ADS Regulations
Guidance and Interpretation Document
OPI Inputs, Comments, and Discussion Table

This document has been prepared to inform GRVA on the status of work on a Guidance and Interpretation Document (GID) to support implementation of the proposed new UN Global Technical Regulation on Automated Driving Systems and new UN Regulation on the approval of vehicles with regard to their Automated Driving Systems. The document is based on GRVA/2026/3 as amended by GRVA-24-29 (the UN Regulation text as approved by GRVA) and WP.29-198-09 (the UN Regulation including DSSAD provisions approved by the EDR/DSSAD and ADS IWG in February 2026).

This document provides draft text as of the 17th GRVA Workshop on ADS (27 April-1 May 2026). The materials will be restructured and refined for submission to the 26th session of GRVA (14-18 September 2026). The stakeholders expect to agree on this format and refinements during a GRVA workshop to be held in Brussels during 14-17 July.

The contents are provided in a table format. The rows shaded in grey provide the text from the draft UN Regulation. The second row provides the guidance or interpretation for the regulatory provision(s). The indented row provides examples.

Para.	*Regulatory text*
GID explanatory text	
	Examples (if any)

The GID aims to support the UN GTR and UN Regulation versions of the requirements for ADS. This draft document has been based on the UN Regulation to ensure coverage of the administrative sections of the UN Regulation that are not found in the Global Technical Regulation. The final submission to GRVA for the September session will cite both regulations.

Draft contents

GID Introductory Text

The purpose of this document is to facilitate the interpretation of the requirements within UN Global Technical Regulation No. [XXX] and UN Regulation No. [YYY] on Automated Driving Systems when applying them to a particular ADS vehicle (or a particular vehicle type with regard to its ADS, in the case of the UN Regulation), to provide guidance on what may be used to evidence those requirements, and to help harmonize application across different manufacturers, authorities and inspection bodies.

The document strictly provides information to support the interpretation of the Regulations and may add guidance to support interpretation as context and to further facilitate understanding. The document in no form introduces new requirements. The Regulations remain the sole authoritative and legal texts as agreed to be adopted by WP.29 under both the 1958 and 1998 Agreements.

The content of this document is all entirely based on the requirements of the ADS Regulations. These Regulations address the safety and safe use of systems performing the entire Dynamic Driving Task (DDT) for a vehicle (i.e., replacing the human driver in operating a vehicle).

There are other WP.29 Regulations as per the 1958 and 1998 Agreements, that include requirements related to the dynamic driving task (such as braking, steering, lighting, etc.). The design, operation and construction of vehicles will be impacted by the addition of ADS, including how they are regulated. WP.29 requested the screening of UN Regulations and GTRs (ECE/TRANS/WP.29/1164, paragraph 30) and amendments to modify these other regulations to accommodate ADS equipped vehicles (ECE/TRANS/WP.29/1173, paragraph 32).

These other regulations may be affected by the fact that a driver is not required while the ADS is performing the dynamic driving task, and in some ADS vehicles, a driver may not be required at all. For example, the technical requirements for systems such as braking, steering, and lighting enable both an ADS or a driver to perform the DDT but may be differ in how they are implemented for the two uses. The subsidiary Working Parties of WP.29 established dedicated task forces to amend these Regulations to ensure their applicability (or to clarify their inapplicability) to ADS vehicles, including those without manual controls and/or those without occupants. These proposals have been implemented in existing WP.29 Regulations in parallel with the development of the ADS Regulation. Though these modifications are related to ADS, they are not in scope of this document.

Nonetheless, the amendments to these other regulations, including those that enable performance of the DDT, are outside the scope of the ADS regulations and of this document.

Instructions for use of the GID

Terminology

Assessor: Global Technical Regulations (GTR) are designed for applicability across regulatory systems worldwide. UN Regulations (UNR) are designed for use specifically under the 1958 Agreement concerning, among other things, the conditions for reciprocal recognition of approvals granted on the basis of the UNR. The GTR does not specify the entity or entities that conduct the assessments and confirmatory testing because such designations are determined by national law. The UNR explicitly requires these activities to be conducted by an approval authority or a designated technical service recognised under the 1958 Agreement. For the purposes of this document, the term "assessor" is used to mean the entity or entities conducting these activities.

Examples
In some cases, the explanation is accompanied by one or more examples to illustrate the point(s) being made. None of these examples individually or collectively should be considered exhaustive, definitive, or compulsory. The ADS regulations explicitly require each safety case to be tailored to the characteristics of the ADS, its features, and their ODD and to be assessed on its own merits.

