	Original draft text	Comments/Proposals	Discussion Outcome(s)
1	Introduction		
2	In 2015, the World Forum for Harmonization of Vehicle Regulations (WP.29) established a programme under the Intelligent Transport Systems (ITS) informal working group to focus on automated driving (ITS/AD).		
3	During its 174th (March 2018) session, WP.29 approved a proposal from the ITS/AD informal group for a "Reference document with definitions of Automated Driving under WP.29 and the General Principles for developing a UN Regulation on automated vehicles".[1]		
4	In March 2018, ITS/AD established a Task Force on Automated Vehicle Testing (TFAV) "to develop a regulatory testing regime that assesses a vehicle's automated systems so as to realise the potential road safety and associated benefits under real life traffic conditions".[2]		
5	TFAV established subgroups to consider AV assessment methods: • Physical certification tests and audit • Real-world test drive.		

[1] ECE/TRANS/WP.29/2018/2 as amended by paragraph 31 of the session report ECE/TRANS/WP.29/1137 and consolidated in ECE/TRANS/WP.29/1140.
[2] TFAV-02-12

	Original draft text	Comments/Proposals	Discussion Outcome(s)
6	In October 2018, TFAV proposed creating an informal working group on Validation Methods for Automated Driving (VMAD) "to develop methods to assess the safety of driving performance of automated driving systems including safe responses to the environment as well as safe behaviour towards other road users": • In a controlled environment, • Via audit of OEM processes, • Under simulation and virtual testing, and • Under real-world conditions.		
7	During its 178th (June 2019) session, WP.29 approved a Framework Document on Automated/Autonomous Vehicles.[3]		
8	The Framework Document provides "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 higher."[4]		

[3] ECE/TRANS/WP.29/2019/34/Rev.2 and ECE/TRANS/WP.29/1147 Annexes V and VI.

[4] The Framework Document refers back to the Automated Driving definitions provided in the reference document ECE/TRANS/WP.29/1140 noted in para. 1.2. The reference document cites SAE J3016:2016 as its source for establishing levels of driving automation (1-5).

	Original draft text	Comments/Proposals	Discussion Outcome(s)
9	The Framework Document established a safety vision and identified key issues and principles for work under WP.29: • System safety • Failsafe response • Human Machine Interface/operator information • Object and Event Detection and Response • Operational Design Domain • Validation for System Safety • Cyber security • Software updates • Event Data Recorder and Data Storage System for Automated Driving.		
10	The Framework Document identified three additional issues not listed in the agreed WP.29 priorities: • Remote operation • Safety of in-use vehicles • Consumer education and training		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
11	Table 1 of the Framework Document allocated work on these WP.29 priorities across several informal working groups: • Functional Requirements for Automated Vehicles (FRAV) • Validation Methods for Automated Driving (VMAD) • Cyber Security and Over-the-Air Software Updates (CS/OTA) • Event Data Recorders/Data Storage Systems for Automated Driving (EDR/DSSAD).		
12	Terms of reference mandated FRAV to develop functional (performance) requirements for automated vehicles, addressing: • System safety • Failsafe Response • HMI /Operator information • OEDR (functional requirements).[5]		
13	Terms of reference mandated VMAD to develop a new assessment/test method (NATM) "to validate the safety of automated systems based on a multi-pillar approach" including: • Scenarios • Audit • Simulation/virtual testing • Test track • Real-world testing.[6]		

[5] ECE/TRANS/WP.29/1147/Annex V.
[6] ECE/TRANS/WP.29/1147/Annex VI.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
14	During its June 2021 session, WP.29 endorsed a draft "New Assessment/Test Method for Automated Driving (NATM) - Master Document" submitted by GRVA that proposed a multi-pillar approach comprised of: • A scenario catalogue • Simulation/virtual testing • Track testing • Real world testing • Audit/assessment procedures • In-service monitoring and reporting.[7]		
15	Through subsequent revisions to Table 1 of the Framework Document, WP.29 directed FRAV and VMAD to deliver, respectively, for its June 2023 session: • Guidelines for regulatory requirements and for verifiable criteria for ADS safety validation, and • Guidelines for NATM.[8]		
16	WP.29 further directed FRAV and VMAD to collaborate and deliver a consolidated FRAV/VMAD submission (requirements and assessment methods) for its June 2024 session.		

[7] ECE/TRANS/WP.29/2021/61 (ECE/TRANS/WP.29/1159)
[8] ECE/TRANS/WP.29/2019/34/Rev.2, ECE/TRANS/WP.29/2021/151, ECE/TRANS/WP.29/2023/43.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
17	During the June 2023 session, WP.29 reviewed and endorsed documents submitted by GRVA presenting the guidelines prepared by FRAV and VMAD (per para. 1.13).[9]		
18	Between 2019 and 2023, some 200 experts participated in nearly 80 FRAV and VMAD sessions to develop this document.		
19	Scope and purpose		
20	This document aims to fulfil the FRAV and VMAD mandates and deliver the consolidated deliverable per the Framework Document described above.		
21	The document proposes guidelines and recommendations for the establishment of safety requirements and assessment methods applicable to ADS vehicles as defined in Section 3.		
22	The diversity of ADS vehicle configurations and the characteristics and constraints of their ODD present challenges in establishing harmonized requirements for worldwide use.		
23	These guidelines recommend the establishment of high-level requirements to cope with this diversity.		

[9] WP.29-190-08 (FRAV draft guidelines with pending open issues) and WP.29/2023/44/Rev.1 (VMAD guidelines)

	Original draft text	Comments/Proposals	Discussion Outcome(s)
24	The guidelines propose a framework for applying these high-level requirements to individual ADS use cases.		
25	The complexity of driving also presents challenges to the assessment of ADS performance across the diversity of possible ODD.		
26	These guidelines recommend a multi-pillar approach to ensure comprehensive and efficient validation of ADS safety.		
27	The guidelines recommend the development of a scenario catalogue for use across five validation pillars: • Audit and safety-by-design assessment • Simulation/virtual testing • Track testing • Real-world testing • In-service monitoring and reporting.	UK comment This list differs from the Overview (item 115 below): The assessment of an ADS for compliance with these safety recommendations rests on five validation pillars: 1. Documentation and audit 2. Virtual testing…	
28	These guidelines and recommendations are intended to support future initiatives that WP.29 may decide to initiate under the 1958, 1997, and/or 1998 Agreements.		
29	Usage of the verbal forms “shall” (indicating an obligatory provision) and “may” (indicating a permissive provision) in this document should be understood within the context of providing such recommendations.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
30	The guidelines recommend technology-neutral and evidence-based requirements and methods for objective, repeatable, and reproducible assessments within a framework that can adapt to technological progress.		
31	Terms and definitions		
32	This section defines terms used in this document. Use of these terms and their definitions is recommended in the development of legal requirements related to ADS and ADS vehicles.		
33	*"Abstraction"* means a process of selecting relevant aspects of a source or referent system to be represented in a model or simulation.[10]		
34	*"Automated Driving System (ADS)"* means the vehicle hardware and software that are collectively capable of performing the entire Dynamic Driving Task (DDT) on a sustained basis.[11]		

[10] Any modelling abstraction carries with it the assumption that it should not significantly affect the intended uses of the simulation tool.

[11] This definition is based on SAE J3016 and ISO/PAS 22736 (Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles). These standards define levels of driving automation based on the functionality of the driving automation system feature as determined by an allocation of roles in DDT and DDT fallback performance between that feature and the (human) user (if any). The term "Automated Driving System" is used specifically to describe a Level 3, 4, or 5 driving automation system.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
35	*"ADS feature"* means an ADS functionality designed specifically for use within an Operational Design Domain (ODD).	FRAV proposal *"ADS feature"* means an application of an ADS designed specifically for use within an Operation Design Domain (ODD).	
36	*"(ADS) function"* means an ADS hardware and software capability designed to perform a specific portion of the DDT.		
37	*"ADS vehicle"* means a vehicle equipped with an ADS.		
38	*"Behavioural competency"* means an expected and verifiable capability of an ADS feature to operate a vehicle within the ODD of the feature.		
39	*"Closed-loop testing*" means testing in an environment in which actions of the ADS hardware, software, or other element(s) in the loop influence the actions of other objects in the simulation.[12]		
40	*"Open-loop testing*" means testing in an environment in which the actions of the ADS hardware, software, or other element(s) in the loop do not affect the actions of other objects in the simulation.[13]		
41	*"Stochastic*" means a process involving or containing a random variable or variables pertaining to chance or probability.		

[12] For example, evaluating ADS interactions with other objects that respond to the actions of the ADS within a traffic model.

[13] For example, evaluating ADS interaction with a recorded traffic situation.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
42	*"Driver"* means a human user who performs in real time part or all of the DDT and/or DDT fallback for a particular vehicle.		
43	*"Dynamic Driving Task (DDT)"* means the real-time operational and tactical functions required to operate the vehicle in on-road traffic.	FRAV proposal *"Dynamic Driving Task (DDT)"* means the real-time operational and tactical functions required to operate the vehicle.	
44	The DDT is always performed in its entirety by the ADS in operation ("the entire DDT" as stated in the definition of an "Automated Driving System" under para. 3.2.) which means the whole of the tactical and operational functions necessary to operate the vehicle. These functions can be grouped into three interdependent categories: sensing and perception, planning and decision, and control.	FRAV proposal When the ADS is in operation, the DDT is always performed in its entirety by the ADS which means the whole of the tactical and operational functions necessary to operate the vehicle (i.e., the ADS performs "the entire DDT" as stated in the definition of an "Automated Driving System" under para. 3.2.). These functions can be grouped into three interdependent categories: sensing and perception, planning and decision, and control.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
45	Sensing and perception include: • Monitoring the driving environment via object and event detection, recognition, and classification. • Perceiving other vehicles and road users, the roadway and its fixtures, objects in the vehicle's driving environment and relevant environmental conditions. • Sensing the ODD boundaries, if any, of the ADS feature. • Positional awareness.		
46	Planning and decision include: • Predicting actions of other road users. • Response preparation. • Manoeuvre planning.		
47	Control includes: • Object and event response execution. • Lateral vehicle motion control. • Longitudinal vehicle motion control. • Enhancing conspicuity via lighting and signalling.		
48	The DDT excludes strategic functions.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
49	*"Strategic function"* means a capability to issue commands, instructions, or guidance for execution by an ADS.[14]		
50	*"Tactical function"* means a capability to perceive the vehicle environment and control real-time planning, decision, and execution of manoeuvres, including conspicuity of the vehicle and its motion.[15]		
51	*"Operational function"* means a capability to control the real-time motion of the vehicle.[16]		
52	*"Edge Case*" means a low-frequency occurrence that might arise within the ODD of an ADS and warrants specific design attention due to the potential severity of outcomes that might result from encountering such a situation or condition across a full-scale deployed fleet of such ADS vehicles.[17]		

[14] Examples include setting the starting point, destination, route, and way points to be used by an ADS during a trip.
[15] Examples include deciding whether to overtake a vehicle or change lanes, signalling intended manoeuvres, deciding when to initiate the manoeuvre, choosing the proper speed, and executing the manoeuvre.
[16] Operational functions involve executing micro-changes in steering, braking, and accelerating to maintain lane position or proper vehicle separation and immediate responsive actions to avoid crashes in critical driving situations.
[17] Examples include a unique road sign or an unusual animal type in the roadway.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
53	*"ADS fallback response"* means an ADS-initiated transition of control or an ADS-controlled procedure to place the vehicle in a minimal risk condition.	FRAV proposal *"ADS fallback response"* means a system-initiated deactivation to manual driving or an ADS-controlled procedure to place the vehicle in a minimal risk condition.	
54	*"DDT fallback"* means a response by the user to either perform the DDT or to achieve a minimal risk condition or a response by an ADS to achieve a minimal risk condition: (1) after the occurrence of one or more DDT performance-relevant system failures, or (2) upon an ODD exit.	OICA/CLEPA proposal *"DDT fallback"* means a response by the user to either perform the DDT or to achieve a minimal risk condition or a response by an ADS to achieve a minimal risk condition**, e.g.**: (1) after the occurrence of one or more DDT performance-relevant system failures, or (2) upon an ODD exit. SAE proposal … achieve a minimal risk condition **in situations that include**:	
55	*"Fallback user"* means a user expected to perform the DDT pursuant to a transition of control.	FRAV proposal *"Fallback user"* means a user designated to perform the DDT pursuant to an ADS fallback response.	
56	*"Minimal Risk Condition (MRC)"* means a stable and stopped state of the vehicle that reduces the risk of a crash.		
57	*"Model*" means a description or representation of a system, entity, phenomenon, or process.		
58	*"Model calibration*" means a process of adjusting numerical or modelling parameters in a model to improve agreement with a referent.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
59	*"Model parameter"* means a numerical value inferred from real-world data and used to characterise a system functionality.		
60	"*Occurrence*" means a safety-relevant event involving an ADS vehicle.		
61	"*Non-critical Occurrence*" means an operational interruption, defect, fault, or other circumstance that influenced or may have influenced ADS safety but did not result in a collision or serious incident.[18]		

[18] Examples include minor incidents, safety degradation not preventing normal operation, emergency/complex manoeuvres to prevent a collision, and more generally all occurrences relevant to the safety performance of the in-service ADS (like transfer of control, interaction with remote operator, etc.).

