

AV Principles Document

Introduction and Purpose

The following set of principles are intended to facilitate and guide all discussions and activities on automated vehicle performance within WP.29 and each of its relevant subsidiary Working Parties. The goal is to capture the shared interests and concerns of regulatory authorities, provide the general parameters for our work, and provide common definitions and guidance to all interested stakeholders both within WP.29 and beyond.

The guiding principle of the document is to identify the mutual interests of all stakeholders based upon the premise that everyone wants automation to fulfill its potential to vastly improve road transportation. Achieving this goal requires public acceptance of automated vehicles based upon safe and trustworthy performance. If automated vehicles confuse users, disrupt traffic, or otherwise perform poorly, they will fail to earn the public's trust. The framework's primary purpose is to provide a comprehensive guidance document for the activities of WP 29 and its subsidiary bodies that all WP.29 contracting parties and interested stakeholders can use to guide their individual activities and to promote collaboration and communication.

Working Principles

- 1) This document shall be approved, managed and administered at the WP.29/AC.3 level because the anticipated scope of work is expected to take place in multiple GRs with extensive cross-coordination between them.
- 2) Research, development and harmonization of provisions and/or guidance resolutions for automated vehicle shall be conducted under the 1958 agreement and 1998 agreements.
- 3) The technical provisions and guidance resolutions for automated vehicle will be technology neutral, based on the current state-of-the-art, avoid restricting future innovation.

Safety Vision

This document sets a vision to realize society where traffic accidents caused by automated driving systems resulting in injury or death become zero in realizing automated driving, and clarifies the significance of promoting the development and spread of automated vehicles.

Towards the realization of this vision, the vehicle safety to be ensured by automated vehicles is defined as such that automated vehicles shall "not cause any non-tolerable risk", meaning that automated vehicle systems, under their operational design domain (ODD), shall not cause any traffic accidents resulting in injury or death that are rationally foreseeable and preventable. Based on this definition, this guideline sets forth vehicle safety requirements to be met by automated vehicles to ensure their safety.

Performance Principles/Elements

This is the consolidated list of all the Contracting Parties that have issued or plan to issue safety guidelines. The elements constitute a master list of principles or performance elements from which WP.29 (or any other UN body or interested stakeholder) may extract or derive its agenda for work. For example, we hope this document could eventually be used to facilitate collaboration with WP.1 and traffic authorities.

Each element section includes a description of the element and why that element is significant (e.g., description and explanation). For example, occupant protection (crashworthiness/passive safety) has several important aspects. At present, AVs still need to meet conventional occupant safety requirements.

No matter how well a vehicle avoids causing a crash, AVs can still be victims of crashes. But crashworthiness also can relate to unconventional seating positions where stakeholders need to ensure occupant protection comparable with that of forward-facing conventional seating. This section should cover these kinds and related safety risks.

An element is a generic concern, not a specific technical issue. In other words, an element might be “Operation Design Domain Definition” described in broad terms as providing clear boundary conditions to govern when a system shall and shall not be operational. Obviously, ODD definition is essential in understanding how to assess performance of a given system. The element section does not delve into detailed recommendations, prioritize areas, or otherwise get into issues that would require extensive discussions, negotiations, or research to justify. The idea of the document is to surface all items of interest, explaining why they are of interest so the stakeholder understands what should be taken into consideration in the area of interest.

The following is the list of common Principles or Performance Elements among Contracting Parties:

1. **Operational Design Domain(ODD) Definition:** Entities should define and document the ODD for each ADS available on their vehicles as tested or deployed for use on public roadways, as well as document the process and procedure for assessment, testing and validation of ADS functionality with the prescribed ODD. The ODD should describe the specific conditions under which a given ADS or feature is intended to function. The ODD 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.
2. **Functional Requirements for automated /autonomous vehicles**
 - a. **System Safety:** Entities are encouraged to follow 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 traffic regulations and their own internal specifications. Design and validation methods should consider including a hazard analysis and safety risk assessment for ADS, for the overall vehicle design into which it is being integrated and when applicable, for the broader transportation ecosystem.
 - b. **Failsafe Responses:** Entities engaged in testing or deployment should ensure the ADS have a documented process for handover the driving tasks to the driver or transitioning to a minimal risk condition when a problem is encountered or the ADS cannot operate safely. Entities engaged in testing or deployment should ensure the ADS has a mechanism to handover the driving tasks to the driver or transition to a minimal condition.
 - c. **Human Machine Interface/Operator information:** Entities should consider whether it is reasonable and appropriate to incorporate driver engagement monitoring in cases where drives could be involved in the driving task to assess driver awareness and readiness to perform the full driving task. In addition, entities should consider external HMI, such as communication with other traffic participants regarding operational status, etc. Entities are encouraged to consider and document a process for the assessment, testing and validation of the vehicle’s HMI interface.
3. **New assessment /Test method**
 - a. **System Safety (reshown):** Entities are encouraged to follow 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 traffic regulations and their own internal specifications. Design and validation methods should consider including a hazard

analysis and safety risk assessment for ADS, for the overall vehicle design into which it is being integrated and when applicable, for the broader transportation ecosystem.

- b. *Object Event Detection and Response (OEDR)*:** Entities are encouraged to have a documented process for assessment, testing and validation of their ADS' OEDR capabilities.
- c. *Validation Methods*:** Entities should develop validation methods to appropriately mitigate the safety risks. Tests should demonstrate the behavioral competencies an ADS would be expected to perform during a normal operation, the ADS' performance during crash avoidance situations and the performance of fallback strategies relevant to the ADS' ODD. Test approaches may include a combination of simulation, test track and on road testing.
- 4. *Cybersecurity*:** Entities should design their ADSs following established best practices for cyber vehicle physical systems and document 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.
- 5. *Software Updates*:** Entities should ensure system updates occur as needed and provide for after-market repairs and modifications as needed. Software upgrade should only be done with the consent of the user and in the case of ensuring vehicle safety. In the event of a system update or after market repair, entities should ensure measures are in place to verify all vehicle systems continue to operate safely and as intended. [Description on over the air: TBD]
- 6. *Event Data Recorder*:** [Description: TBD]
- 7. *Data Storage System for Automated Driving vehicles (DSSAD)*:** Entities engaged in testing or deployment should 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.
- 8. *Occupant Protection and Compatibility*:** Entities should consider incorporating information from the advanced sensing technologies needed for ADS operation into new occupant protection systems that provide enhanced protection to occupants of all ages and sizes. In addition to the seating configurations evaluated in current standards, entities are encouraged to evaluate and consider additional countermeasures that will protect all occupants in any alternative planned seating or interior configurations during use.
- 9. *Post-Crash ADS Behavior*:** Entities engaged in testing or deployment should consider methods for returning ADSs to a safe state immediately after being involved in a crash (i.e.: shutting off the fuel pump, disengaging electrical power, and other actions that would assist the ADS).
- 10. *Remote operation (e.g., unmanned urban transport pods)***
- 11. *Safety of In-Use Vehicles*:** Entities should ensure safety of in-use vehicles, measures related to maintenance (inspection) of automated vehicles etc.
- 12. *Consumer Education and Training*:** Entities are encouraged to develop, document and maintain employee, dealer, distributor, and consumer education and training programs to address the anticipated differences in the use and operation of ADSs from those of conventional vehicles.