1. Scope

2. Definitions

Guidance	"Relevant authority"
	The ADS regulation refers to a generic Relevant Authority in the following paragraphs concerning the post deployment safety: - UNR: 3.2.3., 7.1.8.2., 7.4.3., 7.4.4., 7.4.5, 7.4.7.1. Annex 4 and Annex 5 - GTR: 5.1.8.2., 5.4.3., 5.4.4., 5.4.5, 5.4.7.1. Annex 2 and Annex 3 In this regard, Relevant Authority means any authority* as identified in applicable law, for whom the manufacturer is required to provide post-deployment notifications and reports related to the operation of Automated Driving Systems (ADS). UNR only: Without prejudice to applicable laws, it must be noted that the responsibility for assessing and/or acting upon the content of the post-deployment notifications and reports as per the requirements of this regulation is held by the Granting Type Approval Authority as described in Section 8 of the ADS regulation. * Including regional economic integration organization authorities, if applicable.
2.7.	*"(ADS feature) active"* means the operational state in which an ADS feature is performing the DDT.
2.8.	*"(ADS feature) activation"* means the act of changing the operational state of an ADS feature, from available to active.
2.9.	*"(ADS feature) available"* means the operational state of an ADS feature pursuant to the ADS verification that the ODD conditions of the feature have been met at a time prior to activation of the feature when it is not performing any part of the DDT.
2.10.	*"(ADS feature) deactivation"* means the change of the operational state of the ADS feature from the state in which it is performing all of the DDT to the state in which it is performing none of the DDT.

Several provisions of the regulation refer to operational states of an ADS feature. The regulation defines "available" and "active" states for an ADS feature. The "available" state was defined to enable provisions concerning when an ADS feature is safe for use. The "active" state was defined to enable provisions concerning when an ADS is performing the DDT.

These states were defined based on an overall concept of ADS operation. In concept, an ADS could be entirely inert (which might be termed "off"). The requirements specify that an ADS feature may only be activated if the conditions of its ODD have been met. Therefore, an ADS (as a system) must be operating to monitor the vehicle environment to determine whether the ODD conditions of a feature have been met (which might be termed "on"). Once the ADS has made such a determination, the respective feature becomes "available" for use. The activation of an available feature means that the ADS has assumed performance of the DDT from that specific point in time after which the feature remains "active" until its deactivation.

Although the regulation only defines feature-level states of "available" and "active", the regulation inherently recognizes system-level states of "on" and "off".

[Diagram illustrating the system and feature levels and the terminology concerning their states.]

2.13.1. *"Critical Occurrence"* means an occurrence during which at least one of the following criteria is fulfilled:

(a) At least one person suffers an injury that requires medical attention or dies 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, or

(c) Any vehicle involved in the event experiences a deployment of any non-reversible occupant restraint system, vulnerable road user secondary safety system, or the delta-V thresholds to be met, whichever occurs first.

The term "critical occurrence" was defined to enable provisions concerning the reporting of significant events. Annex 6 provides further information concerning thresholds for determining whether an event qualifies as a "critical occurrence".

Use of the term "critical" in this context should not be confused with its use in defining situations and scenarios. In the context of occurrences, the emphasis is on the outcome of a situation. In the context of situations, the emphasis is on the behaviour of the ADS in responding to the risk of adverse outcomes.

2.33. *"(Driving) situation"* means the conditions surrounding a vehicle (including other road users).

2.34. *"Traffic scenario"* means a representation of a sequence of driving situations that can occur during a given trip.

The text differentiates between real-world traffic conditions an ADS may encounter (*situations*) and representations of such conditions used to assess ADS behavioural competencies (*scenarios*). These terms enable the Regulation to differentiate performance requirements from tools used to demonstrate compliance with the requirements.
See also para. 6.1. on ADS performance requirements.

For example, according to the ODD analysis, an ADS feature might be expected to encounter pedestrians in the roadway (i.e., driving situation). Therefore, the manufacturer might design a set of scenarios for use on a test track to assess the ADS response to such encounters. These scenarios should be sufficient to demonstrate that the ADS will interact safely with pedestrians across reasonably foreseeable conditions of the ODD.

2.33.1.	*"Nominal situation"* means a driving situation that is neither a critical nor a failure situation.
2.33.2.	*"Critical situation"* means a driving situation that requires prompt action by the ADS to avoid or mitigate the risk of a crash that could result in adverse consequences on human health or property damage.
2.33.3.	*"Failure situation"* means a driving situation where a failure compromises the capability of the ADS to perform the entire DDT.

Driving situations and the scenarios derived from these situations are classified as "nominal", "critical", or "failure". These classifications enable assessment of the capability of an ADS to operate a vehicle, its capability to respond to external events requiring prompt action to mitigate their adverse effects, and its capability to manage risks of failures in its safety-relevant dependencies.

The manufacturer is expected to analyse the ODD of the ADS feature(s) to:

(a) Determine the functional capabilities required to operate a vehicle under those conditions,

(b) Identify risks of conflict with other road users, potential road hazards, and other foreseeable conditions that might require rapid ADS responses to manage the risks presented by the conditions, and

(c) Identify potential faults and failures that could compromise the capability of the ADS to perform the entire DDT necessary to operate the vehicle within the ODD of its feature(s).