	Original draft text	Comments/Proposals	Discussion Outcome(s)
62	*"Critical Occurrence"* means an occurrence during which the ADS is performing the DDT and: (a) at least one person suffers an injury that requires medical attention as a result of being in the vehicle or being involved in the event. (b) the ADS vehicle, other vehicles or stationary objects sustain physical damage that exceeds a certain threshold. (c) any vehicle involved in the event experiences an airbag deployment.	OICA/CLEPA proposal *"Critical Occurrence"* means an occurrence during which the ADS is performing the DDT and **at least one of the following criteria is fulfilled**: (a) at least one person suffers an injury that requires medical attention as a result of being in the vehicle or being involved in the event **and/or** (b) the ADS vehicle, other vehicles or stationary objects sustain physical damage that exceeds a certain threshold. (c) any vehicle involved in the event experiences an airbag deployment. AAPC proposal *"Critical occurrence"* means a physical impact between an ADS vehicle and an object during ADS performance of the DDT that results in injury requiring medical attention to the ADS vehicle occupant(s) or other road user(s), a fatality thereof, and/or the deployment of an airbag.	
63	*"Operational Design Domain (ODD)"* means the operating conditions under which an ADS feature is specifically designed to function.[19]	FRAV proposal "*Operational Design Domain (ODD)*" means the operating conditions under which an ADS feature is specifically designed to function.	

[19] Examples include but are not limited to environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
64	"*ODD exit*" means: (a) the presence of one or more ODD conditions outside the limits defined for use of the ADS feature, and/or (b) the absence of one or more conditions required to fulfil the ODD conditions of the ADS feature.[20]		
65	*"Other road user (ORU)*" means an entity in the ADS vehicle environment capable of motion and of coordinated interaction with the ADS vehicle.		
66	*"Priority vehicle"* means a vehicle subject to exemptions, authorizations, and/or right-of-way under traffic laws while performing a specified function.		
67	*"Proving ground"* and "*Test track*" mean a facility closed to public traffic and designed to enable physical assessment of an ADS and/or ADS vehicle performance, including via sensor stimulation and/or the use of dummy devices.	OICA/CLEPA proposal *"Proving ground"* and "*Test track*" mean a facility closed to public traffic and designed to enable physical assessment of an ADS and/or ADS vehicle performance, **e.g.,** via sensor stimulation and/or the use of dummy devices.	
68	*"Real time"* means the actual time during which a process or event occurs.		

[20] ODD conditions are distinct from ADS capabilities. An ADS may be designed to manage transient changes in the operating environment where such transient changes do not represent an ODD exit.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
69	*"Road-safety agent"* means a human being engaged in directing traffic, enforcing traffic laws, maintaining/constructing roadways, and/or responding to traffic incidents.		
70	*"Safety case"* means a compelling, comprehensible, and valid argument, supported by a body of evidence, documenting that a system is, or will be, adequately safe for a given application in a given environment.	OICA/CLEPA proposal *"Safety case"* means an argument, supported by a body of evidence, documenting that a system is, or will be, adequately safe for a given application in a given environment. SAE proposal *"Safety case"* means a structured argument, supported by a body of evidence that provides a compelling, comprehensible, and valid case that a system is or will be adequately safe for a given application in a given environment.[21]	
71	*"Sensor Stimulation*" means a technique whereby artificially generated signals are provided to trigger the element under testing in order to produce the result required for evaluation of the element.		
72	*"Simulation"* means the imitation of the operation of a real-world process or system over time.		
73	*"Simulation toolchain*" means a combination of simulation tools that are used to support the validation of an ADS.		

[21] NASA System Safety Handbook, NASA/SP-2014-612 Version 1.0 November 2014, at 16.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
74	*"Test case specification*" means the detailed specifications of what must be done by the tester to prepare for the test.		
75	*"Test method*" means a structured approach to consistently derive knowledge about the ADS by means of executing tests.[22]		
76	*"Traffic scenario"* means a description of one or more real-world driving situations that may occur during a given trip.[23]	OICA/CLEPA proposal *"Traffic scenario"* means a description of **a sequence of** driving situations that may occur during a given trip.[24]	
77	*"Nominal scenario"* means a traffic scenario representing usual and/or expected objects, object behaviours and/or road conditions.		
78	*"Critical scenario"* means a traffic scenario representing unusual and/or unexpected objects, object behaviours, and/or road conditions.		
79	*"Failure scenario"* means a traffic scenario representing a system failure that compromises the capability of the ADS to perform the entire DDT.		

[22] For example, virtual testing in simulated environments, physical, structured testing in controlled test-facility environments, and real-world on-road conditions.
[23] Scenarios include a driving manoeuvre or sequence of driving manoeuvres. Scenarios can also involve a wide range of elements, such as some or all portions of the DDT, different roadway layouts, different types of road users and objects exhibiting static or diverse dynamic behaviours, and diverse environmental conditions (among many other factors).
[24] Scenarios include a driving manoeuvre or sequence of driving manoeuvres. Scenarios can also involve a wide range of elements, such as some or all portions of the DDT, different roadway layouts, different types of road users and objects exhibiting static or diverse dynamic behaviours, and diverse environmental conditions (among many other factors).

	Original draft text	Comments/Proposals	Discussion Outcome(s)
80	*"Functional Scenario"* means a basic traffic scenario describing a situation and its corresponding elements at the highest level of abstraction in natural, non-technical language.[25]		
81	*"Logical Scenario"* means a traffic scenario elaborated at a lower level of abstraction to include value ranges or probability distributions for each element of the corresponding functional scenario.[26]		
82	*"Concrete Scenario"* means a traffic scenario at a level of abstraction in which specific values have been selected for each element from the continuous ranges as may be defined in the corresponding logical scenario.		
83	*"Complex Scenario"* means a traffic scenario containing one or more situations that involve a large number of other road users, unlikely road infrastructure, or abnormal geographic/environmental conditions.		
84	*"Transition of control (TOC)"* means a procedure by which the ADS transfers performance of the DDT to an ADS vehicle user.		

[25] For example, a description of the ego vehicle's actions, the interactions of the ego vehicle with other road users and objects, and other elements that compose the scenario such as environmental conditions.

[26] For example, elaborating the lane element to cover possible lane widths.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
85	*"TOC request"* means an alert issued by an ADS to an ADS vehicle user prompting the user to intervene in performance of the DDT.[27]	OICA/CLEPA proposal: Delete *Current text included HMI section refers to "user-initiated TOC" and a "system-initiated TOC".*	
86	"*TOC response*" means an ADS vehicle user intervention in performance of the DDT pursuant to a TOC request.		
87	*"(ADS) User"* means a human user of an ADS vehicle.		
88	*"Useful life (of an ADS vehicle)"* means the duration during which an ADS vehicle is in an operational state under which it may be driven on public roads regardless of the operational state of the ADS.		
89	*"Validation of the simulation model*" means the process of determining the degree to which a simulation model is an accurate representation of the real world from the perspective of the intended uses of the tool.		
90	*"Verification of the simulation model*" means the process of determining the extent to which a simulation model or a virtual testing tool is compliant with its requirements and specifications as detailed in its conceptual models, mathematical models, or other constructs.		

[27] The TOC request, depending on the ADS design and reason for initiation of the transition of control, may aim to engage the user in performing the DDT (i.e., to the role of driver manually operating the vehicle) or to achieve an MRC.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
91	*"Virtual testing*" means the process of testing a system using one or more simulation models.		
92	*"Driver-In-the-Loop*" *(DIL*) means a driving simulator with components to enable the driver to operate in and communicate with the virtual environment and used to assess the human-automation interaction design.		
93	"*Hardware-In-the-Loop*" (HIL) means the hardware of a specific vehicle subsystem running the software with input and output connected to a simulation environment to replicate sensors, actuators, and mechanical components in a way that connects all the I/O of the Electronic Control Units (ECU) before the final system is integrated.	OICA/CLEPA proposal "*Hardware-In-the-Loop*" (HIL) means the hardware of a specific vehicle subsystem running the software with input and output connected to a simulation environment to replicate sensors, actuators, **and/or** mechanical components in a way that connects all the I/O of the Electronic Control Units (ECU) before the final system is integrated.	
94	*"Model-In-the-Loop*" (MIL) means high-level-of-abstraction software frameworks running on general-purpose computing systems to enable quick algorithmic development without involving dedicated hardware.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
95	*"Software-In-the-Loop"* (SIL) means a methodology where executable code such as algorithms, an entire controller strategy, or a complete software implementation is assessed within a modelling environment on general-purpose computing systems.		
96	*"Vehicle -In-the-Loop"* (VIL) means a fusion of real-world and virtual environments to assess the dynamics of a physical ADS vehicle on a vehicle test bed or a test track at the same level as real-world testing.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
97	Overview of ADS safety requirements, assessment, and validation		
98	These recommendations concern the assessment and validation of ADS safety within a regulatory context. This section summarizes key aspects of the guidelines and their application to produce an efficient, comprehensive, and coherent assessment.		
99	Driving can be viewed as an exercise in risk management within the context of achieving strategic goals. An ADS must demonstrate the competency to operate the vehicle safely, to respond to external conditions, and to manage internal failures.		
100	Moreover, the ADS must be designed to ensure safe use and the safety of its users throughout the useful life of the vehicle.		
101	These guidelines address the conditions an ADS might be expected to encounter via a framework for the development of traffic scenarios under which an ADS should be assessed. Establishment of scenarios depends primarily on analysis of the Operational Design Domain(s) (ODD) within which the ADS will operate.	Drafting Group: Cross-reference with annex on derivation of scenarios from ODD analysis.	

