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| **Comparison Table of Guidelines for Automated Driving Systems in USA, Canada, Japan, EU, Australia, and China** | | | | | | |
|  | **US (FAVP 3.0)** | **Canada** | **Japan** | **EC** | **Australia** (draft) | **China** |
| **Vision** | To improve quality of life and enhance the mobility and independence of millions of Americans, especially older Americans and people with disabilities.  To increase productivity and facilitate freight movement. To impact safety significantly, by reducing crashes caused by human error, including crashes involving impaired or distracted drivers, saving lives. | To have the safest and most efficient movement of people and goods by road in the world. Hope that the technologies will lead to a significant reduction in traffic collisions and thereby result in corresponding reduction in fatalities and injuries. | To realize society where traffic accidents caused by automated driving systems resulting in injury or death become zero | To make Europe a world leader in the deployment of connected and automated mobility, making a step-change in Europe in bringing down the number of road fatalities, reducting harmful emissions from transport and reducing congestion. |  | To promote the development of autonomous intelligence, and connected technology and industrial applications, promote the transformation and upgrading of transportation and innovation, and standardize the ICV road test management. |
| **Rules** |  |  |  |  |  |  |
| **1** | System Safety (robust design and validation process for ADS free of unreasonable safety risks - use of best practices, design principles, standards) | 5 | Safety of Automated Driving System (Ensure system safety by providing redundancy to control or sensor systems, etc. -Automatically stop a vehicle safely when it is difficult to continue automated driving, such as when the situation becomes outside of the set ODD, etc) | Safety Assessment (The Type-approval authority shall check that the manufacturer has put in place a robust design and validation process of the automated system with the goal to ensure that the vehicle complies with these guidelines in particular will not cause accident and will provide safe take over requests and minimum risk manoeuvres) System Performance in the Automated Mode (The vehicle shall not cause any traffic accidents within the OD) | As per US  +  Design for in-service maintenance and end of life. |  |
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| **2** | Operational Design Domain ( describe ODD and procedure for assessment & validation - roadway types, geographic area, speed range, environmental conditions, other domain constraints; transition to minimal risk condition) | Operational Design Domain (Expected outcome: The ADS(s) has/have a clearly defined Operational Design Domain (ODD). Domain constraints are known, and the vehicle will respond safely and predictably when the ODD is exceeded) | Setting of ODD (Set the operational design domain (specific design conditions related to the driving environment based on which an automated driving system operates properly: ODD) according to the performance of individual automated vehicles and use conditions to limit the driving environment and the way they are used) | System Performance in the Automated Mode (The manufacturer shall declare to the type-approval authority the scope of the automated mode (so called operational domain(s) (OD)) where and when the automated driving system is designed to operate. This shall include at a minimum:Road conditions (motorways/expressways, general roads, number of lanes, existence of lane marks, roads dedicated to automated vehicles, etc.) • Geographical area (urban and mountainous areas, Geofence setting, etc.) • Environmental conditions (weather, night-time limitations, etc.) • Speed range • Other conditions) | As per Canada  +  Prevention of operation outside of ODD  +  Design for in-service changes to ODD (where applicable) | Operational Design Domain（The relevant competent departments of the provincial and municipal governments select a number of typical sections of the roads within the jurisdictions for the ICV road test and announce it to the public.） |
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| **3** | Object and Event Detection and Response (documented process for assessment, testing, and validation of their ADS’s OEDR capabilities) | Object Event Detection and Response (Expected outcome: The vehicle has object event detection and response (OEDR) capabilities adapted to its ODD that enable safe and appropriate actions to be taken when subjected to day-to-day traffic conditions, as well as unexpected events) |  | System Performance in the Automated Mode (When in the automated mode, the vehicle shall have a predictable and careful behaviour and shall allow an appropriate interaction with other road users and law enforcement authorities - An automated driving system shall recognize whether or not the situation is within the set OD, and operate only in that OD - The system shall be designed to cope with any situation within the OD (environment perception capabilities, ability to take right decisions and perform the right dynamic driving tasks and interaction with other road users) without continuous supervision by the driver. The vehicle design shall ensure that the vehicle will not cause any accident within the OD) | As per Canada/EC  +  Operation when unable to meet road rules due to environment |  |
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| **4** | Fallback - Minimal Risk Condition (detection of malfunction or when operating in degraded state or outside the ODD - turn to minimal risk condition after notification of driver to resume control) | Safety Systems (Expected outcome: The vehicle is equipped with safety systems with appropriate redundancies that continuously monitor system performance, perform fault detection, signal any malfunctions, and ultimately take corrective actions or revert to a minimal risk condition when needed) | 1 | Driver / Operator / Passenger Interaction (The system shall detect when it is difficult to continue in the automated mode for instance when reaching the boundaries of the OD or in case of failure) Transition of the Driving Task (The system shall remain in the automated mode as long as the driver has not taken over, and/or will otherwise transfer to a minimum risk manoeuvre.) Minimum Risk Maneuvre (When the system determines that it is difficult to continue automated driving , it shall be able to transfer to a minimal risk condition (with or without take over request) through a minimal risk manoeuvre in accordance with national traffic rules) | As per US/Canada  /Japan/EC |  |