From this analysis, the manufacturer defines the scope of its testing programme, including its scenario-based testing, to build its safety case for compliance with the requirements of the Regulation, including the requirements for performance of the DDT in nominal, critical, and failure situations.

Use of "critical" in this context should not be confused with its use in the term "critical occurrence" (see para. 2.13.1.).

See also 6.1.2., 6.1.3., and 6.1.4. for requirements concerning ADS performance in these situations.

3. Application for approval

3.1. Prior to application for approval, and as early as reasonably practicable, the manufacturer or their duly accredited representative shall provide the following information to the approval authorities[9] of all the Contracting Parties in whose territory features of the ADS can be active ('receiving approval authorities').[10]

(a) A single point of contact for the receiving approval authorities to request information from the manufacturer,

(b) The expected granting approval authority and the designated technical service being used by the manufacturer, if already selected, and

(c) Brief details of the ADS, its feature(s) and ODD; this information shall be treated as confidential by the receiving approval authority.

[9] Using the email address(es) provided on the online platform ("/343 Application") provided by UNECE and dedicated to the exchange of such information: https://www.unece.org/trans/main/wp29/datasharing.html or, if unavailable/discontinued, in the latest revision of document ECE/TRANS/WP.29/343 ('/343 document'). Contracting Parties without an approval authority shall publish the relevant contact details on the online platform ("/343 Application") or in the /343 Document in lieu of the details of an approval authority for this UN Regulation along with a note stating that this is not an approval authority.

[10] These provisions shall be kept under periodic review by GRVA for amendment as necessary to support effective implementation of this UN Regulation.

3.1.1. In the case that the territory of an additional Contracting Party is added as part of an application for extension of a type approval, the requirements of paragraph 3.1. shall apply *mutatis mutandis* with respect to that Contracting Party and its approval authority.

These provisions introduce a requirement for manufacturers to contact the authorities in the countries where the ADS can operate in advance of formally applying for an approval. This step falls before the normal formal process of 'application for approval', which begins with the submission of the application to the granting approval authority. The intention of this notification is to make the receiving authorities aware that an automated vehicle is destined for their territory.

The information provided by the manufacturer is expected to be brief, while giving enough information to understand the kind of vehicle, the type(s) of ADS feature, and any geographical or other significant aspects of the ODD.

'As early as reasonably practicable' means at the point the manufacturer has the information available and is confident that the information is mature and that the ADS vehicle is destined for the given country.

This process is not intended to open significant dialogue between the manufacturer and the approval authority of every destination country.

3.2.3. In the case of ADS with features that can be active in the territory of Contracting Parties other than the Contracting Party issuing the approval, the manufacturer shall provide to the granting approval authority the following information for each territory:

The intention of this provision is to ensure that the manufacturer provides the granting approval authority with the necessary information for them to transmit to the receiving approval authorities during the process described in paragraph 4.5. The information provided should give the receiving approval authority sufficient insight to be able to carry out the review according to paragraph 4.5.2. regarding application and interpretation, taking into account the relevant national context. Further guidance on the kind of information expected for some of the required items is given below.

3.2.3. (a)	Summary of how freedom from unreasonable risk has been defined, including details of specificities for the respective territory (if any),

'Freedom from unreasonable risk' is one of two top-level provisions in the ADS regulation which sets the expectation for ADS safety (alongside the comparison with competent and careful human driving), and what constitutes reasonable and unreasonable may have national specificities.

The concept of freedom from unreasonable risk is aligned with that of 'absence of unreasonable risk' in ISO21448 and ISO26262, where 'unreasonable risk' is defined as:

"Risk judged to be unacceptable in a certain context according to valid societal moral concepts."

The manufacturer's information is expected to describe the method and the sources (e.g. for the different territories) used to collect the information.

3.2.3. (b)	Summary of how the safety level of a competent and careful human driver has been determined, including details of specificities for the respective territory (if any),

[Competent and careful human driver' is referred to in the regulation as a general concept, not necessarily as a statistical value or rate. While many aspects of competent and careful driving are common everywhere, there are also differences in the behavioural competencies expected of such a driver in different jurisdictions. For example, a driving behaviour that is appropriate and safe in one jurisdiction may be inappropriate in another, resulting in a reduction of safety level.

It is understood that not all human drivers behave competently and carefully at all times and so, when making comparisons between ADS driving behaviour and human driving behaviour, a manufacturer would need to explain how competent and careful driving behaviour has been determined, accounting for national specificities (if any).]

3.2.3. (c)	Summary of how applicable traffic rules have been identified, interpreted, and assessed,

As traffic rules differ between countries, are largely written with human driving in mind, and can require interpretation on a case-by-case basis, it is important for manufacturers to have implemented any specificities for each country of operation. The information provided for this item could include details of the relevant SMS processes which cover the identification, interpretation, and assessment of traffic rules, as well as specific examples related to particular national rules.