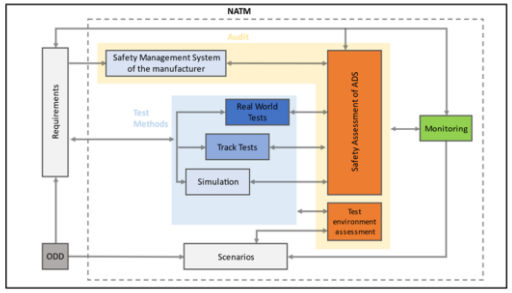
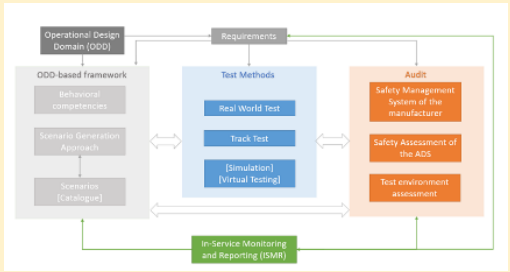
	Original draft text	Comments/Proposals	Discussion Outcome(s)
102	The framework differentiates among nominal, critical, and failure scenarios. Nominal scenarios enable assessment of the ADS competency to operate the vehicle safely. Critical scenarios enable assessment of the ADS competency to manage conflicts and mitigate external risks. Failure scenarios enable assessment of the ADS competency to manage and respond to system failures.		
103	This framework focuses on subjecting the ADS to these scenarios and assessing the behavioural competencies demonstrated by the ADS under each scenario against requirements for performance of the Dynamic Driving Task (DDT). These requirements focus on desired driving capabilities and outcomes. The requirements intentionally avoid technical specifications and performance limits because each traffic situation requires a response appropriate to its combination of elements, risks, and available options.		
104	Under nominal scenarios, an ADS is expected to demonstrate behavioural competencies consistent with the requirements for DDT performance.	ETSC Proposal: Add One of those competencies would be the ability to avoid getting into critical situations through the exercise of careful and competent driving such that, when there is an elevated risk of the occurrence of a critical situation, the vehicle's driving behaviour should be adjusted accordingly.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
105	However, critical scenarios may present conditions where requirements must be prioritised and exceptions to requirements may be necessary. In these cases, the framework proposes safety models to enable assessment of ADS performance within the limits of the safety model(s). For example, an ADS might execute an evasive manoeuvre to avoid a collision or might not be able to avoid a collision given scenario parameters. The ADS performance can be evaluated against one or more safety models that establish the feasibility of collision avoidance and thresholds for prioritising avoidance over other requirements.	OICA/CLEPA proposal However, defining performance criteria in critical scenarios may prove difficult, especially in those conditions where requirements must be prioritised. In these cases, the framework introduces safety models to compare the overall ADS performance to those of the safety model(s). For example, it is recognised that the ADS may not be able to avoid a collision, so the ADS performance needs to be compared with safety model performance to set the threshold between where avoidance is required and where it is not feasible, and if mitigation may be possible	
106	In cases where the behavioural competency demonstrated by the ADS involves such exceptions, the framework relies on safety models to determine whether the exceptions are justified (chapter/annex). For example, an ADS might violate a lane restriction in order to avoid a collision. The safety model enables determinations on the collision risk, the ADS response, and the necessity of the traffic-rule violation.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
107	Failure scenarios address situations where the ADS performance of the DDT has been compromised by a system fault. Unless a fallback user manages the response to the fault, the ADS is expected to bring the vehicle to a safe, stopped condition (i.e., a minimal risk condition). However, depending on the severity of the fault, the safety requirements allow the ADS to adapt its performance of the DDT to the nature of the fault. This tolerance permits an ADS where possible to mitigate risks while reaching a safe location to stop the vehicle.		
108	The guidelines recommend consolidation of these scenarios into a scenario catalogue that may be used under the NATM to systematically validate the safety of an ADS.		
109	These guidelines address the safety of ADS vehicle users via sets of requirements aligned with the relationships that users might have with a given ADS during use of the ADS vehicle. These relationships can vary depending on whether a user is located inside or outside the ADS vehicle, the degree(s) of control that a user may exercise over the vehicle during a trip, and whether a user has a one-to-one relationship with a single vehicle or may be performing functions relative to multiple vehicles.	Drafting Group: Cross reference with chapter or annex on user-safety recommendations.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
110	These guidelines specifically address one-to-one vehicle relationships of users located inside an ADS vehicle (i.e., driver, fallback user, and passenger). The recommendations for user safety differentiate among these user relationships and therefore, differentiate applications of ADS technologies across vehicle designs.		
111	Regardless of any assistance systems, drivers perform the DDT until they activate an ADS feature. An ADS feature is specific to an ODD. Activation of an ADS feature initiates ADS performance of the tactical and operational functions required to perform the entire DDT within the ODD of the feature. In the context of the driver relationship, the vehicle is moving (i.e., the user is driving the vehicle) and the activation involves a transition of control over vehicle operation from the driver to the ADS.		
112	Upon activation of a feature, the ADS performs the entire DDT necessary to operate the vehicle within the ODD of the feature. The driver, therefore, shifts to the role of fallback user. The ADS may transition control back to this user (i.e., fall back upon this user) in the event that the ADS can no longer perform the DDT (e.g., prior to reaching the boundary of the ODD of the feature in use).	UK comment They could also take on the role of a passenger. A user in a L4 vehicle who will not be asked to perform the DDT is a passenger even if the vehicle has manual controls. If they do choose to take control, they stop being a passenger and become a driver, so the following paragraph remains correct.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
113	A passenger has no capabilities to perform the DDT. Nonetheless, passengers require means to select destinations, routes, and stops and therefore have necessary interactions with the ADS.		
114	These guidelines propose principles and specifications to ensure the safety of users and their use of ADS vehicles across these relationships. The guidelines recognise that additional relationships may need consideration in the further development of such safety requirements.		
115	The assessment of an ADS for compliance with these safety recommendations rests on five validation pillars: 1. Documentation and audit 2. Virtual testing 3. Track testing 4. Real-world testing 5. In-service monitoring and reporting.	UK comment This list differs from the Introduction (item 27 above): The guidelines recommend the development of a scenario catalogue for use across five validation pillars: • Audit and safety-by-design assessment • Simulation/virtual testing…	
116	These pillars are intended for use in combination(s) to produce an efficient, comprehensive, and coherent assessment of ADS compliance with the guidelines on safety performance. Figure [1] below illustrates relationships across the ADS safety requirements, ODD analysis and scenario generation, and the validation pillars.	UK comment Some commentary around the links on this diagram would be helpful.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
117	*Figure 1. Relationships across safety requirements, ODD analysis and scenario generation, and validation pillars* 	OICA/CLEPA proposal 	
118		OICA/CLEPA proposal (4 paras.) Figure [1] provides an holistic overview of the interconnections of the ADS functional requirements, the scenario generation approach and [applicable] validation pillars.	
119		In the figure above, the operational design domain underpins the application of relevant requirements and provide an input to the scenario generation approach.	
120		It is recognised that some requirements are specific enough and/or ODD independent and therefor can be assessed directly by means of one of the test methods and/or audit, as shown.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
121		Besides, others need to be further specified, in relation to the operational design domain of the ADS, including e.g. relevant elements and their attributes, and specific rules of the road. Therefore, these requirements need to be specified through the application of the ODD based framework approach and relevant scenarios identified (Annex 2 "ODD Framework").	
122	The pillars concern Audit, Test Methods, and In-Service Monitoring and Reporting.		
123	*Audit*		
124	ADS technologies generate diverse vehicle configurations, intended uses, and limitations on use across operating environments. Therefore, the assessment of an ADS vehicle must be based on a clear understanding of the ADS to be evaluated.		
125	Under these guidelines, the manufacturer is required to furnish documentation covering: • The ODD of each ADS feature • Traffic scenarios relevant to each ODD • Manufacturer's validation of the ADS • ADS design safety • Manufacturer's ADS safety management system		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
126	The Audit pillar concerns the evaluation of this documentation to verify the robustness of the manufacturer's development and validation of the ADS and capabilities to assure ADS safety after deployment	Drafting: Cross reference with chapter and/or annex(es) on audit pillar.	
127	*Test Methods*	UK comment: Maybe include separate sub heading for the three test methodologies.	
128	Virtual testing provides means to assess ADS performance across a wide range of traffic scenarios efficiently. These guidelines recommend procedures for evaluating the reliability of the manufacturer's virtual testing tool chains and methodologies. This credibility assessment enables confidence in applying these tools and methods, and the evidence they generate, to the assessment of ADS safety (chapter/annex).	UK comment Would it be better to promote the concept of a successful "credibility assessment". Overall, the term is probably too well embedded now but it seems to be used in slightly different ways throughout the documents. I would prefer to refer to the guidelines providing a "simulation (credibility) framework" and then the review would be an assessment of that framework. Ideally, I would like to drop the term "credibility completely" and adopt management system terminology. One aspect of the audit would effectively be the acceptance of the "Modelling & Simulation management system (M&SMS)". Drafting: Cross reference with chapters and/or annex(es) on credibility assessment.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
129	Virtual testing uses different types of simulation toolchains to assess compliance of an ADS with safety requirements across a wide range of traffic scenarios, including some of which would be difficult (if not impossible) to reproduce in physical settings.		
130	The toolchain methodologies include (but are not necessarily limited to): • Model in the Loop (MIL) • Software in the Loop (SIL) • Hardware in the Loop (HIL) • Vehicle in the Loop (VIL) • Driver in the Loop (DIL)		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
131	Virtual testing enables efficient assessment across nominal, critical, and failure scenarios and ranges of parameters within scenarios relevant to the ADS configuration, intended uses, and limitations on use, including determination of the boundaries between collision avoidance and crash mitigation. Virtual testing also enables assessment of compliance with safety requirements relevant to user interactions, especially through DIL and similar “user in the loop” methodologies.		
132	Virtual testing enables identification of scenarios that result in exceptions to nominal DDT performance requirements (e.g., deviation from traffic rules, evasive manoeuvres, collision outcomes) for assessment based on safety models.		
133	Methods of randomization of parameters and scenario composition enable ADS performance assessments under critical scenarios, including low probability events.		
134	Virtual testing enables the identification of high-value scenarios that can be applied to track testing. After ADS deployment, virtual testing can contribute to the analysis of ADS behaviours inconsistent with behavioural competencies demonstrated during the original assessment.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
135	Track testing concerns the physical assessment of ADS performance under controlled conditions on closed-access grounds. For these reasons, track testing may be best suited to assessment of ADS performance under scenarios that entail significant safety risks in case of failure to meet the requirements.		
136	Having determined performance boundaries and identified situations involving ADS responses to manage conflicts and mitigate risks under the virtual testing, concrete test scenarios can be defined for track testing based on the parameters of the corresponding virtual scenarios. Comparison of performance between a virtual test and a track test when executing the same scenario enables assessment of the accuracy of the virtual testing toolchain (see credibility assessment).		
137	Real-world testing assesses the capability of the ADS to perform the DDT and its interactions with its user(s) while in operation on public roads under real-world traffic conditions.		
138	The primary aim is to verify compliance with safety requirements for DDT performance under normal operational and road conditions and for nominal ADS interactions with its user(s).		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
139	While this method provides a high degree of environmental fidelity for testing an ADS, constraints on time, cost, controllability, reproducibility, and safety assurance limit the feasibility of covering traffic scenarios in the strict sense.		
140	Therefore, this method requires attention to designing test routes that capture predictable aspects of the ODD (e.g., road types and geometries), elements found in the related nominal scenarios (e.g., other road users, signs, and signals), and typical dynamic conditions (e.g., high/low traffic densities). The test routes should also enable verification of nominal requirements for the safety of user interactions, including prior to, at the time of, and after entering and exiting the ODD of an ADS feature.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
141	To the extent that an ADS encounters critical or failure situations during a real-world test drive, the response of the ADS, including exceptions to the nominal performance requirements, may be considered in conjunction with the outcomes of track and virtual testing.	ETSC comment This will be at odds with the real-world testing section of the NATM Guidelines, follow the forthcoming update of the guidelines. "It is recommended that real world testing assess ADS in nominal [RWT] scenarios. It is acknowledged that critical and/or failure scenarios may occur during real-world testing, but they shall not be tested on purpose. In case such scenario would occur, it shall not be excluded from the assessment." ETSC proposal To the extent that an ADS encounters critical or failure situations during a real-world test drive, the response of the ADS, including exceptions to the nominal performance requirements, may shall be considered, and may be considered in conjunction with the outcomes of track and virtual testing where deemed appropriate.	Ref: VMAD, para. 54. Specific infractions identified during real-world testing may be reviewed and/or assessed by evaluating the data gathered during that test and any data gathered during additional virtual, track and real-world testing. *(DG: Proposed text consistent with comment.)*

	Original draft text	Comments/Proposals	Discussion Outcome(s)
142	*In-Service Monitoring and Reporting*		
143	In addition to initial assessments of ADS safety, the guidelines also recommend post-deployment validation of ADS performance under an In-Service Monitoring and Reporting (ISMR) pillar.	Drafting Group: Cross reference with section [8] on ISMR. OICA/CLEPA proposal In addition to initial assessments of ADS safety, the guidelines also recommend post-deployment **assessment** of ADS performance under an In-Service Monitoring and Reporting (ISMR) pillar.	
144	The guidelines recommend that manufacturers monitor the performance of their in-service ADS vehicles and report safety-relevant information to the safety authority.		
145	The monitoring requires manufacturers to collect and analyse information representative of in-service ADS performance to: (a) Identify safety concerns, including predictive monitoring for trends indicative of emerging risks, (b) Identify instances of ADS performance inconsistent with the safety requirements and/or behavioural competencies demonstrated during the original assessment, and (c) Characterise beneficial and adverse occurrences.	UK proposal: Add (d) Ongoing validation of the safety case (/safety concept - depending on terminology used elsewhere)	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
146	The reporting requires manufacturers to inform the safety authority in the short-term and periodically concerning the above in order to: (a) Ensure the implementation of remedial actions to address the identified safety concerns, (b) Assess the impact of ADS use on road safety, (c) Improve ADS safety assessments, including addition of new traffic scenarios, and (d) Efficiently disseminate information to enable continuous improvement of ADS safety performance.		
147	As noted above, the manufacturer must evidence its capability to perform this monitoring of its ADS vehicles in use during the Audit assessment.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
148	Audit and Manufacturer's System Documentation	*Editorial note: References to FRAV and VMAD might be removed; the document is destined for endorsement as WP.29 guidelines and recommendations.* OICA/CLEPA supports above note: suggests "ADS functional requirements" and "ADS validation methods".	
149	Introduction		
150	An audit of the ADS manufacturer's safety assessment of the ADS design and safety management system is an important validation pillar that VMAD has explained in detail. FRAV recommends certain documentation requirements that in many ways correlate directly with the documentation that the audit pillar would require that manufacturers submit to the approval authority. This section fully explains and synthesizes the elements of the audit pillar and the FRAV documentation recommendations.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
151	FRAV Documentation Requirements		
152	FRAV guidelines recommend that ADS manufactures provide documentation on several specific points, set out below: • The manufacturer shall provide written information on the ADS configuration and the intended uses and limitations on the use of its feature(s). • The manufacturer shall describe the information and approach to be made available to the public to promote a correct understanding of the intended uses and limitations on the use of the ADS and its feature(s). • The manufacturer shall establish terms for the correct use of the ADS and its feature(s). • The manufacturer shall provide written information on the roles and responsibilities of the ADS vehicle user(s), including on permissible user activities while the ADS is performing the DDT. • The manufacturer shall provide written instructions for the activation and deactivation of the ADS. • The manufacturer shall provide written information on ADS responses to ADS vehicle user interventions in the dynamic control of the vehicle. • The manufacturer shall provide written descriptions of the transition	Drafting: Note bracketed text	

	of control procedures, including ADS notifications and fallback user responses. • The manufacturer shall list the potential faults identifiable by the diagnostic system(s) of the ADS. • The manufacturer shall establish the ODD conditions and boundaries of each ADS feature in measurable and/or verifiable terms [in accordance with Appendix A]. • For the ADS users, the ADS shall be supported by documentation and tools to facilitate user understanding of the functionality and operation of the system covering at least: o An operational description of the ADS features, capabilities, and limitations (the information should also refer to specific scenarios and/or ODD). o A description of the roles and responsibilities of the driver/user and ADS when an ADS (feature) is active. o A description of the permitted transitions of roles and the procedure for those transitions. o A general overview of non-driving-related activities (NDRA) allowed when an ADS feature is active. • The ADS manufacturer / vehicle manufacturer (as appropriate) shall		