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| **5** | Validation Methods (development of validation methods to mitigate associated safety risks - may include a combination of simulation, test track, and on-road testing) | Testing and Validation (Expected outcome: Safety risks were considered throughout the development of the vehicle and the ADS technologies. Sufficient pre-deployment testing has been conducted and validation methods have been employed to verify performance, usability, and ensure safe integration and operation of the vehicle and ADS in day-to-day traffic, unexpected events, and various weather conditions) | Safety Evaluation (Verify and confirm safety in advance by conducting simulations, and test track and road tests in adequate combination for rationally foreseeable hazardous events within the set ODD) | Safety Assessment (The manufacturer shall in particular conduct a hazard and safety risk analysis for the automated system, its integration in the overall vehicle design and the broader transportation ecosystem and put in place adequate design and redundancy to cope with these risk and hazards (safety concept) - All design decisions shall be tested, validated and verified by the manufacturer as individual subsystem and as part of the entire vehicle architecture) | As per US/Canada  /Japan/EC  +  Includes verification for Australian specific environment (roads/ signage/  flora/fauna)  +  Design to recognize future changes to road rules | Testing and Validation （Conduct full vehicle testing in specific areas such as closed roads and sites. It meets the relevant national industry standards, the test requirements issued by the provincial and municipal governments, and the test evaluation procedures of the test applicants.） |
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| **6** | Human Machine Interface (considerations for driver, operator, occupants, external actors including other vehicles - at minimum proper function, ADS mode active, unavailable for use, malfunction, take over request) | Human Machine Interface and Accessibility of Controls (Expected outcome: Vehicle controls are accessible to users (i.e. intuitive/easy to understand). The vehicle can communicate critical messages to passengers and other road users when needed, taking into account relevant accessibility factors, needs of different passengers, and the intended use of the vehicle) | Human Machine Interface (HMI) (Install HMI that has the following functions to notify the driver or passengers of the operation status of the automated driving system - For conditional automated driving vehicles, to monitor to see if the driver is ready to take over driving from the system and issue an alarm as necessary (driver monitoring system, etc.) - For conditional full automated driving vehicles, to inform the driver or passengers (a person responsible for operation) in advance that the system has determined that it is difficult to continue automated driving and will stop the vehicle automatically) | Driver / Operator / Passenger Interaction (The vehicle shall always inform the driver (or person responsible for operation) or passengers about the operational status of the system in an unambiguous manner - If the system is designed to request the driver to take over under some circumstances, the system shall monitor permanently whether the driver is ready to take over driving from the system. It shall ensure through appropriate design (driver monitoring system, etc.) and warnings that the driver remains available to respond to take over request and prevent any foreseeable and preventable misuse by the driver in the OD) Transition of the Driving Task (The system shall be designed to enable the driver to clearly recognize the request to take over from the system) | As per US/Canada  /Japan/EC  Noting that only US and Canada refer to external actors here | Human Machine Interface（The system has two modes of manual operation and autonomous driving, and can realize mode conversion in a safe, fast and simple way with corresponding prompts to ensure that the vehicle can be instantly converted into manual operation mode under any circumstances.） |
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| **7** | Vehicle Cybersecurity (systematic and ongoing safety risk assessment, use of best practices for cyber vehicle physical systems - documentations of actions, changes, design choices, analysis and associated testing taken - report incidents to Auto-ISAC) | Cyber Security (Expected outcome: Adequate design and mitigation strategies have been developed to protect the vehicle from cyber security threats. Programs, plans, and/or operating procedures have been established to manage cyber events. Consideration should also be given to how these events are communicated to other stakeholders including government agencies to prevent similar events in the future) | Cybersecurity (Design and develop vehicles that take account of cybersecurity such as measures against automated vehicle hacking, etc. based on the most recent requirements on cybersecurity by the UN (WP.29) or other organizations) | Cybersecurity (The Vehicle shall be designed to protect the vehicle against automated vehicle hacking. See for instance the most recent requirements on cybersecurity by the UN (WP.29) or other organizations - Vehicle manufacturers shall take measures such as those related to updating of software, etc., installed in automated vehicles necessary to ensure in-use cybersecurity) | As per US/Canada  +  Design for in-service vulnerability fixes and upgrades |  |
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| **8** | Crashworthiness (new occupant protection systems if necessary for intended alternative seating configurations, crash compatibility appropriate for VRU and other vehicle types) |  |  |  |  |  |