4. Approval

4.1.1. The approval authority or its designated technical service shall verify in accordance with paragraph 8 that the manufacturer has taken the necessary measures relevant for the vehicle type in respect of:

(a) The test environments according to paragraph 7.2,

(b) The safety case according to paragraph 7.3,

(c) Post-deployment safety according to paragraph 7.4,

(d) Other manufacturer requirements according to paragraph 7.5.

UN Regulation No. 79, as adapted to be fit for ADS vehicles, does not make specific prescriptions on the level of redundancy required for ADS steering (for example the amount of stored energy). Instead, the manufacturer provides a safety concept and the approval authority verifies the performance of the system under failure conditions against this concept.

The necessary manoeuvres to reach a safe and acceptable MRC under any reasonably-foreseeable circumstances are a function of the ODD of the ADS. It is therefore important at the time the ADS is approved to ensure that the safety concept certified for the steering system is sufficient for the ADS vehicle to be free from unreasonable risk in the case of steering failures during operation.

4.5. Approvals covering ADS features that can be active in the territory of a Contracting Party other than the Contracting Party issuing the approval.[11]

[11] These provisions shall be kept under periodic review by GRVA for amendment as necessary to support effective implementation of this UN Regulation.

These provisions are intended to help ensure that the interpretation and application of the ADS regulation are harmonised, thereby facilitating the smooth operation of mutual recognition under the 1958 Agreement (i.e. avoiding requests for any further testing or documentation before vehicles are placed on the market, and reducing the chance of later dispute between Contracting Parties).

4.5.2. Following a review of the documentation described in paragraph 4.5.1, the receiving approval authority may provide comments to the granting approval authority on the interpretation or application of this UN Regulation with respect to their territory. Comments shall be provided within 30 days of receipt of the documentation described in paragraph 4.5.1. In case of dispute, a detailed justification shall be provided by the receiving approval authority making the comments to the granting approval authority.

The review by receiving authorities according to this paragraph is not intended to be a re-audit or re-assessment of the documentation supplied by the manufacturer. It is intended to review the high-level application and interpretation of the requirements of the regulation with regard to the specificities of their territory, focussing on the items listed in paragraph 3.2.3. (a)-(f).

Receiving authorities are not obliged to carry out a review or to make any comments. After 30 days have passed without receiving comments, the granting approval authority can assume that there are no comments from a given approval authority. Receiving authorities can also notify the granting approval authority that they do not intend to carry out a review, or that they have no comments, in order to speed up the process.

If a receiving approval authority comments that the regulation has not been applied or interpreted appropriately with respect to the receiving territory, a detailed explanation and justification must be given so that the granting approval authority can fully understand the issue and decide on the appropriate action needed, if any, to take the comments into account before granting the approval.

4.5.2.1.	Having taken account of any comments, the granting approval authority shall grant the approval with the respective Contracting Party or Parties included in the list in Appendix 2 to Annex 1.

Depending on the nature and content of the comments received, the granting approval authority has a variety of options for taking them into account. These could consist of, but are not limited to:

- Providing further documentation or explanation to the approval authority which made the comments.
- Requesting additional or updated documentation from the manufacturer.
- Doing nothing, if the granting approval authority is satisfied that the comments are already covered and do not need to be addressed.

5.	General requirements
6.	ADS requirements
6.1.	Performance of the DDT
6.1.2.	ADS Performance of the DDT in Nominal Situations
6.1.3.	ADS Performance of the DDT in Critical Situations
6.1.3.1.	The requirements for DDT performance under nominal situations shall continue to apply during critical situations as far as is reasonably practicable under the specific circumstances with the aim of minimising overall safety risks.
6.1.4.	ADS Performance of the DDT in Failure Situations
6.1.4.1.	The requirements for DDT performance in nominal situations shall continue to apply during failure situations as far as is reasonably practicable under the specific circumstances with the aim of minimising overall safety risks.

See also items 2.34 and 2.35

The distinction between the nominal critical and failure is important as different DDT requirements apply across the different categories, nominal requirements only apply “as far as reasonably practicable with the aim of minimising overall risk” in critical and failure situations. In all situations the ultimate goal is to minimise the risk of harm.

Both scenarios and situations can be categorised as nominal, critical or failure depending on the conditions within them. This classification is not based on the capabilities of the ADS but rather on the characteristics of the situation itself.

If the ADS causes a collision in an otherwise nominal situation the intention was that this does not make the situation critical, instead it is intended to be a noncompliance with the nominal situation requirements. (i.e. it is not reclassified as a critical situation due to an error by the ADS).

In addition, complexity alone does not make a situation critical. A nominal scenario can be complex with many road users interacting with each other but no prompt action required by the ADS in order to avoid a collision.