	provide documentation available for audit on: ○ The details of their user-centred design process. ○ Its intended educational approach for theoretical and practical training. ○ Human-Factors related standards used in the design process.		
153	The audit pillar, as described below, generally addresses all of the FRAV documentation requirements as part of the safety assessment, either in the portion of the assessment that requires a comprehensive system description or the portion that requires provision of information to users. Therefore, FRAV's documentation requirements are largely subsumed by the documentation aspects of the audit pillar, but the FRAV requirements are in some cases more detailed than relevant language in the audit pillar.	Drafting Group: The FRAV documentation requirements above in some cases contain more detail than the related VMAD audit pillar contents below. This seems particularly true with regard to issues related to providing information to ADS users. We have attempted to show the relationships between the FRAV and VMAD language by showing in brackets after each FRAV requirement above the portions below of the VMAD audit pillar that is relevant. However, we should consider whether the final integrated document will blend the FRAV documentation requirements into the audit pillar language. Also, in that case, we should consider whether the FRAV documentation requirements should be simplified into a single requirement that requires all documentation necessary to fulfil the audit pillar.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
154	Purpose and Elements of the Audit Pillar		
155	The purpose of the audit pillar is to assess/demonstrate that: (a) The manufacturer has the right processes to ensure operational and functional safety during the vehicle lifecycle, and (b) The vehicle's design is safe by design and that the design has been sufficiently validated before market introduction.	OICA/CLEPA proposal The purpose of the audit pillar is to assess/demonstrate that: (a) The manufacturer has the right processes to ensure operational and functional safety during the vehicle lifecycle, and (b) The **ADS** is safe by design and that the design has been sufficiently validated before market introduction.	
156	Therefore, this pillar is composed of two main components: the audit of the manufacturer processes established through a safety management system, and the audit of the safety assessment of the ADS design.		
157	It is recommended that the manufacturer be required to demonstrate that:		
158	(a) Robust processes are in place to ensure safety throughout the vehicle's lifecycle (development, production, operation, and decommissioning). This shall include taking the right measures to monitor the vehicle during the in-service operation and to take appropriate (corrective or preventive) action to address any issues,		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
159	(b) The hazards and risks of the ADS have been identified and it is clear that a "safety-by-design" approach exists and had been applied to mitigate them; and		
160	(c) The risk assessment and the safety-by-design approach have been validated, through testing, by the manufacturer and show that the vehicle meets the safety requirements before market introduction. The vehicle should be free of unreasonable safety risks to the broader transport ecosystem, and in particular, to the driver, passengers and other road users. Based on the evidence provided by the manufacturer and including the tests, authorities will be able to assess whether the processes, the risk assessment, the design and the validation are robust enough with regard functional and operational safety.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
161	Safety Management System		
162	The purpose of the audit of the manufacturer's safety management system is to confirm that the manufacturer has robust processes to manage safety risks and to ensure safety throughout the ADS lifecycle (development, production, operation and decommissioning). It should include taking appropriate measures to monitor the vehicle during the in-service operation and to take the corrective remedial action when necessary.		
163	An SMS is a systematic approach to managing safety, which encompasses and integrates organizational, human and technical factors: (a) Human component ensuring the ADS lifecycle is monitored by personnel with appropriate skills, training, and understanding to identify risks and appropriate mitigation measures, (b) Organisational component procedures and methods that help to manage the identified risks, understand their relationships and interactions with other risks and mitigation measures, and helping to ensure that there are no unforeseen consequences. (c) Technical component using appropriate tools and equipment.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
164	An adequate SMS will incorporate all three factors to monitor and improve safety and help to control the identified risks. The SMS evaluation is based on automotive (or other industry) engineering standards, guidebooks, and best practice documents relevant to safety.		
165	Safety Policy		
166	It is recommended that a safety policy be established to outline the aims and objectives that the organisation will use to achieve the desired safety outcomes. The policy should declare the principles and philosophies that lay the foundation for the organisation's safety culture and be communicated to all staff throughout the organisation. The creation of a positive safety culture begins with clear, unequivocal safety governance.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
167	The processes and activities that are recommended to be documented by the manufacturer include: (a) Safety policies and principles (in line with the concept stated in ISO 21434, para. 5.4.1 and ISO 9001 Automotive 5.2 (b) Organisation safety objectives and the process for creating safety performance indicators used in the safety case (c) Appropriate structure for SMS, taking into account regulation, standards, best practice guidance and the use-case of the vehicle and mapping its organisation structure, processes, and work products onto the SMS. (d) Safety culture (ISO 26262-2, para. 5.4.2) (e) Safety Governance elements including: (i) Management commitment (in line with the concept stated in ISO 21434, para. 5.4.1 and ISO 9001 Automotive 5.1, (ii) Roles and responsibilities (ISO 26262-2, para. 6.4.2, this relates to the organizational and project dependent activities) (f) Effective communications within the organization on safety issues (ISO 26262-2, para. 5.4.2.3) (g) Information sharing outside of the organization (in line with the concept	Drafting Group: Note use of “safety case”; intended to refer to “safety concept”? should safety case be used instead and defined?	

	stated in ISO 21434, para. 5.4.5 and ISO 9001, but from a safety perspective) (h) Quality Management System (e.g., as per IATF 16949 or ISO 9001 or equivalent) to support safety engineering, including change management, configuration management, requirement management, tool management etc.		
168	Risk Management		
169	It is recommended to establish a Safety risk management process to identify and assess the risks associated to the three SMS factors described above (i.e., human, organizational, and technical). Any operational risk identified in the product should, where appropriate, have mitigations implemented during the Design and Development phase. The ADS manufacturer should then be able to show the link between the overall risk management process, the mitigations and the resulting operational risks.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
170	Examples of risk management processes and activities that are recommended to be documented by the manufacturer: (a) Risk identification (in line with ISO 31000 para. 6.4.2 standard or equivalent) (b) Risk analysis (in line with ISO 31000 para. 6.4.3 standard or equivalent) (c) Risk evaluation (in line with ISO 31000 para. 6.4.4 standard or equivalent) (d) Risk treatment (in line with ISO 31000 para. 6.4.5 standard or equivalent), (e) Processes for keeping the risk assessments up to date, 14 (f) Review of safety performance of the organization and effectiveness of safety risk controls.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
171	Design and Development Process		
172	It is recommended that the design and development process is well established and documented. It should include risk management, requirements management, requirements' implementation, testing, failure tracking, remedial actions, and release management. Examples of processes and activities that should be considered to assure that responsibilities are properly discharged: (a) Roles and responsibilities of the people involved during the design and development phase (b) Qualifications and experience of persons responsible for making decisions that affect safety (c) Coordination of roles, responsibilities and information transfer between design and production activities		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
173	Examples of processes and activities that should be documented to ensure the robustness of the design and development phase: (a) A general description of how the organization performs all the design and development activities (b) Vehicle\system development, integration, and implementation. (i) Requirements management (e.g. Requirement capture and validation) (ii) Validation strategies, including but not limited to a. Assessment of the physical testing environment b. Credibility assessment for virtual tool chain c. System integration d. Software e. Hardware (iii) Management of functional Safety and operational safety, including the ongoing evaluation and update of risk assessments and interactions with InService Safety (iv) Management of Human Factors (e.g. Human centered design processes) (c) Design and change management, including but not limited; (i) The major design decisions,		

	(ii) The relevant design modifications to the ADS (iii) The personnel involved in the design (iv) The tools and thresholds adopted for the ADS safety verification.		
174	It is recommended that the manufacturer institutes and maintains effective communication channels between the departments responsible for functional/operational safety, cybersecurity and any other relevant disciplines related to the achievement of vehicle safety.		
175	The following are examples of processes and activities that should be documented to assure independent design audit and assessment: (a) assurance that all practices and procedures applied during the vehicle\system development are followed; (b) assurance that there is an independent check of compliance with the applicable requirements and regulations is performed. (i.e., not from person creating the compliance data); (c) process to assure the continuing evaluation of the Safety Management System to ensure that it remains effective.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
176	Production and Deployment Process		
177	It is recommended that the Production process is well established and documented. Examples of processes and activities that are recommended to be documented to ensure the robustness of the development and the production phase include: (a) Quality Management System accreditation (e.g., as per IATF 16949 or ISO 9001 or equivalent) (b) A description of the way in which the organisation performs all the production functions including management of working conditions, working environment, equipment and tools.		
178	Examples of processes and activities to be documented to assure robustness of development and distributed production: (a) Liaison between the vehicle and/or ADS manufacturer and all other organisations (partners or subcontractors) involved (b) Criteria for the acceptability of "subsystem/components" manufactured by other partners or subcontractors. (i.e., deployment of production assurance requirements to supply chain)		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
179	It is recommended that the manufacturer demonstrate that periodic independent internal audits and external audit are carried out to ensure that the processes established for the Safety Management System are implemented consistently.	Drafting Group: Suggestion- add recommendation for a robust process to ensure software updates are properly validated and distributed and downloading is confirmed.	
180	It is recommended that a manufacturer puts in place suitable arrangements (e.g. contractual arrangements, clear interfaces, quality management system) with any organization involved in the development, manufacturing or in-use deployment of their vehicles (e.g. contracted suppliers, service providers or manufacturers' sub-organizations) to ensure that their approach to safety management related to the committed activities complies with the recommendations of the present guidelines. Examples of processes and activities that are recommended to be documented: (a) Organizational policy for supply chain (b) Incorporation of risks originating from supply chain (c) Evaluation of supplier SMS capability and corresponding audits (d) Processes to establish contracts, agreements for ensuring safety across the phases of development, production, and postproduction (e) Processes for distributed safety activities		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
181	SMS documentation shall be regularly updated in line with any relevant changes to the SMS processes. It is recommended that gap analysis should be used when auditing and updating the SMS, examining the current safety culture before formulating new and more appropriate SMS processes to ensure issues are adequately resolved. The SMS shall be subject to a process of continual improvement (e.g. “Plan, Do, Check, Act as described in ISO 9001). Any changes to SMS documentation should be communicated as required to the relevant authority.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
182	Safety throughout the Useful Life of the ADS and its Features		
183	This section addresses the safe use of an ADS and its feature(s) during the useful life of the ADS vehicle. It is recommended that the Safety Management System ensure that:		
184	(a) The ADS shall provide an interface for the purposes of maintenance and repair by authorized persons.		
185	(b) The ADS shall be designed to protect against unauthorized access to and modification of the ADS functions.		
186	(c) The measures ensuring protection from unauthorized access should be provided in alignment with engineering best practices.		
187	(d) ADS safety shall be ensured in the event of discontinued production, support, and/or maintenance.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
188	Link with the in-service monitoring/reporting pillar		
189	It is recommended that a manufacturer has processes to monitor safety-relevant incidents/ crashes/collisions caused by the ADS. The manufactures should also have a process to manage potential safety-relevant gaps during the in-service operation phase (possibly identified by in-service monitoring) and a process to update those vehicles.		
190	The manufacturer should have processes to report safety relevant occurrences (e.g. collision with another road users and potential safety-relevant gaps, see the In-service Monitoring and Reporting Pillar) to the relevant authority when they occur.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
191	The manufacturers should set up processes for the operational phase to confirm of compliance with the defined safety case. It should include, early detection of new unknown situations (in line with SOTIF safety development goal to minimize the unknown scenarios area), event investigation, to share learnings derived from incidents and near-miss analysis to allow the whole community to learn from operational feedback and to contribute to the continuous improvement of automotive safety. Example of guiding principles: Is there a document describing the appropriate procedure of reporting incidents to the management? Is there evidence that the company is complying with that procedure? Is there a document describing the appropriate procedure of investigation and documentation of incidents? Is there evidence that the company is complying with that procedure?	Drafting Group: “safety case” is used. Does it refer to “safety concept”? Should one term or the other be used throughout?	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
192	Safety Assessment of the ADS		
193	The purpose of the audit of the safety by design concept of the ADS is to demonstrate that hazards and risks relevant to the ADS have been identified by the manufacturer and a consistent safety-by-design concept has been implemented to mitigate these risks. In addition, it should demonstrate that the risk assessment and the design have been validated by the manufacturer through testing. This should demonstrate that, before the vehicle is placed on the market, it meets the relevant safety requirements. This means it is free of unreasonable safety risks to the broader transport ecosystem and in particular to the driver, passengers, and other road users.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
194	ADS General Description		
195	It is recommended that a description should be provided, which gives a simple explanation of the operational characteristics of the ADS and ADS features: (a) Operational Design Domain (Road Speed limits, road type, country, Environment, Road conditions, etc.); (b) Basic performance (e.g. Object and Event Detection and Response (OEDR), etc.) (c) Interaction with other road users (d) Main conditions for Minimum Risk Manoeuvres. (e) Interaction with the driver (if relevant) (f) Supervision centre (if relevant) (g) The method of activating, overriding or deactivating the ADS by any or all of the driver (where relevant), the human supervision centre (where relevant), passengers (where relevant) or other road users (where relevant).		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
196	Description of the Functions of the ADS		
197	A description should be provided which gives a clear explanation of all the functions including control strategies of the ADS and the methods employed to perform the dynamic driving tasks within the ODD and the boundaries under which the ADS is designed to operate, including a statement of the mechanism(s) by which control is exercised. It is recommended that a list of all input and sensed variables is provided and the working range of these defined, along with a description of how each variable affects system behaviour. A list of all output variables which are controlled by the ADS should be provided and an explanation given, in each case, of whether the control is direct or via another vehicle system. The range of control exercised on each variable should be defined.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
198	ADS Layout and Schematics		
199	(a) Inventory of components		
200	A list should be provided, including all the units of the ADS and mentioning the other vehicle systems which are needed to achieve the control function in question. An outline schematic showing these units and their relationships should be provided, with both the equipment distribution and the interconnections made clear. It is recommended that the outline includes: (i) Perception and objects detection including mapping and positioning (ii) Characterization of decision-making (iii) Remote supervision and remote monitoring by a remote supervision centre (if applicable). (iv) Information display / user interface (v) The data storage system (e.g., DSSAD).		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
201	(b) Functions of the units		
202	The function of each unit of the ADS should be outlined and the signals linking it with other units or with other vehicle systems should be shown. This may be provided by a labelled block diagram or other schematic, or by a description aided by such a diagram. It is recommended that interconnections within the ADS should be shown by a circuit diagram for the electric transmission links, by a piping diagram for pneumatic or hydraulic transmission equipment and by a simplified diagrammatic layout for mechanical linkages. The transmission links both to and from other systems should also be shown. There should be a clear correspondence between transmission links and the signals carried between units. Priorities of signals on multiplexed data paths should be stated wherever priority may be an issue affecting performance or safety.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
203	(c) Identification of units		
204	Each unit should be clearly and unambiguously identifiable (e.g. by marking for hardware, and by marking or software identification for software content). This should provide a clear method for identifying the hardware and software in the associated documentation. Where the software version can be changed without requiring replacement of the marking or component, the software identification must be updated by means of the newly released software. It is recommended that where functions are combined within a single control unit or indeed within a single computer, but shown in multiple blocks in the diagram, then for clarity and ease of explanation, only a single hardware identification marking should be used. The identification defines the hardware and software version and, where the software changes and alters the function of the unit, the identifier associated with that software should also be changed.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
205	(d) Installation of sensing system components		
206	The manufacturer should provide information regarding the installation options that will be employed for the individual components that comprise the sensing system. These options should include, but are not limited to, the location of the component in/on the vehicle, the material(s) surrounding the component, the dimensioning and geometry of the material surrounding the component, and the surface finish of the materials surrounding the component, once installed in the vehicle. The information should also include installation specifications that are critical to the ADS's performance, e.g., tolerances on installation angle. Any changes to the individual components of the sensing system, or the installation options, should be updated in the documentation.		
207	(e) ADS specifications		
208	(i) Description of ADS specifications in nominal, critical, and failure situations, acceptance criteria and the demonstration of compliance with those criteria. (ii) List of applied regulations, codes, and standards.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
209	Safety Concept and Validation of the Safety Concept by the Manufacturer	Drafting Group: "safety concept" or "safety case"?	
210	The manufacturer should provide a statement which affirms that the ADS is free from unreasonable risks for the driver (if applicable), passengers and other road users. In respect of software employed in the ADS, the outline architecture should be explained and the design methods and tools used should be identified. The manufacturer should show evidence of how the ADS capabilities were realized and checked during the design and development process.		
211	It is recommended that the manufacturer should provide an explanation of the design provisions built into the ADS to ensure functional and operational safety. Possible design provisions in the ADS include: (a) Fall-back (or fail safe) operation using a partial system. (b) Redundancy using separate systems. (c) Removal of some or all automated driving function(s). If a chosen provision utilizes a partial performance mode of operation under certain fault conditions (e.g. in case of severe failures), then these conditions should be stated (e.g. type of failure). The resulting ADS behaviour and capabilities should be defined (e.g. initiation of a minimum risk manoeuvre immediately) as well as the warning strategy to the		

	driver/remote supervision centre (if applicable). If the chosen provision selects a second (back-up) means to realize the performance of the dynamic driving task, it is recommended that the principles of the change-over mechanism, the logic and level of redundancy and any built-in back-up checking features be explained and the resulting limits of back-up effectiveness defined. If the chosen provision selects the removal of an automated driving function, it is recommended that this is done in compliance with the relevant provisions of this regulation. All the corresponding output control signals associated with this function should be inhibited.		
212	The documentation should be supported, by an analysis which shows how the ADS will behave to mitigate or avoid hazards which can have a bearing on the safety of the driver (if applicable), passengers and other road users. It should show how unknown hazardous scenarios will be managed by the manufacturer to keep the residual risk level under control. The chosen analytical approach(es) should be established by the manufacturer and made available for assessment to the relevant authority before market introduction.		

