interact with them safely.
- Road users have indicated they may wish to distinguish between vehicles operated by humans from those operated by automation.

Overview of Research Project with UofT:

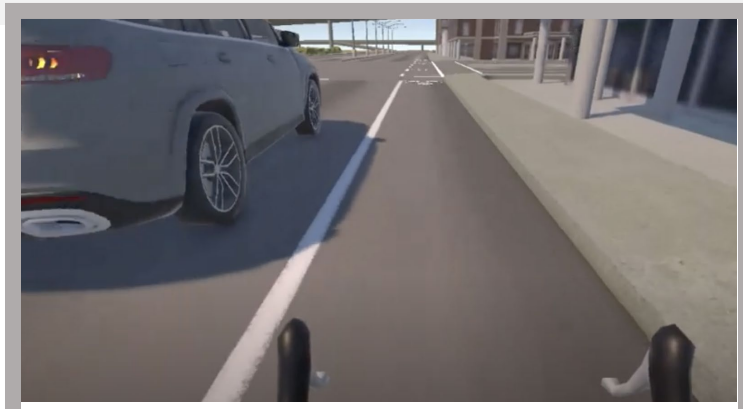
1) Literature review of CAV lighting research & scan of solutions

2) Identify promising light designs and their compliance with existing international regulations

3) A controlled study of road user comprehension, acceptance, and planned behaviours in response to:
   a) CAV lights (Cyan = automated) - with vs without lights
   b) Roles - driver, pedestrian, cyclist
   c) Scenarios - turning vehicle, pedestrian crossing, merging vehicle…

Results of CAV Lighting Study

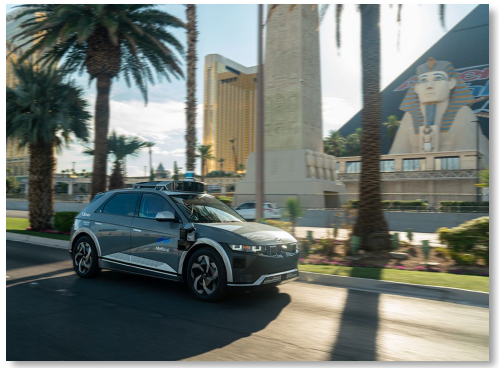
- Literature indicated that no single design has been found effective in all traffic situations (intention displays, actions, motion, status).
- Purpose of the cyan lights was not intuitive - only 1 of 24 participants guessed correctly.
- Once the meaning of the lights was explained, there was consensus that a clear indicator of automated driving mode is essential.
- Road users prefer being more cautious around CAVs.



2. State of play of AV operations

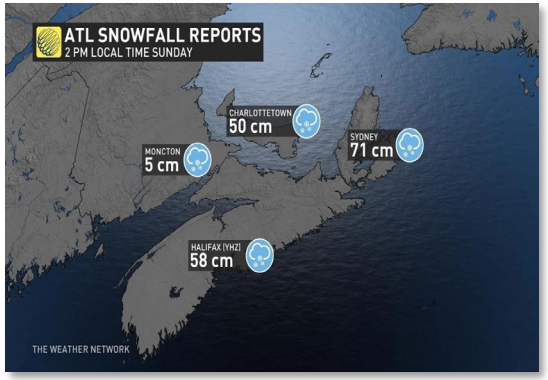
- Commercial deployment of L3 automation driving features have started in some jurisdictions (e.g., Germany, U.S.); as well as L4 robotaxi fleets (e.g., U.S., China) and L4 motor carriers (U.S. southwest).
- Winter weather remains a key challenge for wide-scale AV deployment in Canada.
- Still, industry signaling an interest in the Canadian market in the coming years, particularly those that are already active in the U.S.

How soon will this…..



…be ready for this?





Current State: ADS testing and deployment in Canada

University of Waterloo
“Autonomoose”

Low speed shuttle pilot by Keolis Canada in Candiac, Quebec

First fully driverless trial in Canada launched by Gatik in partnership with Loblaws in greater Toronto area

Most recent driverless trial announced in Canada – Magna’s Last-Mile delivery pilot in Toronto, expected to begin Spring 2025

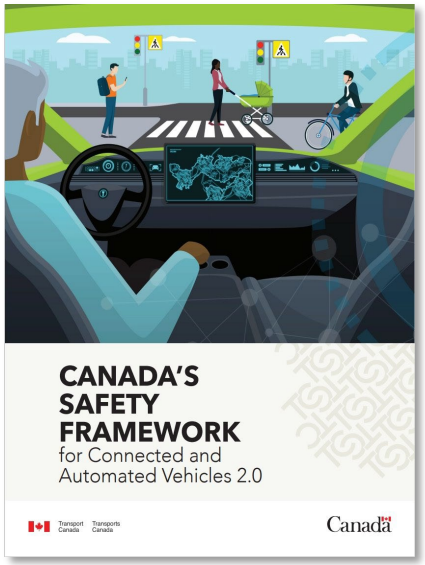
- On road trials and demonstrations of ADS have occurred in 4 provinces to date; involving approximately 20 different testing entities (OEMs, technology companies; academia etc.)