Examples (optional)
Nominal
- A queue of cars stopped at a traffic light
- A roundabout
- Urban street with pedestrians crossing ahead

Critical
- A pedestrian runs out in front of the ADS vehicle
- Harsh cut in on the highway
- ORU reversing into the ADS vehicle
- Extreme weather event creates a hazard on the road

Failure
- DDT-related sensor failure
- Tyre puncture
- Power loss to ADS
- ADS related actuator failure
- On-board ADS related communication failure

6.1.2.1. The driving behaviour of the ADS shall not cause a collision.[14]

[14] It is acknowledged that establishing causation can be complex, and not always possible. However, where it is established that the behaviour of an ADS caused a collision, this is a non-compliance with this requirement.

This requirement has pre and post deployment implications. Where there are collisions in which the ADS is involved during the approval process (e.g., during the manufacturer's on-road testing or confirmatory testing) there is expectation that a root cause analysis is done to assess the causes of such collision and an explanation provided. Where the ADS is determined to have played a role in causation, the manufacturer will provide evidence of how the related causal factors have been addressed in the final ADS prior to approval.

Where a collision happens post deployment it is covered by the ISMR process as implemented within national law of the country in which the collision occurred concerning how to define relevant collisions; how and by whom causation is determined; and the consequences of post-deployment crashes in which the ADS played a causal role.

6.1.2.2. The ADS shall adapt its driving behaviour in line with safety risks: this shall at least include:

(a) Anticipating the risks in the driving environment to reduce the likelihood of encountering a critical situation,
(b) Adapting its speed in line with safety risks, and
(c) Maintaining appropriate distances from other road users by controlling the longitudinal and lateral motion of the vehicle.

This requirement and the three sub requirements all refer to the adapting the behaviour of the ADS in line with safety risks. These separate requirements were all grouped together to cover ADS behaviour; it is intended that the manufacturer explains how the ADS demonstrates behaviours that cover these safety goals.

a) Example behaviours demonstrating the anticipation of risks in the driving environment:

- Predicting possible hazards based on the surrounding conditions in order to avoid a situation where prompt action would be needed to avoid a collision
- Assessing the significance of possible hazards and prioritising responses recognising that other road users may sometimes not comply with traffic rules.
- Anticipating road and traffic conditions, and acting in good time
- Avoiding reactive stopping as much as possible by planning an approach to hazards which enables the vehicle to keep moving.

b) Example behaviours demonstrating the adaptation of speed in line with safety risks:

- Making safe, reasonable progress appropriate for the road, traffic and weather conditions and the road signs and speed limits.
- Not exceeding the speed limit.
- Approach hazards at a safe, controlled speed, without being over cautious or interfering with the progress of other traffic.
- Adopting a safe, realistic speed for the road and traffic conditions

c) Example behaviours demonstrating the maintaining of appropriate distances:

- Maintain a safe following distance, adjusting for speed, road gradients, surface conditions and weather.
- Allowing for longer stopping distances on wet or slippery roads
- Leaving enough space in traffic queues to manoeuvre safely if the vehicle in front becomes obstructed
- Leaving enough space when overtaking other road users taking into account approaching road users if necessary.

6.1.2.3.	The ADS shall avoid unreasonable disruption to the flow of traffic in line with safety risks.

The intention of this requirement is to avoid the ADS stopping or driving slowly in a way that is unreasonably disruptive to other road users. The addition of ‘unreasonable’ was included to allow normal interaction with traffic (e.g. using an on ramp to a highway, slowing for traffic lights, waiting at unprotected turns), which may require other road users to adapt their speed. Compliance with traffic rules is not intended to be considered as causing an unreasonable disruption (See also 6.1.2.6.)

6.1.2.4.	The ADS shall detect and respond to objects and events relevant to its performance of the DDT.

Examples of objects that are relevant to the DDT

- ORU
- Infrastructure
- traffic furniture

Examples of Objects that are not relevant to the DDT

- Planes in the sky,
- People inside buildings,
- Vehicles driving on an adjacent (but completely segregated) road
- Leaves blowing in the wind.

6.1.2.5. The ADS shall detect and respond to priority vehicles in accordance with the applicable traffic law(s).

This requirement allows for an ADSF-1 to transfer control to the fallback user (fallback response) in the case of a priority vehicle interaction. For both ADSF-1 or ADSF-2, the manufacturer may also use non-ADS strategies to ensure that the priority vehicles are responded to correctly (however the ADS is always responsible for detecting and responding to them). The manufacturer should follow any available guidance and best practice engaging with emergency services prior to deployment.

- Remote intervention.
- Hand-over to fallback user.

6.1.2.6. The ADS shall comply with traffic rules in accordance with application of relevant law within the area of operation.

This requirement uses the terms “application of relevant law” to refer to how the law is applied in practice, consistent with case law.