213	The auditor should perform an assessment of the application of the analytical approach(es), including: (a) Inspection of the safety approach at the concept (vehicle) level. (b) It is recommended that this approach be based on a Hazard / Risk analysis appropriate to system safety. (c) Inspection of the safety approach at the ADS level including a top down (from possible hazard to design) and bottom-up approach (from design to possible hazards). The safety assessment may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) and a System-Theoretic Process Analysis (STPA) or any similar process appropriate to system functional and operational safety. (d) Inspection of the documentation that should demonstrate the validation/verification plans and results including appropriate acceptance criteria. It should include testing appropriate for validation, for example, Hardware in the Loop (HIL) testing, vehicle on-road operational testing, testing with real end users, or any other testing appropriate for validation/verification. The auditor/assessor should perform an assessment of the physical testing (proving ground and/or public road) environment and should assess the	Drafting: Insert cross-reference to credibility assessment at end of subparagraph (d). OICA/CLEPA proposal The auditor should perform an assessment of the application of the analytical approach(es), including: (a) Inspection of the **ADS** safety approach at the concept level.	

	documentation of the virtual tool chain provided by the manufacturer. The auditor/assessor may decide to carry out tests of the complete integrated tool to assess the credibility of the virtual tool chain. Results of validation and verification may be assessed by analysing coverage of the different tests and setting minimal coverage thresholds for various metrics.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
214	It is recommended that the documentation confirms that at least each of the following items are covered where applicable: (a) Issues linked to interactions with other vehicle systems (e.g., braking, steering); (b) Failures of the automated driving system and the resulting risk mitigation strategy; (c) Situations within the ODD when a system may create unreasonable safety risks for the driver (if applicable), passengers and other road users due to operational disturbances, for instance: • lack of or wrong comprehension of the vehicle environment; • lack of understanding of the reaction from the driver (if applicable), passenger or other road users; • inadequate control; • challenging scenarios. (d) Identification of the relevant scenarios within the ODD boundaries and the methodology used to select scenarios and choose the validation methodology and approach. (e) Decision making process for the performance of the dynamic driving tasks (e.g. emergency manoeuvres), the interaction with other road users and the compliance with traffic rules (f) Cyber-attacks that may have an impact on the safety of the vehicle.		

	(g) Reasonably foreseeable misuse by the driver (if applicable) (e.g., the use of a driver availability recognition system and an explanation on how the availability criteria were established), mistakes or misunderstanding by the driver if applicable (e.g., unintentional override) and intentional tampering of the ADS.		
215	The documentation should have arguments supporting the safety concept that is understandable and logical and cover all the different functions of the ADS. The documentation should also demonstrate that validation plans are robust enough to demonstrate safety (e.g., reasonable coverage of chosen scenarios as part of the validation methodology chosen) and have been completed.	Drafting Group: “concept” or “case”?	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
216	It is recommended that the documentation provides evidence that the vehicle is free from unreasonable risks for the driver (if applicable); vehicle occupants and other road users in the operational design domain. This could be achieved through: (a) Overall validation targets (i.e., validation acceptance criteria) supported by validation results, demonstrating that at entry into service of the ADS will not increase the overall level of risk for the driver (if applicable), vehicle occupants, and other road users compared to a manually driven vehicles within the ODD; and (b) A scenario specific approach showing that the ADS will not increase the overall level of risk for the driver (if applicable), passengers and other road users compared to a manually driven vehicles within the ODD for each of the safety relevant scenarios.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
217	The documentation should allow the relevant authority to test and verify the safety concept. It is recommended that the documentation itemizes the parameters being monitored on the vehicle and should set out, for each failure condition of the type defined in accordance with 84.6. of this annex, the warning signal to be given to the driver (if applicable) /vehicle occupants/other road users and/or to service/technical inspection personnel. This documentation should also describe the measures in place to ensure the ADS is free from unreasonable risks for the driver (if applicable), vehicle occupants, and other road users when the performance of the ADS is affected by environmental conditions e.g. climatic, temperature, dust ingress, water ingress, ice packing.	Drafting Group: "concept" or "case"? Need to identify reference to annex and insert it here. OICA/CLEPA proposal The documentation should give to the Authorities sufficient information to verify the manufacturer ADS safety concept. It is recommended…	
218	Data Storage System		
219	It is recommended that the documentation describe: (a) Storage location and crash survivability (b) Data recorded during vehicle operation and occurrences (c) Data security and protection against unauthorized access or use (d) Means and tools to carry out authorized access to data.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
220	Cybersecurity and Software Update Management		
221	The documentation should describe: (a) Cyber security and software update management, (b) Identification of risks, mitigation measures, (c) Secondary risks and assessment of residual risks, (d) Software update procedure and management put in place to comply with legislative requirements.		
222	Information Provision to Users		
223	It is recommended that the documentation include:	OICA-CLEPA comment: maintenance and repair manual should not be given to the user. Many of the points under "Information Provision to Users" will be related to maintenance and not in scope of the documentation to provide to the User. Propose to further review the current text.	
224	(a) The distinction between maintenance and an operational manual,	OICA/CLEPA proposal (b) safety-relevant information for the user	
225	(b) A safety precaution manual that includes safety-relevant information for the user,		
226	(c) A briefing on the user's role and how it might change during the vehicle operation, including when the user is responsible for the safety and control of the vehicle,		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
227	(d) Information on how to use the ADS, o Transition of Control (ToC), where applicable o Take over o ADS activation o ODD o Role of the user after regaining control	OICA/CLEPA proposal (d) **If applicable,** information on how to use the ADS, o Transition of Control (ToC), where applicable o Take over o ADS activation o ODD o Role of the user after regaining control.	
228	(e) System Description and functional limitations		
229	(f) Operational description (e.g., implications of switching off the ADS)		
230	(g) Nominal Operations		
231	(h) Emergency Operations		
232	(i) Role of the user within the ADS' ODD	OICA/CLEPA proposal: Delete	
233	(j) Information related to the HMI's indications o Visual tell-tales, icons o Auditory signs o Haptic signs		
234	(k) Means to deactivate the automated driving mode (take-over)		
235	(l) Safety measures to be taken in the event of malfunctioning of the ADS	OICA/CLEPA proposal: Delete	
236	(m) Extent, timing and frequency of maintenance operations	OICA/CLEPA proposal: Delete	
237	(n) Means to enable a periodical technical inspection		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
238	(o) Documents and templates for maintenance, repair and periodical technical inspection		
239	(p) Precautionary statements in the sense of compliance with limit values for the technical functions		
240	(q) Data protection and data security functionalities		
241	(r) List of system fault codes	OICA/CLEPA proposal: Delete	
242	Type of Documentation to be Provided		
243	Documentation should be brief yet provide evidence that the design and development has had the benefit of expertise from all the ADS fields which are involved.		
244	(a) A documentation package which gives access to the basic design of the ADS and how it is linked to other vehicle systems or by which it directly controls output variables.		
245	(b) Documentation explaining the function(s) of the ADS, including the control strategies and the safety concept.		
246	(c) For periodic technical inspections, the documentation should describe how the current operational status of the ADS can be checked	OICA/CLEPA proposal: Delete	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
247	(d) Documentation about how the software version(s) and the failure warning signal status can be readable in a standardized way via the use of an electronic communication interface (i.e., using a standard interface, such as the OBD port).	OICA/CLEPA proposal: Delete "failure warning…" to read, (d) Documentation about how the software version(s) can be readable in a standardized way via the use of an electronic communication interface (i.e., using a standard interface, such as the OBD port).	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
248	It is recommended that the documentation package shows that the ADS: (a) Is designed and was developed to operate in such a way that it is free from unreasonable risks for the driver (if applicable), passengers and other road users within the declared ODD; (b) Is capable of recognizing its boundaries; (c) Respects any performance requirements specified by FRAV; (d) Was developed according to the development process/method declared by the manufacturer;		
249	Documentation should be made available in three parts:		
250	(a) An information document which is submitted to the authority and should contain brief information on all the items.		
251	(b) The formal documentation package annexed to the information document, which should be supplied to the Authority for the purpose of conducting the safety assessment.	OICA/CLEPA proposal (b) The formal documentation package annexed to the information document, which should be supplied to the Authority for the purpose of **conducting an evaluation of the manufacturer** safety assessment.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
252	(c) Additional confidential material and analysis data (intellectual property) which should be retained by the manufacturer, but made open for inspection (e.g. on-site in the engineering facilities of the manufacturer) at the time of the product assessment / process audit.		
253	The manufacturer should ensure that this material and analysis data remains available for a period of 10 years counted from the time when production of the ADS is discontinued. Any changes to ADS safety design should be communicated as required to the relevant authority.		
254	Requirements for ADS Performance of the DDT		
255	Introduction		
256	The following subsections recommend criteria for validating the safety of ADS and/or ADS vehicles. Annex [] contains a matrix linking these criteria with recommended test methods.	Drafting Group: Note the Annex when numbering has been determined.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
257	As a general concept, the safety level of ADS shall be at least to the level at which a competent and careful human driver could minimize the unreasonable safety risks to the drivers and other road users. Subsections 6.3-6.6 concern ADS performance of the DDT. The recommended requirements have been drafted for worldwide application. These requirements, therefore, do not specify technical performance limits due to the diversity of ODD-specific conditions and requirements that may influence safe performance of the DDT.		
258	Scenario generation and behavioural competencies		
259	Driving involves real-time risk management under prevailing traffic conditions. Therefore, safe ADS performance of the DDT depends upon the conditions presented under each individual scenario.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
260	Annex X provides a recommended approach to scenario generation and to the establishment of ADS behavioural competencies to be demonstrated under these scenarios. Each scenario is associated with one or more behavioural competencies. The ODD-based approach to scenario generation provides analytical methods to ensure that the scenarios cover the ODD of the ADS feature(s). These scenarios address nominal, critical, and failure situations to enable assessments in accordance with the WP.29 Framework Document on Automated Vehicles (FDAV). The behavioural competencies define ADS responses that comply with the following global requirements (Subsections 6.3-6.6) within the bounds of a relevant safety model quantifying dimensions for assessment of ADS performance (as described in Annex X). The behavioural competencies align with the layer of abstraction of the scenario to provide verifiable criteria at the functional layer down to measurable criteria at the concrete layer of abstraction. Compliance with the recommended requirements under Subsections 6.3-6.6. is determined by verifying that the ADS demonstrates the behavioural competencies associated with the scenarios relevant to the ODD of its features. These requirements shall be applied in the definition of behavioural competencies to be demonstrated under traffic scenarios.	Drafting Group: Update reference to annex when known.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
261	ADS Performance of the DDT under Nominal Traffic Scenarios		
262	The following recommendations address the Framework document on automated/autonomous vehicles (ECE/TRANS/WP.29/2019/34/Rev.2) guidance that ADS vehicles shall not cause traffic accidents or disrupt traffic. Compliance with this broad objective can be verified by subjecting the ADS and/or ADS vehicle to nominal traffic scenarios representing usual and expected traffic conditions and behaviours. By minimizing risk factors outside the ADS nominal performance of the DDT, the impact of the ADS driving behaviour on other road users and the flow of traffic can be isolated. This section recommends requirements for assessing ADS performance of the DDT under normal operational and driving conditions.		
263	The ADS shall be capable of performing the entire Dynamic Driving Task (DDT) within the ODD of its feature(s).		
264	The ADS shall operate the vehicle at safe speeds.		
265	The ADS shall maintain appropriate distances from other road users by controlling the longitudinal and lateral motion of the vehicle.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
266	The ADS shall adapt its driving behaviour to the surrounding traffic conditions (e.g., by avoiding disruption to the flow of traffic).		
267	The ADS shall adapt its driving behaviour in line with safety risks (e.g., by giving all road users and passengers the highest priority).		
268	The ADS shall detect and respond to objects and events relevant to its performance of the DDT.		
269	The ADS shall detect and respond to priority vehicles in service in accordance with the relevant traffic law(s).		
270	Under nominal traffic scenarios, the driving behaviour of the ADS shall not force other road users to take evasive action to avoid a collision with the ADS vehicle.		
271	Under nominal traffic scenarios, the driving behaviour of the ADS shall not cause a collision.		
272	The ADS shall comply with traffic rules in accordance with application of relevant law within the area of operation.		
273	The ADS shall interact safely with other road users.		
274	The ADS shall avoid collisions with safety-relevant objects where possible.		
275	The ADS shall signal intended changes of direction.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
276	The ADS shall signal its operational status in accordance with national rules.		
277	Pursuant to a passenger request under para. 7.4.1., the ADS shall bring the vehicle to a safe stop.	Drafting Group: Ensure correct cross-reference in final version of document.	
278	ADS Performance of the DDT under Critical Traffic Scenarios		
279	The following recommendations address the Framework document on automated/autonomous vehicles (ECE/TRANS/WP.29/2019/34/Rev.2) guidance that ADS vehicles shall not cause any traffic accidents resulting in injury or death that are reasonably foreseeable and preventable. Compliance with this broad objective can be verified by subjecting the ADS and/or ADS vehicle to critical traffic scenarios representing unusual or unexpected traffic conditions, objects, and/or object behaviours that elevate road safety risks. By introducing foreseeable external risk factors into scenarios, the capability of the ADS to manage safety-critical events that may arise within its ODD can be assessed.		
280	The requirements of section 6.3. shall continue to apply during critical scenarios as far as is reasonably practicable under the specific circumstances with the aim of minimising overall risk.	Drafting Group: Ensure correct cross-reference in final version of document.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
281	In the event of a collision, the ADS shall stop the vehicle in an MRC and/or in accordance with applicable traffic laws.[28]		
282	The ADS shall not resume travel until the safe operational state of the ADS vehicle has been verified.		
283	The ADS may resume the trip where permissible under the applicable traffic rule(s) and other safety considerations.		
284	ADS Performance of the DDT under Failure Scenarios		
285	The following recommendations address the Framework document on automated/autonomous vehicles (ECE/TRANS/WP.29/2019/34/Rev.2) guidance regarding the assurance of system safety and responses to system failures that compromise the capability of the ADS to perform the entire DDT.		
286	The requirements of section 6.3 shall continue to apply during failure scenarios as far as is reasonably practicable under the specific circumstances with the aim of minimising overall risk.		