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| **9** | Post-Crash ADS Behavior (return ADS to a safe state immediately after involved into a crash - collision notification - documentation of maintenance and repair necessary after crashes) | User Protections during Collisions or System Failures (Expected outcome: The vehicle is equipped with adequate safety features to protect users, and mitigate injuries and damages in the event of a collision or system failure. The vehicle will be brought to a safe state following a collision or system failure and convey safety critical information to passengers, first responders, and emergency services) |  |  | As per US |  |
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| **10** | Data Recording (establish a documented process for testing, validating, and collecting necessary data related to the occurrence of malfunctions, degradations, or failures in a way that can be used to establish the cause of any crash) | 17 | Installation of Data Recording Devices (Have a device that records the operational status of the automated driving system, the status of the driver, etc.) | Installation of Data Storage System (Automated vehicles should be equipped with an on-board device that records the operational status of the automated driving system and the status of the driver to determine who was driving during an accident - The data shall at least include the operation status of the automated driving system, state of the driver, information on surrounding, control information of the vehicle. Further Specific data to be recorded need further discussion - Specific requirements for data recording devices (recording time, retention time, for what purposes data is used, standardized access , how to handle personal information, etc.) need further discussion - The on-board device shall be able to cope with a vehicle crash) | As per Japan/EC  +  Stored data to be available in Australia  +  Data gathered in real-time | Data Recording  （ Data recording equipment should have vehicle status record, storage and online monitoring functions.） |
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| **11** | Consumer Education and Training (training programs for anticipated differences between conventional vehicles and ADS - operation, capabilities and behavior of ADS) | Public Education and Awareness (Expected outcome: Concrete actions have been taken to ensure common awareness of the capabilities and limitations of the ADS of the vehicle, as well as the vehicle’s safe fallback conditions. Users/drivers are aware of what is expected of them in relation to the dynamic driving task under different conditions and of the vehicle and ADS(s) maintenance requirements. Users/drivers will be informed of any changes in these expectations that arise following a system update) | Information Provision to Automated Vehicle Users (Take measures to inform the users of automated vehicles how to use the system, scope of ODD, functional limitations, etc) | Driver / Operator / Passenger Interaction (The driver shall be made aware of the use and the limits of the automated mode as well as the side tasks for the driver that may be enabled by the system) | As per US/Canada  /Japan/EC  +  Particularly on drivers safely engaging and disengaging with the ADS  +  Education for future owners (ie not the original owner) | Driver education（ The tested applicants need to carry out autonomous driving training for the driver, and make him familiar with the autonomous driving test procedures, master the automatic driving test operation method, and have the handling capability under emergency.） |
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| **12** | Federal, State, and Local Laws (documentation of process how to account for all applicable laws for design and operation of ADS as well as process for updating these requirements) |  | 14 | 20 | 1 |  |
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| **13** | 2 | Level of Automation and Intended Use (Expected outcome: The ADS(s) level(s) of automation is/are clearly defined based on SAE levels of automation found in J3016. The definition of the level of automation identifies the agent responsible for the dynamic driving task (DDT) under different circumstances and the vehicle’s intended use is clearly articulated) | 2 | 2 | 2,6,11 |  |
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| **14** | 1, 2, 5, 6, 7 | International Standards and Best Practices (Expected outcome: To the extent possible and as applicable, the vehicle and ADS complies with relevant standards and best practices, such as those developed by SAE International and the International Organization for Standardization (ISO)) | Compliance with Safety Regulations, etc. (Comply with the existing Safety Regulations for Road Vehicles related to automated driving - Compliance with related international standards such as ISO is recommended) | Safety Assessment (Automated vehicles, their systems, components and technical units shall comply to the largest extent with the existing EU Safety Regulations unless it is incompatible with the purpose of the automated vehicles) | 1 | Safety Assessment (Vehicles are required to comply with national regulations and standards other than durability, and sufficient specific area testing， and complete the testing requirements for the autonomous driving function in the test procedures.) |
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| **15** | 9 | System Updates and After-Market Repairs/Modifications (Expected outcome: In the event of a system update or after-market repair/modification, measures are in place to verify all vehicle systems continue to operate safely, and as intended) | 19 |  | 1, and as per Canada |  |
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| **16** |  | User Privacy (Expected outcome: Measures are in place to safeguard the information collected by the vehicle and ADS to protect the privacy of users) |  |  | As per Canada |  |
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| **17** | 10 | Collaboration with Government Agencies and Law Enforcement (Expected outcome: Vehicles that collect data related to collisions or other incidents share relevant information with federal and provincial/territorial law enforcement and government agencies to support investigations, including defect and collision investigations) | 10 |  | As per Canada |  |