The intention is to allow flexibility for the ADS to deal with complex real-world situations but is not intended for the manufacturer to ignore traffic rules if other humans are (e.g. speeding on the motorway) in these situations case law would show humans in similar situations were still held liable. This provision is also intended to cover cases where traffic rules conflict with one another to still allow the ADS to take appropriate action. The term “area of operation” refers to the specific jurisdiction the ADS is operating in and the applicable traffic rules that apply in that jurisdiction.

6.1.2.8. The ADS shall avoid collisions with safety-relevant objects.

Safety-relevant objects are defined as an object that, if collided with, is likely to cause non-trivial damage to the vehicle or that is likely to pose a safety risk to other road users, vehicle occupants, or infrastructure.

Nontrivial damage is a threshold defined by the manufacturer in 7.3.2.3. This is intended to allow for cases where hitting some objects (e.g., a plastic bag, road debris) may be safer than the ADS taking evasive action or stopping to avoid it. Collisions with other road users would be likely to pose a safety risk to them.

Examples (illustrative and non-exhaustive)

Safety-relevant objects
- Any ORU (pedestrian, cyclist, other vehicle)
- Street furniture (bollards, signage, etc)
- Parked vehicle

Non-safety-relevant objects
- Plastic bag
- Road debris
- Litter

6.1.2.9. The ADS shall signal its operational status if required by applicable laws.

This requirement refers to external signalling of the ADS status; this regulation does not mandate the use of an ADS status signal unless the applicable laws in the area of operation require one.

6.1.2.11.	The ADS shall have strategies in place to appropriately detect and respond to instructions from road safety agents.

This requirement allows for the response for an ADSF-1 to transfer control to the fallback user (fallback response) in the case of a road safety agent interaction. For either feature type the manufacturer may also use non-ADS strategies to ensure that the road safety agents are responded to correctly (however the ADS is always responsible for detecting them).

Example Non-ADS Strategies
- Remote intervention
- Hand-over to fallback user
- The road safety agent may be permitted to drive the vehicle themselves

Examples of Road Safety Agent instructions to the ADS Vehicle, which varies depending on their jurisdiction
- Pull over (including following to a safer stopping point)
- Give way to vehicles
- Stop after a collision
- Move out of the way
- Avoid a specific road
- Not to overtake

Instructions from a road safety agent which depending on their jurisdiction, could be issued via various communication methods including lights, sirens, audio message, temporary barriers, written text on a sign or a message via a light bar.

6.1.3.3.1.	The ADS shall not resume travel unless: (a) The safe operational state of the ADS vehicle has been verified, and (b) It is permissible under the applicable laws.

This requirement does not allow the ADS to move off following a collision until both points are fulfilled, its is permissible under applicable law and the operational state has been verified. This might be accomplished in a variety of ways, the ADS checking itself, the fallback user checking the operational state or a third party confirming safety in some way.

Where applicable laws require that a vehicle not be moved off after a collision occurs, the completion of the necessary procedures regarding vehicle movement under the applicable laws may be interpreted as “permissible”.

6.1.3.3.	In the event of a collision involving the ADS vehicle, if required to stop by applicable law, the ADS shall fall back to an MRC or bring the vehicle to a standstill as appropriate. During this process, the user may initiate deactivation of the ADS if the design of the ADS allows.

In this requirement the obligation to stop is determined by whether the applicable law in the area of operation would require a vehicle to stop following that collision. In some cases, it would be more appropriate to bring the vehicle to an immediate standstill rather than find an appropriate MRC.

6.1.3.3.2.	Notwithstanding para. 6.1.3.3.1.(a), if the collision occurred while an ADSF-2 was active, when directed by a road safety agent, the ADS shall move the vehicle unless the ADS determines that the manoeuvre poses an unreasonable safety risk or is not technically possible due to damage. Alternatively, the safety case shall describe how the road safety agent's instructions will be complied with in such circumstances.

This requirement provides an exception to the previous requirement, specifically when the operational state has not yet been verified but there is still a need to move the vehicle in an emergency. E.g. moving the vehicle off the road to allow emergency services access or to move to a safer location away from a burning vehicle. This may be accomplished by the ADS or non-ADS strategy. It is limited to ADSF-2 as with an ADSF-1 the fallback user would move the vehicle.

- Remote intervention.
- Hand-over to fallback user.
- The road safety agent may be permitted to drive the vehicle themself.

6.1.4.2. The ADS shall detect faults, malfunctions, and abnormalities that compromise its capability to perform the DDT within the ODD.

In this requirement the intention was for "faults, malfunctions, and abnormalities" to cover any failure in the ADS' capability to perform the DDT, they do not have specific distinct meanings with regards to this requirement.

This requirement encompasses three kinds of issues:
1. Warning signals sent by other systems (note this is covered more directly by paragraph 6.3.6)
2. Faults, malfunctions and abnormalities without warning signals that a driver would be expected to perceive (e.g., sideway drift when braking)
3. Faults, malfunctions and abnormalities within the ADS itself (e.g. sensors/perception, actuators…)

Receiving a warning does not necessarily mean an immediate impact on the DDT and the obligation is to detect and respond to faults that do compromise the capability to perform the DDT.
The response of the ADS to these faults is handled in other requirements (e.g. 6.1.4.3.)

