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**Intelligent Transport Systems and coordination
of automated vehicles related activities****Revised framework document on automated/autonomous
vehicles****Note by the Secretariat***

The text reproduced below was adopted by the World Forum for Harmonization of Vehicle Regulations at its 178th session, see ECE/TRANS/WP.29/1147, para. 27. It had been prepared by the representative of China, European Union, Japan and the United States of America, to propose modifications to working document ECE/TRANS/WP.29/2019/34 (Framework document on automated/autonomous vehicles) and took into account the views expressed by the Contracting Parties.

* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/274, para. 123 and ECE/TRANS/2018/21/Add.1, cluster 3.1), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.



Framework document on automated/autonomous vehicles

1. Purpose

1. This Framework document's primary purpose is to provide guidance to WP.29 subsidiary Working Parties (GRs) by identifying key principles for the safety and security of automated/autonomous vehicles of levels 3 and higher¹. The framework document also defines the work priorities for WP.29 and indicates the deliverables, timelines and working arrangements for those certain work products related to those priorities.

2. Working Principles

2. Technical provisions and/or guidance and resolutions for automated/autonomous vehicles shall be conducted within the contexts of both the 1958 Agreement and 1998 Agreement.

3. Technical provisions, guidance resolutions and evaluation criteria for automated vehicles will to the extent possible, be performance based, technology neutral, and based on state of the art technology while avoiding restricting future innovation.

4. Existing standards/guidelines of the contracting parties and in standardization bodies shall be reviewed as well as previous work and reference documents agreed in UNECE.

5. This document shall be approved and managed by WP.29 as specific work items are expected to be prepared in multiple GRs with extensive cross-coordination between them. The implementation of each work item shall be monitored at each WP.29 session under a dedicated agenda item. Furthermore, this document shall be reviewed once a year and be updated, if necessary.

3. Safety Vision

6. WP.29 recognizes that for automated/autonomous vehicles to fulfil their potential in particular to improve road transport, then they must be placed on the market in a way that reassures road users of their safety. If automated/autonomous vehicles confuse users, disrupt road traffic, or otherwise perform poorly then they will fail. WP.29 seeks to avoid this outcome by creating the framework to helping to deliver safe and secure road vehicles in a consistent manner, and to promote collaboration and communication amongst those involved in their development and oversight.

7. The level of safety to be ensured by automated/autonomous vehicles implies that "an automated/autonomous vehicle shall not cause any non-tolerable risk", meaning that automated/autonomous vehicle systems, under their automated mode ([ODD/OD]), shall not cause any traffic accidents resulting in injury or death that are reasonably foreseeable and preventable. Based on this principle, this framework sets out a series of vehicle safety topics to be taken into account to ensure safety.

4. Key issues and principles to be considered by WP29 subsidiary bodies as a priority

8. The following list of issues and principles will guide discussions and activities on automated/autonomous vehicles within WP.29 and each of its relevant subsidiary Working Parties. The aim is to capture the shared interests and concerns of regulatory authorities, provide the general parameters for work, and to provide common definitions and guidance.

9. The following is a list of common principles with brief descriptions and explanation. It is expected these would form the basis for further development.

- a. *System Safety*: When in the automated mode, the automated/autonomous vehicle should be free of unreasonable safety risks to the driver and other road users and ensure compliance with road traffic regulations.

¹ See Automated Driving definitions referenced in WP.29 ECE/TRANS/WP.29/1140, adopted in March 2018.