[28] This provision requires further consideration regarding the threshold for collisions that would require the fallback to an MRC.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
287	The ADS shall detect faults, malfunctions, and abnormalities that compromise its capability to perform the entire DDT within the ODD of its feature(s) per the manufacturer's documentation under Section [].	Drafting Group: Update cross-reference in final version of document.	
288	The ADS may continue to operate in the presence of faults that do not prevent that ADS from fulfilling the safety requirements applicable to the ADS.		
289	In response to a fault, the ADS may permit activation and use of a feature impacted by the fault provided that the ADS continues to provide the functions necessary to perform the entire DDT.		
290	The ADS shall adapt its performance of the DDT in accordance with the severity of the fault to ensure road safety.		
291	The ADS shall prohibit activation of an ADS feature in the presence of a fault in an ADS function that compromises the ADS capability to perform the entire DDT within the ODD of the feature.		
292	The limited operation of the ADS should comply to the normally applicable safety requirements.		
293	Remote termination of individual or multiple ADS or feature(s) by the manufacturer and/or service operator shall be possible when requested by Authorities.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
294	Remote termination for an ADS performing the DDT shall be capable of triggering an ADS fallback response.		
295	Remote termination of an ADS or ADS feature(s) shall render them unable to be activated by user.		
296	ADS Performance of the DDT at ODD Boundaries	FRAV secretary comment: Structural change not consistent with FRAV document. Should reinstate original FRAV proposal.	
297	The ADS shall recognise the conditions and boundaries of the ODD of its feature(s) pursuant to the manufacturer's declaration under paragraph 5.2.	Drafting Group: Update cross-reference to manufacturer's description of the ODD in final version of the document.	
298	The ADS shall be able to determine when the conditions are met for activation of each feature.		
299	The ADS shall prevent activation of a feature unless the ODD conditions of the feature are met.		
300	The ADS shall execute a fallback response when one or more ODD conditions of the feature in use are no longer met.		
301	The ADS shall be able to anticipate foreseeable exits from the ODD of each feature.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
302	Minimum Risk Condition Requirements	FRAV secretary comment: Structural change not consistent with FRAV document. Should reinstate original FRAV proposal. Defined term (under reconsideration by SAE/ISO) is “minimal risk condition” and requirements concern fallbacks.	
303	The ADS shall signal its intention to place the vehicle in an MRC.		
304	The ADS shall execute a fallback response in the event of a failure in the ADS and/or other vehicle system that prevents the ADS from performing the DDT.		
305	In the absence of a fallback-ready user, the ADS shall fall back directly to an MRC.		
306	If the ADS is designed to request and enable intervention by a human driver, the ADS should execute a fallback to an MRC in the event of a failure in the transition of control to the user.		
307	Upon completion of a fallback to an MRC, a user may be permitted to assume control of the vehicle.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
308	Multi pillar approach	OICA/CLEPA comment: Structure and reading issue: the current structure sees topic in this order: - DDT requirements (chapt 6.3 to 6.7) - Multi-pillar approach (chapt 6.8) - User requirements (chapt 7) There is inconsistency in the stucture above, Multi-pillar Approach is "collapsed" between requirements. Proposals: 1) Move the Multi-pillar approach section (chapter 6.8) at the end of chapter 4, or 2) Move the Multi-pillar approach section (chapter 6.8) at the end of chapter 7	
309	As previously noted, the multi-pillar approach recognizes that the safety of an ADS cannot be reliably assessed/validated using only one of the pillars. Each of the aforementioned testing methodologies possesses its own strengths and limitations, such as differing levels of environmental control, environmental fidelity, and scalability, which should be considered accordingly.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
310	It is important to note that a single assessment or test method may not be enough to assess whether the ADS is able to cope with all occurrences that may be encountered in the real world.		
311	For instance, while real-world testing provides a high degree of environmental fidelity, a scenario-based testing methodology using only real-world testing could be costly, time-consuming, difficult to replicate, and pose safety risks. Consequently, track testing may be more appropriate methods to run higher risk scenarios without exposing other road users to potential harm. Further, test scenarios can also be more easily replicated in a closed track environment compared to the real-world. That said, test track scenarios can be potentially difficult to develop and implement, especially if there are numerous or complex scenarios, involving a variety of scenario elements.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
312	Simulation/virtual testing, by contrast, can be more scalable, cost-effective, safe, and efficient compared to track or real-world testing, allowing a test administrator to safely and easily create a wide range of scenarios, including complex scenarios, where a diverse range of elements are examined. However, simulations may be of a lower fidelity than the other methodologies. Simulation software may also vary in quality and tests could be difficult to replicate across different simulation platforms.		
313	In addition to the respective strengths and weakness of each test pillar, the nature of the safety requirements being assessed will also inform what pillars are used:		
314	Virtual testing may be more suitable when there is a need to vary test parameters and a large number of tests need to be carried out to support efficient scenario coverage (e.g., for path planning and control, or assessing perception quality with prerecorded sensor data).		
315	Track tests may be best suited for when the performance of an ADS can be assessed in a discrete number of physical tests, and the assessment would benefit from higher levels of fidelity (e.g., for HMI or fall back, critical traffic situations).		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
316	Real-world testing may be more suitable where the scenario may not be precisely represented virtually or on a test track (e.g., interactions with other road-users and perception quality may be assessed through real world evaluation).		
317	Given these considerations, it should be noted that the sequence and composition of test pillars used to assess each safety requirement may vary. While some testing might follow a logical sequence from simulation to track and then to real world testing, there may be deviations depending on the specific safety requirement being tested.		
318	It is therefore necessary for the NATM pillars to be used together to produce an efficient, comprehensive, and cohesive process, considering their strengths and limitations. The methods should complement one another, avoiding excessive overlaps or redundancy to ensure an efficient and effective validation strategy.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
319	Considerations for specific requirements	OICA-CLEPA comment: FRAV-VMAD invited to consider if effectiveness to have 2 chapters for the requirements (6 and 7). Merging Chapter 6 and 7 together could bring to have only one section including all the "considerations for specific requirements" covering chapter 6.9 and 7.5 FRAV secretary comment: FRAV proposed requirements without mention of “specific requirements”. Where does this concept come from? What does it mean?	
320	See Annex [] for the matrix giving a mapping of each requirement to the relevant validation pillars.	Drafting: Update annex reference in final version of document.	
321	Application of the validation pillars to nominal traffic scenario requirements		
322	Most of the requirements of section 6.3 can be validated with any of the test methods, however complex scenarios with high levels of traffic can be potentially difficult to implement on a test track.	Drafting: Update cross-reference to DDT performance under nominal scenarios in final version of document.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
323	Application of the validation pillars to critical traffic scenario requirements		
324	The requirements of section 6.4 cover difficult and/or unsafe scenarios that would be dangerous to be sought out amongst naïve traffic in the real world. Some critical scenarios can be recreated on test tracks in controlled conditions, but virtual testing is recommended for testing the most dangerous situations.	Drafting: Update cross-reference to DDT performance under critical scenarios in final version of document. OICA/CLEPA comment: Delete "naïve" wherever present in the document, “traffic” already covers the definition.	
325	Application of the validation pillars to failure scenario requirements		
326	The requirements of section 6.5 cover scenarios where system failures compromise the capability of the ADS to perform the entire DDT. Considerations must be made for how to manually trigger a failure through either hardware or software mechanisms. Purposefully degrading the performance of the ADS in the real world amongst naïve traffic would be dangerous except in very specific low traffic situations. Testing failures is safer and more applicable on test tracks and via virtual testing.	Drafting: Update cross-reference to DDT performance under failure scenarios in final version of document. OICA/CLEPA: Delete “naïve”	
327	Application of the validation pillars to ODD boundary requirements	FRAV secretary comment: Inconsistent with FRAV proposal for assessments under nominal, critical, and failure scenarios.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
328	The requirements of section 6.6 cover situations where the ADS interacts with the boundaries of its ODD. Some of these boundaries can be validated on a test track provided that track testing is conducted on a testing ground that is part of, or suitably represents, the ODD of the ADS. However, certain boundaries such as performance at the edge of geofenced ODD boundaries will only be possible to validate via real world or virtual testing.	Drafting Group: Update cross-reference in final version of document.	
329	Application of the validation pillars to Minimum Risk Condition requirements	FRAV secretary comment: Inconsistent with FRAV proposal for assessments under nominal, critical, and failure scenarios. Defined term (under reconsideration by SAE/ISO) is “minimal risk condition” and requirements concern fallbacks.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
330	The requirements of section 6.7 are related to the ADS achieving a MRC. Depending on the design of the ADS, this MRC may not necessarily be desirable on a real world road e.g. stopping in lane. As such, testing MRC in the real world amongst naïve traffic could be dangerous depending on the design of the MRC. Testing MRC may then be safer and more applicable on test tracks and via virtual testing.	Drafting Group: Update cross-reference in final version of document. OICA/CLEPA: Delete "naïve" FRAV secretary: "MRC" is a stable, stopped condition of the vehicle that reduces safety risks. It is not related to the ADS design or related to whether it is desirable. It is a response to an urgent failure situation where the ADS vehicle must be stopped (analogous to a conventional vehicle breakdown). When necessary because the ADS cannot safely operate the vehicle, the ADS executes a DDT fallback to the user or to an MRC. Assessing the ADS capability to fall back to an MRC involves triggering a failure which involves safety risks and should not be intentionally conducted during real-world testing.	
331	Requirements for safe interactions between Users and ADS		
332	The following subsections provide safety-related recommendations to support user interactions with ADS. It is noted that the recommendations vary depending on user role, system design, and tasks to be performed by the user during the use of the ADS equipped vehicle.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
333	For a safe use of the ADS by users who may need to take over control of the driving task from the ADS, it is necessary to provide correct information on the capabilities of the ADS to ensure that the user can develop a mental model that correctly reflects these capabilities. This information should be provided before and during driving with an ADS vehicle.		
334	To further detail some of the recommendations it is recommended to draw on Human Factors knowledge, which is an established multidisciplinary science that applies knowledge of human abilities and limitations to the design and evaluation of technology for improved safety and usability.	OICA/CLEPA proposal: Delete	
335	It has to be noted that knowledge on testing the interaction between user and ADS including pass/fail criteria partly still needs to be developed. It also relevant to aim for a certain level of 'commonality' in the user interactions with the ADS for all brands and models. This will help users to develop and apply a single mental model and will also help to reduce the risk of user confusion (e.g., mode confusion) when changing between vehicles with ADS from different manufacturers. Such commonality cannot be defined now, but it is vital to establish it as a goal of future design.	OICA/CLEPA proposal: Delete	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
336	This section provides recommendations on the design of the ADS user interactions between users and ADS vehicles to obtain safe operation of ADS vehicles. These recommendations do not apply to ADS vehicles and ADS features designed without accommodations for a user. The types of ADS users considered in this document are driver, fallback user, passenger.		
337	General recommendations		
338	The ADS shall signal the presence of any failure that limits the operation of an available feature.		
339	The ADS shall signal its intention to place the vehicle in an MRC to the ADS user(s).		
340	An ADS that controls the operation of doors shall provide an emergency override to the user.		
341	The ADS HMI shall provide safety relevant information and signals clearly noticeable to the target user(s) under all operating conditions, multimodal (e.g., optical, acoustic, haptic) if needed, simply and unambiguously.		
342	ADS features that allow a user to take over manual control of the DDT		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
343	General recommendations		
344	When the ADS is active, the vehicle driving controls, indicators, tell-tales, and DDT-related warnings may be disabled, suppressed, de-activated, inhibited or by other means made unavailable, as needed to mitigate the risk of errors in operation, misuse and reduce ambiguous states of vehicle control.		
345	The ADS shall be designed to prevent misuse and errors in operation by the user.		
346	The vehicle controls dedicated to the ADS shall be clearly identified and distinguishable to accommodate only the appropriate interactions.[29]		
347	While an ADS feature is active, it shall inform the user on: (a) ADS status information. (b) the role of the fallback user, if applicable. (c) Any failure of the ADS that limits the operation of an available feature.		
348	The ADS shall indicate the availability of a feature for activation.		