6.1.4.3. In response to a fault, the ADS shall either:
…
(b) Adapt its performance of the DDT in accordance with the severity of the fault provided the resulting performance complies with the requirements under paragraph 6.1.

Part (b) of this requirement covers the case where there is a fault that has led to a failure which has impaired the ability of the ADS to perform the DDT but it is still capable of doing so with reduced performance. If the ADS continues to perform the DDT in this failure situation with reduced performance then doing so should as far as reasonably practicable continue to meet the nominal situation requirements with the aim on minimising overall risk (e.g., it would increase risk to fall back to a MRC immediately rather than continuing to a better point, on a highway for example, then that risk assessment should be made considering the failure.)

Examples
- A camera is partially obscured, so the ADS slows down and maintains extra buffer while continuing along the highway.
- Braking performance is reduced but still safe, so the ADS lowers speed and increases following distance while continuing
- A sensor for driving in heavy rain in damaged, it minimises risk for the ADS to continue driving during clear conditions rather than stopping immediately

6.1.4.4.	The ADS shall be capable of remote termination.
6.1.4.4.1.	The procedure for remote termination of an ADS performing the DDT shall include the capability to perform an ADS fallback response.
6.1.4.4.2.	The remote termination of an ADS or ADS feature(s) shall render it unable to be activated until such time as the remote termination is rescinded.

This requirement refers to the capability to prevent an ADS feature being used. This could apply to an ADS feature across many vehicles (e.g. a problem has been identified with a feature and it is dangerous to use) or a single vehicle that needs to be stopped in an emergency (e.g., an ADS vehicle is operating out of ODD in a dangerous manner). This covers both the cases where the ADS needs to immediately fall back to an MRC and where it should complete its journey and then no longer allow activation of the feature, which option is appropriate would be dependent on the specific situation. In the case where the remote termination is triggering a fallback to an MRC the ADS still performs the DDT and chooses an appropriate stopping position. This regulation only covers the mechanism for remote termination being possible, the ADS should operate in accordance with applicable laws regarding if and when it should be used.

6.1.5.4.1.	In response to an ODD exit, ADSF-2 shall aim to bring the ADS vehicle to a stop in a safe location that complies with traffic rules (e.g., a parking space).

An ADSF-2 features by definition “does not include an ADS fallback response requiring a fallback user” so there is no expectation that any human driver will be able to take over the performance of the DDT following a MRC. Of course, depending on the vehicle design, an ADSF-2 feature may be present in a vehicle with a human user who could take control after an MRC is achieved. In order to prevent the MRC resulting in the vehicle blocking the road or being parked illegally, the requirement states as a goal that the ADSF-2 feature “shall aim to bring the ADS vehicle to a stop in a safe location that complies with traffic rules.” The use of “aim to” acknowledges that some conditions may prevent a legal parking space being achieved in some specific circumstances but that the ADS is still “aiming” to park legally. The fallback to MRC in both an ADSF-1 or ADSF-2 may be interrupted by the user taking over if the design of the ADS allows. For both feature types the ADS feature is required to be designed to be free from unreasonable risk (see 5.2) and the MRC should reflect that.

6.1.6.2.	For ADSF-1, if it has not been possible to complete a system-initiated deactivation procedure, the ADS shall execute a fallback to an MRC. During the fallback to MRC, the user may initiate the deactivation of the ADS.

The text “not been possible to complete a system-initiated deactivation procedure” means the case where the normal system-initiated deactivation process (i.e. transition demand) has not resulted in the fallback user taking the role of the driver. This could be due to fallback user not responding in the transition period determined by the manufacturer, or some external event preventing that full transition period being possible (e.g., a sudden unexpected ODD exit where it is not safe for the ADS to wait for the entire transition period before beginning the fallback to MRC). In this latter case the fallback user may still want to take over performance of the DDT during this fallback to an MRC, rather than wait for the vehicle to come to a stop.

6.2.	Interactions between the ADS and its User(s)

6.2.1.1. Safety-relevant information and signals shall be:
(a) Noticeable by the target user(s) under all operating conditions,
(b) Comprehensible and unambiguous, and
(c) Multi-modal (e.g., optical, auditory, haptic) if needed.

This requirement is a general requirement and therefore applies to ADS features that permit a user to take over the performance of the DDT and to ADS features that do not permit a user to take over the performance of the DDT.

Safety-relevant information depends on the ADS feature, the current mode, current situation, and upcoming situation. Safety-relevant information and signals could include:

- ADS feature status (e.g., active, inactive, available),
- Current role (e.g. fallback user) and current responsibilities of the user or any possible changes in role,
- Stages of the deactivation process,
- Vehicle and ADS faults and consequent adapted performance,
- Warnings on attempts to use the controls that are disabled, suppressed or by other means made unavailable,
- Information supporting the building up of situation awareness prior to and during a transition from ADS,
- Alerts to the user prior to and during the MRC process,
- Approaches to planned ODD exits (pre-alerts to system-initiated transitions) and the estimated time or distance remaining to such exit.