- Diverse use cases including low-speed shuttles, middle-mile freight, last-mile parcel delivery.

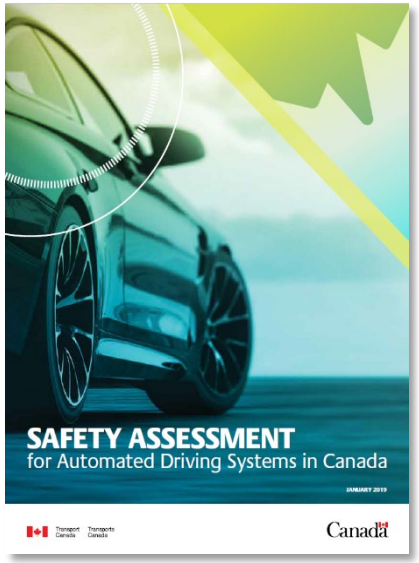
- Trial activities evolving from early developmental testing of systems to carrying out actual commercial activities as part of projects.

3. Domestic efforts to support early ADS testing and deployment

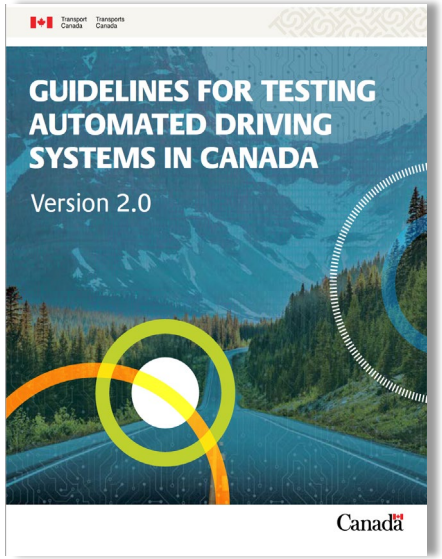
Amendments to the *Motor Vehicle Safety Act*
March 2018



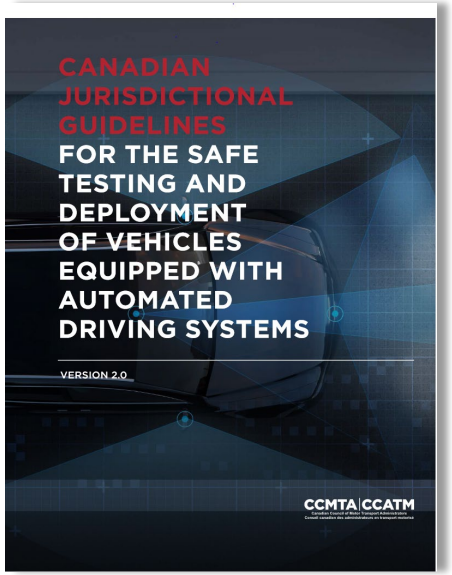
Transport Canada Safety Framework
February 2025