[29] Through size, form, location, colour, type, action, spacing and/or control shape. The provision aims to promote correct use and is not intended to prohibit multifunction controls.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
349	Recommendations on the ADS feature activation		
350	The ADS shall ensure a safe ADS feature activation. (a) The ADS shall provide prompt feedback to indicate success or failure when the user attempts to enable an ADS feature. (b) The feature activation process (e.g., sequence of actions and states) shall take into account relevant recommendations or standards. (c) An ADS feature activation resulting in a user becoming a fallback user shall inform the fallback user of the consequent expectations on them.		
351	Recommendations on ADS feature deactivation to manual driving		
352	The ADS shall have a monitoring system to support safe and appropriate engagement of the user as necessary.		
353	At the completion of the deactivation process, lateral and longitudinal control shall be returned to the driver without any continuous control assistance active.[30]		

[30] This provision may be changed pursuant to evidence from manufacturers demonstrating assurance of the safety of continuous control assistance pursuant to ADS deactivation.

	Original draft text	Comments/Proposals	Discussion Outcome(s)
354	ADS features that allow a user-initiated system deactivation to manual driving[31]		
355	The ADS shall be designed to ensure a safe user-initiated system deactivation process. (a) The ADS shall only allow the user to initiate a system deactivation process if the ADS can verify that the user is in a position to resume the role of the driver. (b) ADS feature deactivation may be delayed if it is assessed by the ADS that the situation is unsuitable for the subsequent mode of vehicle operation. (e.g., due to the current situation being unsuitable or unsafe for the subsequent mode of operation). (c) The user-initiated system deactivation process (e.g., sequence of actions and states) shall take into account relevant recommendations or standards. (d) The ADS shall assess the user is suitably engaged to resume the DDT before completion of the deactivation process. (e) The ADS shall provide a specific indication of the completion of the deactivation of the ADS. (f) If applicable upon ADS deactivation, the vehicle controls, indicators,		

[31] An ADS that may "suggest" the user takes control (e.g., when approaching the end of its ODD) and that is not designed to require a fallback user to continuously be ready to take control should be considered as a user-initiated system deactivation with regard to the requirements of this section.

	warnings, and tell-tales shall be set to an appropriate state for manual driving. (g) If applicable, ADS features operating control of closures shall no longer influence closures or the controls associated with closures.		
356	ADS features that have a system-initiated deactivation to manual driving		
357	The ADS shall ensure a safe system-initiated deactivation to a fallback user. (a) A system-initiated deactivation in nominal situations should be indicated in a timely manner to support the fallback user re-engaging to the driving task. (b) The system-initiated deactivation to manual driving process (e.g., sequence of actions and states) shall take into account relevant recommendations or standards. (c) The ADS shall: (i) Continuously assess whether the fallback user is available for a system-initiated deactivation. (ii) Provide effective procedures for re-engaging the fallback user who has been detected not to be available. (iii) Trigger an MRM where it has not been possible, feasible and/or safe to re-engage the fallback user. (iv) Where appropriate, adapt the system-initiated deactivation		

	process (e.g., timing, levels of warnings) according to the current circumstances (e.g., the engagement of the fallback user, the status of the ADS and vehicle, the current traffic situation). (d) The ADS shall assess the user is suitably engaged to resume the DDT before completion of the deactivation process. (e) The ADS shall remain active until the system initiated deactivation process has been completed or the ADS vehicle reaches a minimal risk condition. (f) The ADS shall provide a specific indication of the completion of the deactivation of the ADS. (g) If applicable upon ADS deactivation, the vehicle controls, indicators, warnings, and tell-tales shall be set to an appropriate state for manual driving. (h) If applicable, ADS features operating control of closures shall no longer influence closures or the controls associated with closures.		
358	ADS features that do not allow a user to take manual control of the DDT		
359	The ADS shall provide the passenger(s) with means to request to stop the vehicle.		
360	The ADS vehicle shall provide safety-related information to the passengers.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
361	The ADS shall not initiate motion unless the safety risks to the passenger(s) have been mitigated.		
362	The ADS may provide the user(s) with information related to ongoing operations (e.g., destination, upcoming stops, route progress).		
363	Controls provided for manual driving (e.g., steering, service brake, parking brake, accelerator, lighting) shall be designed to prevent any effect on the DDT whilst the ADS is performing the DDT, or reasonable safeguards shall be put in place to prevent access to controls.		
364	Testing User interaction requirements	OICA-CLEPA comment (per above): FRAV-VMAD invited to consider if effectiveness to have 2 chapters for the requirements (6 and 7). Merging Chapter 6 and 6 together could bring to have only one section including all the "considerations for specific requirements" covering chapter 6.9 and 7.5	
365	See Annex [] for the matrix giving a mapping of each user requirement to the relevant validation pillars.	Drafting: Update with annex number in final version.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
366	Many HMI requirements relate to the design of the system, whilst the effects of these design can be tested in practice using simulation, test track and real world tests, the audit pillar would be most applicable for determining if the design requirements are followed.		
367	DIL virtual testing can be helpful to support the assessment of this category of safety requirement by analysing the interaction between the driver and the ADS in a safe and controlled environment.		
368	Track tests may be well suited for when the performance of an ADS can be assessed in a discrete number of physical tests, and the assessment would benefit from higher levels of fidelity for HMI related tests or those testing the ADS fall back response.		
369	Utilising the information on ADS performance under real-world conditions could help to enhance or modify track tests. Furthermore, ISMR concerning user-interaction metrics could provide information useful for improving an ADS's HMI, its usability, and driver education.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
370	As with the DDT requirements user requirements in failure scenarios such as 7.2.1, and 7.3.1.2.2 c require considerations must be made for how to manually trigger a failure through either hardware or software mechanisms. Purposefully degrading the performance of the ADS in the real world amongst naïve traffic would be dangerous [except in very specific low traffic situations.] Testing failures is therefore safer and more applicable on test tracks and via virtual testing.	Drafting: Note bracketed text. Update cross-references in final text. OICA/CLEPA: Delete “naïve”	
371	Requirements 7.2.2, 7.2.3., 7.3.5.1. c.iii. and 7.3.5.1. e., may lead to the ADS achieving a MRC. Depending on the design of the ADS, this MRC may not necessarily be desirable on a real world road e.g. stopping in lane. As such, testing MRC in the real world amongst naïve traffic could be dangerous depending on the design of the MRC. Testing MRC may then be safer and more applicable on test tracks and via virtual testing.	Drafting: Update cross-references in final text. OICA/CLEPA: Delete “naïve”	
372	Systems that rely on the presence of a fallback user must fulfil requirements related to detecting the presence of this fallback user. To fully test such a requirement the fallback user must not be present/available when required. The system should be able to cope with this eventuality, but this aspect should still be tested on a controlled test track to avoid putting naïve traffic participants at risk should the ADS not meet the requirement.	OICA/CLEPA: Delete “naïve”	

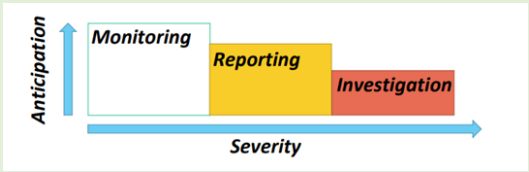
	Original draft text	Comments/Proposals	Discussion Outcome(s)
373	Virtual testing covers both traffic simulation and vehicle simulators, for most requirements one of those will cover the requirement, however some cases such as 7.3.5.1 d require assessment of both the ADS and a human driver which may be challenging on a simulator test.	Drafting: Update cross-reference in final text.	
374	In-Service Monitoring and Reporting		
375	Introduction		
376	In-Service Monitoring and Reporting (ISMR) is a validation methodology which is part of the multi pillar approach. It addresses the in-service safety of automated vehicles after market introduction.		
377	In principle, ISMR is not a pre-deployment validation tool like the others, but it can still (especially the monitoring part) be used to validate ADS requirements . ISMR is mainly designed to provide evidence of in-service safety performance of the ADS, to identify a drift or deviation from the demonstrated performance and to find areas where ADS fails, and not provide evidence that the requirement itself is validated pre-deployment as demonstrated by simulation, track testing and real-world testing.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
378	In practice, the application of the other pillars of the NATM guidelines will assess whether the ADS is safe, according to the existing criteria, for market introduction; whereas the in-service monitoring and reporting will gather additional evidence from its in-service operation to demonstrate that the ADS continues to be safe after market introduction, i.e., that use of the ADS does not present an unreasonable safety risk.		
379	This pillar describes how to monitor the dynamic nature of the in-service operational use and then to provide feedback to ensure that there is continuous improvement of the safety of the ADS.		
380	It relies on the collection of fleet data in the field to assess whether the ADS continues to be safe when operated on the road. This data collection can also provide information to help develop new scenarios or variations of existing scenarios for the scenarios catalogue allowing the whole ADS community to learn from major ADS accidents/incidents.		
381	ISMR requires ADS manufacturers to collect and analyse the safety-relevant information related to their in-service ADS' operation and report data on safety related concerns, occurrences and performance metrics to the relevant authority.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
382	The ADS's safety performance remains the responsibility of the manufacturer throughout its lifetime.		
383	ISMR is a mechanism to provide safety authorities with information about a manufacturer's ADS that complements information that may be gathered from other sources.		
384	It is recommended that a feedback loop (fleet monitoring) is put in place to confirm the safety argument and confirm the validation carried out by the manufacturer before market introduction.		
385	ISMR enables the identification of unreasonable risks related to the use of an ADS on public roads and the evaluation of its safety performance during real-world operation.		
386	Objectives		
387	The aim of ISMR is to contribute to the improvement of road safety by ensuring that relevant information on safety is collected, processed, and disseminated.		
388	The ISMR aims to fulfil three main objectives:		
389	Identify safety risks related to ADS performance that need to be addressed, including instances of non-compliance with ADS safety requirements (objective 1);		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
390	Support the development of the Scenario Catalogue through capturing information when the ADS does not perform safely in unanticipated situations (objective 2);		
391	Share information and recommendations to promote continuous improvement of ADS safety performance (objective 3).		
392	The actual level of safety will only be confirmed once there are enough ADS vehicles in-service that have encountered a sufficient range of traffic and environmental conditions. It is therefore essential that a feedback loop, facilitated by ISMR, is in place.		
393	This data will be used to assess and review the ADS manufacturer's safety case and to validate the information that was used to enable market introduction.		
394	The operational experience feedback from ISMR will allow ex-post evaluation of the regulatory requirements and validation methods, providing an indication of any issues and consequently the need for any modification to the requirements.		
395	Unanticipated situations, risks and hazards might be identified during real-world ADS operation, and this information could be used to develop new scenarios for the common scenario catalogue.	OICA/CLEPA proposal Unanticipated situations, risks, and hazards might be identified during real-world ADS operation, and this information could be used to develop new scenarios **for a** (or) **to contribute to a future scenario catalogue.**	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
396	In the early phase of market introduction of ADS vehicles, it is essential that the whole community learns from safety-critical situations involving an ADS. It is important therefore that there is a mechanism that allows information from the ISMR and recommendations from its analysis to be shared with the ADS community. This will allow others to react and should lead to developments that reduce or prevent that situation from occurring in another ADS.		
397	However, the ISMR has a more extensive application. For example, utilising the information on ADS performance under real-world conditions could help to enhance or modify track tests. Furthermore, ISMR concerning user-interaction metrics could provide information useful for improving an ADS' HMI, its usability, and driver education.		
398	Collection, processing and dissemination of information related to ADS safety performance from the ISMR will also help to evaluate the impact of ADS on the safety of the road network. The information collected thanks to the ISMR can also be used to share the safety benefits of ADS.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
399	Monitoring, Reporting, and Investigation		
400	Monitoring refers to the overall data collection and analysis conducted by the manufacturers with aim at extracting safety related information from data. It mainly concerns the collection of relevant data elements during normal ADS operation to have a proactive approach to provide evidence of the in-service safety performance of the ADS.		
401	Reporting applies to occurrences which endanger or which, if not corrected, would endanger a vehicle, its occupants or any other person, and in more terms the reporting of all occurrences relevant to the safety performance of the ADS. The reporting constitutes an event-based data collection methodology that is triggered by the happening of the set of occurrences.		
402	It is expected that the ISMR will be complemented by safety investigations of (at least) critical occurrences conducted by an independent body.		
403			