- b. *Failsafe Response*: The automated/autonomous vehicles should be able to detect its failures or when the conditions for the [ODD/OD] are not met anymore. In such a case the vehicle should be able to transition automatically (minimum risk manoeuvre) to a minimal risk condition.
- c. *Human Machine Interface (HMI) /Operator information*: Automated/autonomous vehicle should include driver engagement monitoring in cases where drivers could be involved (e.g. take over requests) in the driving task to assess driver awareness and readiness to perform the full driving task. The vehicle should request the driver to hand over the driving tasks in case that the driver needs to regain a proper control of the vehicle. In addition, automated vehicle should allow interaction with other road users (e.g. by means of external HMI on operational status of the vehicle, etc.)
- d. *Object Event Detection and Response (OEDR)*: The automated/autonomous vehicles shall be able to detect and respond to object/events that may be reasonably expected in the [ODD/OD].
- e. *Operational Design Domain (ODD/OD)] (automated mode)*: For the assessment of the vehicle safety, the vehicle manufacturers should document the OD available on their vehicles and the functionality of the vehicle within the prescribed OD. The OD should describe the specific conditions under which the automated vehicle is intended to drive in the automated mode. The OD should include the following information at a minimum: roadway types; geographic area; speed range; environmental conditions (weather as well as day/night time); and other domain constraints.
- f. *Validation for System Safety*: Vehicle manufacturers should demonstrate a robust design and validation process based on a systems-engineering approach with the goal of designing automated driving systems free of unreasonable safety risks and ensuring compliance with road traffic regulations and the principles listed in this document. Design and validation methods should include a hazard analysis and safety risk assessment for Automated Driving System (ADS), for the OEDR, but also for the overall vehicle design into which it is being integrated and when applicable, for the broader transportation ecosystem. Design and validation methods should demonstrate the behavioural competencies an Automated/autonomous vehicle would be expected to perform during a normal operation, the performance during crash avoidance situations and the performance of fall back strategies. Test approaches may include a combination of simulation, test track and on road testing.
- g. *Cybersecurity*: The automated/autonomous vehicle should be protected against cyber-attacks in accordance with established best practices for cyber vehicle physical systems. Vehicles manufacturers shall demonstrate how they incorporated vehicle cybersecurity considerations into ADSs, including all actions, changes, design choices, analyses and associated testing, and ensure that data is traceable within a robust document version control environment.
- h. *Software Updates*: Vehicle manufacturers should ensure system updates occur as needed in a safe and secured way and provide for after-market repairs and modifications as needed.
- i. *Event data recorder (EDR) and Data Storage System for Automated Driving vehicles (DSSAD)*: The automated/autonomous vehicles should have the function that collects and records the necessary data related to the system status, occurrence of malfunctions, degradations or failures in a way that can be used to establish the cause of any crash and to identify the status of the automated/autonomous driving system and the status of the driver. The identification of differences between EDR and DSSAD to be determined.

Additional issues not listed in the currently agreed WP29 priorities

- j. *Vehicle maintenance and inspection*: Vehicle safety of in-use vehicles should be ensured through measures such as related to maintenance and the inspection of automated vehicles etc. Additionally, vehicle manufacturers are encouraged to have documentation available that facilitates the maintenance and repair of ADSs after a crash. Such documentation

would likely identify the equipment and the processes necessary to ensure safe operation of the automated/autonomous vehicle after repair.

- k. *Consumer Education and Training:* Vehicle manufacturers should develop, document and maintain employee, dealer, distributor, and consumer education and training programs to address the anticipated differences in the use and operation of automated vehicles from those of conventional vehicles.
 - l. *Crashworthiness and Compatibility:* Vehicle manufacturers should develop, document and maintain employee, dealer, distributor, and consumer education and training programs to address the anticipated differences in the use and operation of automated vehicles from those of conventional vehicles.
 - m. *Post-crash AV behavior:* Automated/autonomous vehicles should be able to return to a safe state immediately after being involved in a crash. Things such as shutting off the fuel pump, removing motive power, moving the vehicle to a safe position off the roadway, disengaging electrical power, and other relevant actions should be considered. A communication with an operations center, collision notification center, or vehicle communications technology should be used.
10. The annex contains the full consolidated list of safety aspects in the guidelines of Contracting Parties.