Safety Assessment for Automated Driving Systems
February 2019



Testing Automated Driving Systems in Canada (2.0)
August 2021



CCMTA Jurisdictional Guidelines
February 2022

UPDATE UNDERWAY

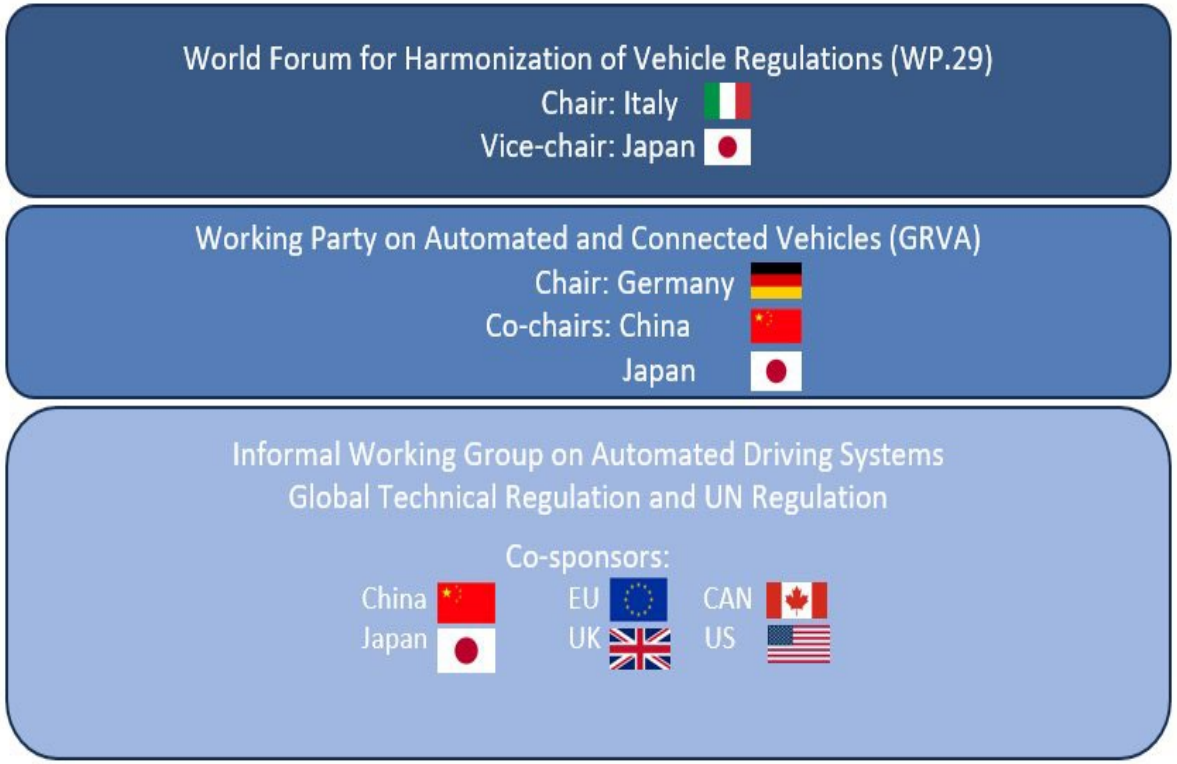
Current federal legislation (*Motor Vehicle Safety Act*) and associated regulatory framework can accommodate Automated Driving Systems (ADS) deployment **today** leveraging existing safety standards; regulatory flexibilities (e.g. exemptions); defect provisions; information gathering authorities; and non-regulatory guidance.

Documents can be accessed at **www.Canada.ca/automatedvehicles**

4. World Forum for the Harmonization of Vehicle Regulations (WP.29)

- WP 29 works under two international agreements that provide a framework to establish international regulatory instruments concerning motor vehicles and motor vehicle equipment:
  - **1958 Regulatory Agreement** –UN "Type Approval" Regulations that are followed by the EU, UK, Japan and other jurisdictions
  - **1998 Regulatory Agreement** - Global Technical Regulations (GTRs) that meet the needs of both type approval and North American self-certification regimes
- WP.29 includes six permanent Working Parties that address various aspects of motor vehicle safety:
  - Automated and Connected Vehicles (GRVA) is composed of various informal technical working groups where Canada is closely engaged
- In Fall 2023, agreement reached at WP29 to develop a Global Technical Regulation (GTR) and parallel UN Regulation building upon consolidated non-regulatory guidance completed in June 2024.
- Ambitious goal to complete GTR/UN reg by **June 2026**
- Deliberations can be followed on the following Wiki page.
  - Link to draft regulatory text

Development of a Global Technical Regulation/UN Regulation on ADS Safety



Overview of draft GTR on ADS Safety

- Requirements in the regulation are to ensure safety throughout the life of the ADS vehicle.
- Manufacturers must document and implement a safety management system - structured framework that considers safety through ADS design, development, validation and operation.
- Manufactures must prepare a safety case to demonstrate the system is free from unreasonable risk and meets requirements of the regulation, with supporting evidence.
- The GTR establishes performance requirements for the evaluation of ADS driving behaviours.
  - The ADS safety level must be as safe as a careful human driver, minimizing unreasonable safety risks to the ADS vehicle user(s) and other road users.
  - A broad range of other requirements address Dynamic Driving Task (DDT) performance, human user interactions, in-service monitoring and reporting, and other elements (e.g., cyber security, data storage system, software updates).

Considerations for domestic implementation

- Domestic implementation of the GTR will take a few years, in close consultation with provinces and territories and other stakeholders once the regulation is sufficiently mature.
- Update of TC Safety Assessment for ADS (anticipated late fall 2025)- will serve as an interim tool until ADS GTR can be adopted as a Canada Motor Vehicle Safety Standard.
- Implementation may also require new legislative authorities (still under analysis).
- TC officials look forward to working closely with CCMTA colleagues to advance a coordinated approach to AV regulation, that ensures federal/provincial/territorial requirements operate in a cohesive fashion.
- We welcome opportunities to brief provincial/territorial colleagues and any other interested stakeholders on the draft GTR text to get their early views.