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| **18** |  |  | Safety of vehicles used for unmanned driving services (additional requirement) (For automated vehicles used for unmanned driving services (conditional full automated driving), in addition to requirements (i) to (vi), have a camera that enables the operation control center to monitor the situation inside the vehicle, etc. and a function to automatically send a notification to the operation control center when the vehicle is stopped at emergency) | Driver / Operator / Passenger Interaction (For driverless systems, a camera and voice communication device shall be provided in the vehicle so that an operation control centre can monitor the situation inside the vehicle. A function shall be provided to send an emergency notification to the operation control centre) |  |  |
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| **19** | 9 | 15 | Safety of in-use Vehicles (Take measures such as maintenance (inspection) of automated vehicles and cybersecurity software update, etc. to ensure safety of in-use vehicles) |  | 1, and as per Japan |  |
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| **20** | 2 | 2 | 2 | System Performance in the Automated Mode (When in the automated mode ("Operational Domain"-OD), the automated vehicle drives in accordance with the traffic rules and shall replace the driver for all the situations which can be reasonably expected in the OD) | 2 |  |
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| **21** | 2 | 2 | 2 | System Performance in the Automated Mode (The OD shall be set in a way that it allows the driver to take over safely from the automated system and in compliance with the relevant traffic rules) | 2 |  |
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| **22** |  |  |  | Driver / Operator / Passenger Interaction (The activation of the automated mode shall only be possible when the conditions of the OD are met. Means shall be provided to humans (driver or if no driver, passenger) to deactivate immediately in an easy manner the automated mode. The system may however momentarily delay deactivation when immediate human deactivation could compromise safety) |  |  |
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| **23** |  |  |  | Transition of the Driving Task (The system may request the driver to take over with a sufficient lead time in particular when the system determines that it is difficult to continue automated driving, such as when the situation becomes outside the OD, or when a problem has occurred to the automated vehicle) | 6 |  |
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| **24** |  |  |  | Transition of the Driving Task (The system shall be able to determine whether or not control authority has been transferred from the system to the driver) | 3,6 |  |
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| **25** |  |  |  | Minimum Risk Maneuvre (The Minimum Risk Manoeuvre (MRM) shall comply with traffic rules. MRM settings for automated vehicles may include measures to stay in or change the lane while warning to the surrounding and automatically stop the vehicle in a safe manner. The driver may be asked to take over at the minimum risk manoeuvre (e.g. to park on the side of the road in case of level 3 lane keeping system)) | 4 |  |
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| **26** |  |  |  | Minimum Risk Maneuvre (Other road users shall be informed unambiguously that the vehicle is performing a minimum risk manoeuvre in accordance with applicable traffic rules) | 6 |  |
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| **27** | 1, 2, 5, 6, 7 | 5, 7, 14 | 1, 7, 14 | Safety Assessment (System shall in particular be designed to cope with risks that could impact safety critical functionality due to fault, cyber-attacks and failure (functional safety) but also potential inadequate control, undesirable control actions, misuse and inadequate interaction with other road users (operational safety). Relevant methods include the latest version of Annex 6 of UN Regulation 79 and ISO 26262 for functional safety and a system-theoretic process analysis (STPA) for operational safety) | 1,2,7 |  |
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| **28** |  |  | 5 | Safety Assessment and Tests (The type-approval authorities shall carry out a minimum number of check and tests to verify that the process put in place by the manufacturer for the particular type of vehicle subject to the exemption is safe from the functional and operational safety point of view - The type-approval authority and the technical services acting on its behalf shall have the necessary competences and training to carry out the vehicle safety assessment and tests) | 5 | Safety Assessment and Tests (The test vehicle automatic driving function shall be tested and verified by a third-party testing institution authorized by the state or the province to engage in automobile-related business, and the testing and verification project includes 34 scenarios of 14 functions.) |
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| **29** | 11 | 11, 15 | 19, 11 | Information Provision to Automated Vehicle Users (Vehicle manufacturers shall inform automated vehicle users of the following points using easy-to-understand materials, etc., and take measures to make them understand about them: • Operational conditions of the system, scope of OD, functional limitations • Driver’s tasks (such as the need for the driver to take over driving when the system cannot continue driving for level 3 vehicles) •Possible action to take other than driving according to the performance of the system and its operation status (for level 3 vehicles) •Information related to indications by HMI (whether or not the automated driving system is operating, etc.)  • Behaviours of the vehicle when a problem has occurred to the system •Need to conduct proper maintenance (inspection) and software update of in-use automated vehicles) |  |  |
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|  |  |  |  |  |  | Basic security Function (the autonomous driving vehicle should also have basic active safety functions such as automatic emergency braking after the autonomous driving system is turned off.) |