Table 1

Detailed WP.29 work priorities related to automated/autonomous vehicles

<i>Title</i>	<i>Description of work / ECE/TRANS/WP.29/2019/2</i>	<i>Corresponding principles/elements</i>	<i>Allocation to</i>	<i>Main targets</i>	<i>Activities</i>		<i>Deliverable/ Deadline for submission to WP29</i>
					<i>Current activities</i>	<i>Future Activities</i>	
Functional Require-ments for automated/ autonomous vehicles)	This work item should cover the functional requirements for the combination of the different functions for driving: longitudinal control (acceleration, braking and road speed), lateral control (lane discipline), environment monitoring (headway, side, rear), minimum risk manoeuvre, transition demand, HMI (internal and external) and driver monitoring. This work item should also cover the requirements for Functional Safety.	a. System safety b. Failsafe Response c. HMI /Operator information d. OEDR (Functional Requirements)	GRVA/ ACSF informal group New informal group	Automated / Autonomous vehicles	ACSF /ALKS Functional requirements for Lane Keeping systems of SAE levels 3/4 (New UN Regulation for contracting parties to the 1958 Agreement)		March 2020
						Common functional requirements on existing national/regional guidelines and other relevant reference documents (1958 and 1998 Agreements)	March 2020
New assessment / Test method	Multi-pillar concept: Audit, simulation, electronic system compliance, digital identity, test track, real world driving evaluation. This work item should also cover the assessment of Functional Safety.	d. OEDR (Assessment Method) f. Validation for System Safety (including CEL)	GRVA/ VMAD informal group	Automated / Autonomous vehicles		The test and assessment method, (including CEL) for Lane Keeping systems of SAE levels 3/4 as New UN Regulation for contracting parties to the 1958 Agreement]	March 2020
					New assessment /Test method of AD	Review of the existing and upcoming methods and a proposed way forward for the assessment of AD	March 2021 March 2020

Title	Description of work / ECE/TRANS/WP.29/2019/2	Corresponding principles/elements	Allocation to	Main targets	Activities		Deliverable/ Deadline for submission to WP29
					Current activities	Future Activities	
						CEL for AD	March 2021
Cyber security and (Over-the-Air) Software updates	Work of Task Force on Cyber Security and (OTA) software updates (TF CS/OTA) ongoing. Draft recommendations on the approach (based on draft technical requirements).	g. Cybersecurity h. Software Updates	GRVA Cyber/software update informal group	Conventional and Automated / Autonomous vehicles	Test phase on the draft requirements under 1958 Agreement Review of draft set of technical requirements for 1998 CPs	Review of the report of the test phase on the draft requirements	November 2019 November 2019
Data Storage System for Automated Driving vehicles (DSSAD)	DSSAD are for autonomous vehicles (e.g. accident recoding). This work item should take into consideration of the discussion at GRVA and its Informal Working Group on Automatically Commended Steering Function (IWG on ACSF). Clear objectives, deadline and the identification of differences with EDR to be determined first before discussion on detailed data information.	i. EDR/DSSAD	First: GRVA Later: GRSG (in coordination with GRVA) New EDR/DSSAD informal group	Automated / Autonomous vehicles		Clear objectives, deadline and the identification of differences with EDR DSSAD requirements for Lane Keeping systems of SAE levels 3/4 as New UN Regulation for contracting parties to the 1958 Agreement Review of the existing national / regional activities and a proposed way forward for DSSAD	November 2019 March 2020 March 2020
Event Data Recorder (EDR)	Existing systems - as road safety measure (e.g. accident recoding).	i. EDR/DSSAD	GRSG New EDR/DSSAD informal group	Conventional and Automated / Autonomous vehicles		Clear objectives, deadline and the identification of differences with DSSAD	November 2019

<i>Title</i>	<i>Description of work / ECE/TRANS/WP.29/2019/2</i>	<i>Corresponding principles/elements</i>	<i>Allocation to</i>	<i>Main targets</i>	<i>Activities</i>		<i>Deliverable/ Deadline for submission to WP29</i>
					<i>Current activities</i>	<i>Future Activities</i>	
						Review of the existing national /regional activities and a proposed way forward for EDR	March 2020
						Technical requirements on EDR.	November 2020