	Original draft text	Comments/Proposals	Discussion Outcome(s)
404	ISMR Processes		
405	Before the deployment of the ADS, the manufacturer should establish processes to demonstrate its capabilities to execute an effective ISMR. These processes should be part of the SMS of the manufacturer.		
406	The processes for ISMR should demonstrate the capabilities:		
407	• To monitor critical and non-critical occurrences caused by the ADS		
408	• To manage potential safety-relevant gaps during the in-service operation phase		
409	• To report safety-relevant occurrences to the authority when they occur		
410	• To confirm the compliance with the defined safety case		
411	• To share learnings derived from incidents and near-miss analysis		
412	• To contribute to the continuous improvement of automotive safety		
413	The manufacturer should define appropriate Key Performance Indicators (KPI) to measure the effectiveness of ISMR activities for the ADS operations.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
414	The processes put in place by the manufacturer to manage safety of the ADS during in-service operation, e.g. to manage changes in the traffic rules and in the infrastructure, fall outside this pillar and are assessed with the audit pillar.		
415	ISMR Implementation		
416	In-Service Monitoring		
417	The manufacturer and (where applicable) the fleet operator should set up a monitoring program aimed at collecting and analysing vehicle data, and data from other sources. It should provide evidence of the in-service safety performance of the ADS and confirmatory evidence of the audit results of the Safety Management System requirements established by the Audit Pillar. (Note: The in-service monitoring is intended to be applicable to all individual ADS types, not to a subset selected by the manufacturer or where applicable, by the fleet operator).		
418	The monitoring program should include a data acquisition strategy, data retention strategy, data access, security and protection policy.		
419	The data acquisition strategy ensure a representative collection of data to monitor the ADS in service performance.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
420	The retention strategy should ensure that the dataset is retained until the corrective action and review processes are complete. In addition, the strategy should ensure the retention of the data for longer-term trend analysis (i.e. subset of the collected data).		
421	The data access, security and protection policies should ensure that information access is allowed only to authorised persons and contains safeguards to ensure the security and protection of the data.		
422	The data monitoring program should allow the manufacture and (where applicable) the fleet operator to:		
423	Identify areas of operational risk and quantify current safety margins (e.g. in service safety performance monitoring),		
424	Identify when the ADS prevents incidents/accidents (e.g. MRM, EM),	Editorial note: MRM, EM not defined terms. MRM was deprecated by SAE/ISO and intentionally avoided in FRAV.	
425	Identify and quantify operational risks by collecting data to characterize and analyse occurrences,		
426	Use metrics and thresholds to assess safety risks and discover trends that suggest the emergence of unacceptable risks if that trend continues,	Editorial note: replace “unacceptable” by “unreasonable” for consistency?	
427	Put in place procedures for remedial action when an unacceptable risk is discovered or predicted by trends,		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
428	Confirm the in-service safety level and effectiveness of any remedial action		
429	The data monitoring program should ensure that the data analysis is performed with sufficient frequency so that remedial action can be taken promptly and in line with reporting requirements.		
430	The analysis techniques should comprise the following:		
431	Routine measurements: a selection of parameters should be collected to characterise each trip and to allow a comparative analysis. These measurements should aim at identifying and monitoring emerging trends and tendencies before the trigger levels associated with exceedances are reached. (e.g. vehicle performance monitoring).		
432	Exceedance detection: a set of core ”value” should be selected to cover the main areas of interest for the ADS operation with aim at searching for deviations from vehicle performance and limits. Typically, the main areas of interest are derived from the assessment of the most significant risks before the market introduction. However, they should be continuously reviewed to reflect the current operations. (e.g., speed limits exceedance, near misses, harsh braking, etc.).	Editorial note: “deviation” rather than “exceedance”? FRAV secretary: Consider alignment with FRAV “behavioural competencies”.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
433	Occurrence analysis: recorded data should be able to characterize and investigate all the occurrences listed in the annex IV.	Drafting note: Ensure alignment in reference annex.	
434	Statistics: Data Series should be collected to support the analysis process with additional information. These data should provide information to generate rate and trends. (e.g. driven km, operating hours).		
435	The data monitoring programme should identify KPIs to assure that the monitoring is performing at an optimal level, and address any issues affecting the effectiveness of the monitoring program (e.g., data corruption or loss, or result in delayed or degraded event detection). Examples of KPIs for monitoring are trip collection rate, i.e. time between actual safety occurrence and detection of the occurrence (Date of detection of the occurrence by the In-service Monitoring – Date of the actual occurrence of the event).		
436	Section 8.5.2 describes the relationship between ADS requirements and ISMR activities through a cross-reference matrix (reported in the Annex II) that specifies which requirements are suitable for monitoring.	Drafting: Ensure alignment of references in final document. 8.5.2. refers to “monitoring of performance” subsection. Annex II refers to the matrix on FRAV safety requirements and ISMR.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
437	Vehicle data collection		
438	There is regulatory work to introduce Event Data Recorder (EDR) and Data Storage System for Automated Driving (DSSAD) requirements. Until those requirements have been defined this section is only suggesting the data elements that should be collected and uploaded by the manufacturer from ADS vehicles for aggregation and processing to allow reporting of the metrics defined in the Reporting section. Additionally, access to EDR data might be subject to data privacy issues, because the data is generally owned by the vehicle owner which raises the need for dedicated data collection provisions for the ISMR use case		
439	Other manufacturer-accessible sources of data indicative of ADS performance		
440	Manufacturers may be expected to collect data relevant to typical operations such as dealer reports, customer reports, etc.		
441	Monitoring of Performance		
442	The monitoring of the ADS performance is intended:		
443	To provide evidence of in-service safety performance of the ADS		
444	To identify a drift or deviation from the demonstrated performance including the ones that end in an occurrence		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
445	Following the results obtained from the monitoring, the manufacturer should evaluate:		
446	In-service safety performance		
447	The adequacy of the metrics and thresholds	OICA/CLEPA proposal the adequacy of the related metrics	
448	Any mitigation actions.	Editorial note: is “mitigation” referring to “remedial” actions per the preceding paragraphs?	
449	Annex 2 contains the matrix which links the ADS requirements to ISMR activities.	Drafting: Ensure correct annex reference in final version.	
450	In-Service Reporting		
451	The main purpose of occurrence reporting is to identify possible improvement for the ADS safety performance, and not to attribute blame or liability.		
452	Recommended reporting by the manufacturer		
453	The manufacturer should report, as required by the Authority, in accordance with this section and the section 8.5.4 and 8.5.5. It is expected that two types of reports on the in-service safety performance will be produced. These are short-term and periodic.	Drafting: Ensure correct references in final version. 8.5.4. refers to the “occurrence reporting” subsection. 8.5.5. refers to the “tools for reporting” subsection.	

	Original draft text	Comments/Proposals	Discussion Outcome(s)
454	Short term reporting of occurrences and safety concerns is required for matters of such safety importance that they may require the manufacturer to take remedial action, including:		
455	Indications of failure to meet safety requirements		
456	Critical occurrence where the ADS was involved known to the ADS manufacturer or OEM		
457	Other safety-relevant performance issues		
458	At National level, there may be further requirements for immediate reporting/notification to the authority in the event the ADS manufacturer becomes aware of a failure /defect which poses an immediate risk to public safety.		
459	The manufacturer should also undertake periodic reporting of performance metrics and occurrences to the safety authority.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
460	The periodic report should provide evidence of the in-service ADS safety performance. In particular, it should demonstrate that:		
461	No inconsistencies have been detected compared to the ADS safety performance declared prior to market introduction;		
462	The ADS fulfils the performance requirements and as evaluated in the test methods;		
463	Any newly discovered significant ADS safety performance issues that pose an unreasonable risk to safety have been adequately addressed and how this was achieved.		
464	Section 8.5.4 provides a list of critical and non-critical occurrences aligned with Safety requirements. This represents the generic areas of interest to be defined in greater detail considering both the usefulness of each suggested reporting element to the safety authorities, their capacity to review the volume of data reported, and the feasibility of storing, collecting and reporting the various elements.	Editorial note: Ensure correct reference in final version. 8.5.4. refers to “occurrence reporting” subsection.	
465	During the investigation, the authority should be informed about the data processing (for example: filtering and conditioning) procedure and agree on the steps undertaken to deliver the data supporting the report.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
466	Where feasible, a harmonized approach to the reporting should be developed by contracting parties, and their relevant domestic authorities.		
467	The authority, where necessary, may verify the information provided and, if needed, may make recommendations to the enforcement authority and/or to the ADS manufacturer to remedy any detected conditions constituting an unreasonable risk to safety		
468	If a serious safety risk is identified, the safety authority may recommend temporary safety measures, including immediately restricting or suspending the relevant operations, and require actions to restore an acceptable level of safety		
469	Reporting from other sources		
470	The effectiveness of the ISMR pillar is determined by the availability of data on ADS safety performance. Limiting the reporting to manufacturers would also restrict the type of occurrences that may be identified by ISMR, and consequently the level of safety improvement achievable through operational experience feedback will be limited.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
471	It is recommended that CPs consider extending the operational reporting mechanism to other sources (e.g. drivers, operators, users, managers, road traffic authorities …), following best practices already adopted in other transport sectors		
472	Occurrence reporting		
473	The short term and periodic reports should be made available, as required by the Authority, in two parts:		
474	A report (according to Annex III), that contains a summary and the information relevant to the requirements for reporting,		
475	The data underpinning the report, exchanged with the authority by means of an agreed data exchange file.		
476	Short term reporting is expected to be submitted for each critical occurrence.	OICA/CLEPA proposal Short term reporting is expected to be submitted for the critical occurrences related to ADS performance of the DDT.	
477	Short term reporting is due within one month of the manufacturer's knowledge of the matter. Short term reporting is needed to provide awareness of situations in which the ADS may be or is posing an unreasonable risk to safety in-service.		
478	Manufacturers are required to notify such concerns promptly upon their identification and to issue a report within 30 days form the knowledge of the matter.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
479	The reporting scheme applies to automated vehicles features of an ADS which was active, at least, 30 seconds before the critical occurrence.		
480	Periodic reporting should be submitted regularly, at least every year, in the form of aggregated data (e.g., per hour of operation and distance driven) for ADS-vehicle type and related to ADS operation (i.e., when ADS is activated).		
481	8.5.4.7. The occurrences have been subdivided into four categories, 1. Occurrences related to ADS performance of the DDT 2. Occurrences related to ADS interaction with ADS vehicle users 3. Occurrences related to ADS technical conditions, including maintenance and repair 4. Occurrences related to the identification of new safety-relevant scenarios		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
482	The following is a list of occurrences that have been derived from the ADS safety requirements. It is recommended that these form the basis of the reporting requirements. For each occurrence, its relevance to the short-term and/or periodic reporting has been flagged in the table below.	OICA-CLEPA proposal for amendments submitted in the last SG3 session, but no time to introduce to the group. OICA-CLEPA proposal will be introduced in next SG3 (date TBC). *Comments in table below.*	

Occurrence	*Short-term reporting [1 Month]*	*Periodic Reporting [1 Year]*
1) Occurrence related to ADS performance of the DDT		
1.a. Safety critical occurrences known to the ADS manufacturer or OEM Occurrences related to ADS performance known to the ADS manufacturer or OEM not covered from following points 1.(x) of the list	X	X
1.b. Occurrences related to ADS operation outside its ODD	X	X
1.c. ADS failure to achieve a minimal risk condition when necessary	X	X
1.d. Communication-related occurrences		X
1.e. Cybersecurity-related occurrences		X
1.f. Interaction with remote operator if applicable Propose to delete		X
2) Occurrences related to ADS interaction with ADS vehicle users		
2.a. ~~Driver unavailability (where applicable) and~~ other user-related occurrences		X
2.b. Occurrences related to Transfer of Control failure		X
~~2.c. Prevention of takeover under unsafe conditions~~		X

3.a. Occurrences related ADS failure		X
3.b. Maintenance and repair problems **related to the ADS system.**		X
3.c. Occurrences related to unauthorized modifications		X
3.d. Modifications made by the ADS manufacturer or OEM to address an identified and significant ADS safety issue Propose to move elsewhere	X (if the issue presented an unreasonable risk to safety)	X
4. Occurrences related to the identification of new safety-relevant scenarios	(already covered under 1.a, 1.b, 1.c and 3,d)	X

	Original draft text	**Comments/Proposals**	**Discussion Outcome(s)**
483	Tools for reporting		
484	The reporting templates aim at assuring the harmonization of the information to be reported and facilitating the information sharing.		
485	The reporting templates aim at ensuring that a consistent and comprehensive set of information is delivered to the safety authority to foster an effective application of reporting scheme. ~~Further granularity of the information can be considered depending on the ADS use cases.~~	OICA/CLEPA proposal The templates proposed aim to promote uniformity across reporting and to facilitate sharing of nonconfidential information. The reporting templates aim to suggest the collection of relevant information available to the manufacturer and to other stakeholders to foster an effective application of reporting scheme.	
486	The reporting shall be carried out according to the laws applicable in each contracting party and according to the information available to the reporting actors (manufacturers and/or operators).		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
487	The short term template (Annex 3) provides a list of information with corresponding specifications that should be made available to the authority following the occurrence of an event flagged under the "Short term reporting" in the Section 8.5.4		
488	In particular, the short-term reporting provisions shall contribute to identify:	OICA/CLEPA proposal Based on the monitoring and analysis performed by the manufacturer in accordance with Table 1 above, these guidelines recommend that manufacturers report the following:	
489	a. Safety-relevant occurrences caused by an ADS.	OICA/CLEPA proposal Safety-critical occurrences related to ADS performance	
490	b. Traffic situations unforeseen in the original validation that resulted in ADS behaviors inconsistent with the expected behavioral competencies	OICA/CLEPA proposal Traffic situations that resulted in ADS behaviours inconsistent with the behavioural competencies demonstrated during the original validation	
491	c. ADS noncompliance with the ADS safety requirements		
492	d. Safety concerns in need of remedy.		
493	It shall also be noticed that information reported in the short term template will remain confidential.		

	Original draft text	Comments/Proposals	Discussion Outcome(s)
494	The periodic reporting template (Annex 3) provides a list of information with corresponding specifications that should be made available to the authority on a yearly basis in accordance with the occurrences under the "periodic reporting" in the Section 8.5.4.		
495	Annexes		
496	Annex 1: Background on development of ADS safety requirements		
497	Annex 2: Matrix of DDT performance and user safety requirements and assessment methods		
498	Annex 3: Approach to derive verifiable performance criteria		
499	Annex 4: Traffic Scenarios		
500	Annex 5: Virtual testing and credibility assessment		
501	Annex 6: Track and real-world testing		
502	Annex 7: ISMR and safety requirements matrix		

503	Annex 8: ISMR reporting templates	OICA-CLEPA proposal to reorganize the "short term" and "Periodic" templates sections has been submitted to SG3. The amendment proposal in this annex, not reported in this table but available in Word document (see details later) highlights information that will be available to the OEM and ones available to other stakeholders that will provide at first-hands. Rules used for the reorganization: • Not added new rows in the templates • Reorganized current templates contents in 3 categories: 1) Safety relevant Info Available to the OEM 2) Additional Info available to other stakeholders 3) Manufacturer and other stakeholders information reporting • Proposed to delete some rows not safety relevant. Please refer to OICA-CLEPA text submitted as comment to the IG leadership (.docx) on Nov 20th. In alternative, same proposal also submitted to SG3 (sent by SG3 leadership on Nov 9th): ppt and word doc.	

504	Annex 9: Additional recommendations for effective in-service monitoring		
505	Annex 10: Further considerations for future work		