**Note by China:**

Autonomous driving is now stepping into a rapid development stage worldwidely. Several countries have issued guideline documents to support the development of autonomous driving technology. China is in favor of VMAD developing the guideline documents and appreciates the efforts OICA had made for collecting and comparing the guidelines from different countries.

In 2018, the Chinese government issued two specific documents in support of the application of automated driving system, which has been providing a favorable environment for automated driving vehicles to be able to test on public roads, namely the "The Management of Intelligent & Connected Vehicle Road Test" and "Intelligent & Connected Vehicle Autonomous Driving Functionality Test Specification".

The first management document puts forward the requirements for public testing in terms of the applicants, vehicles, drivers, insurance, accident handling and application procedures, which is used to improve the AD vehicle management process. The second document “Test Specification” specifies 34 test scenarios for the validation tests of 14 autonomous driving functions and implements them on the proving ground to verify the safety capability of AD vehicle before being tested on public road.

Based on the above two documents, China has supplemented the documents of the guidelines for automated driving systems in various countries and regions collected and organized by OICA, as shown in the following table.

In addition, the development of AD technology has stepped into a stage in which large-scale public road testing is in great demand, thus the guideline for navigating such operation will be beneficial to the industry in current development phase, as well as for better supporting the application of AD vehicles in the future market. Therefore, China would like to propose a specific section for public testing in this guideline document and is willing to provide any possible contribution to this work.

**Note by Australia:**

There was a strong desire in Australia for the vehicle to manage itself as much as possible in terms of not allowing operation outside of the ODD, of limiting its own operation if it could not be updated for whatever reason, and regarding end of life decommissioning of the ADS (where the vehicle may continue to operate in non-automated mode). There was also the desire that a vehicle model be validated (as an extension to general test conditions) against local Australian conditions such as signage, native animals (eg Kangaroos) etc.

The means for education of second or third owners, holding/availability of data within Australia, financial viability of the supplier of the vehicle (for liability purposes) and corporate presence in Australia are also requirements being considered for manufacturers/importers. This is beyond the vehicle approval and is more about a manufacturer approval in national legislation, but is something that hopefully could be harmonized from country to country as well.