If needed for multimodality means that the manufacturer should demonstrate that the selected modality schemes for safety-relevant information and signals are appropriate in each case.

Assessment of this provision could make reference to the manufacturer's process described in paragraph 7.1.6.2.(b)(viii).

Example: A mode indication presented as a prominent visual change, designed to be readily detectable within the driver’s primary and peripheral field of view, may enhance noticeability and reduce the likelihood that a change in system state is missed. Conversely, a mode indication presented as a subtle change to an existing visual indicator (e.g., a tell-tale or other visual symbol) may be less noticeable and therefore overlooked.

6.2.2.1.1. The ADS feature shall be designed to prevent misuse and errors in operation by the user.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT.

The intention of this requirement is that any action performed by the user while the ADS is performing the DDT should not lead to errors in vehicle operation or misuse of the ADS by the user.

An example of misuse of an ADSF-1 is not being awake while the ADS is performing the DDT.

An example of error in operation would be switching off the power train or to switching off the lights while the ADS performs the DDT in the dark.

An example of misuse of an ADS feature that does not permit a user to take over the performance of the DDT is a passenger accidentally acting on the controls provided for manual driving.

6.2.2.1.2. While an ADS feature is active:

(a) The controls related to manual performance of the DDT shall be disabled, suppressed, or, by other means, made unavailable in a manner that prevents unsafe interference with the ADS performance of the DDT:

…

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT and when the ADS performs the DDT.

The controls related to manual performance of the DDT include longitudinal and lateral vehicle controls, external lighting controls and audible warning device controls.

6.2.2.1.2. (b) Devices for indirect vision, tell-tales, indicators, and non-ADS-related warnings may be disabled, suppressed, or, by other means, made unavailable, and

[Non-ADS-related warnings refer to any warnings that are not immediately related to the ADS performance of the DDT. For example, the warning to recharge the battery might be disabled when the ADS performs the DDT. However, the warning may be provided when the ADS assesses that the battery has to be recharged for the ADS to continue to perform the DDT.]

6.2.2.1.3. The vehicle controls dedicated to the ADS shall be clearly identified and distinguishable to accommodate only the appropriate interactions.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT.

The controls dedicated to the ADS (e.g. to enable the ADS or begin a user-initiated deactivation) can be distinguishable through size, form, location, colour, type, action type, spacing and/or control shape. The requirement aims to promote correct use and is not intended to prohibit multifunction controls.

6.2.2.1.4. While an ADS feature is active, it shall inform the user of:
(a) ADS status information,
(b) The role of the fallback user in the case of an ADSF-1, and
(c) Adapted performance of the DDT consequent to some failure of the ADS.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT and while the ADS performs the DDT.

‘While’ in the requirement refers to continuous presentation of information. Informing the user can be interpreted as reminding the user.

(a) ADS status information could cover:
- Which ADS feature is active and whether the ADS is operating as a specific ADSF-1 or ADSF-2 in the case of vehicles with a capability for both modes,
- The presence of faults leading to an imminent fallback response,
- The presence of faults leading to adapted performance of the DDT

Examples of how a user can be reminded are the use of a tell-tale, use of ambient lighting, change of dashboard colour, etc.

Examples of how a user can be reminded are the use of a tell-tale, use of ambient lighting, change of dashboard colour, etc.

6.2.2.2.3. The feature activation procedure (e.g., sequence of actions and states) shall take into account relevant recommendations or standards.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT. Relevant standards could include ISO/TR 21959-1, "Road vehicles — Human performance and state in the context of automated driving: Part 1: Common underlying concepts".

6.2.2.3.5. ADS feature deactivation may be delayed if it is assessed by the ADS that the situation is unsuitable or unsafe for the subsequent mode of vehicle operation. In this case, the user shall be informed of this circumstance.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT.

Situations in which a handover might currently be risky could include:

- Driving in a curve at speed with high lateral acceleration where the user might not be able to steer the vehicle safely.
- While the ADS feature is executing a lane-change manoeuvre in circumstances where a sudden control action by the user could lead to a collision with a lead or following vehicle.
- During an overtaking manoeuvre where a control action from the user could cause a collision with a vehicle being overtaken or a vehicle traveling in the opposite direction.

6.2.2.3.7. The deactivation procedure (e.g., sequence of actions and states) shall take into account relevant recommendations or standards.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT.
Relevant standards could include ISO/TR 21959-1 Road vehicles — Human performance and state in the context of automated driving: Part 1: Common underlying concepts.

6.2.2.3.8.1. A user is considered suitably engaged to resume the DDT when they are at least:
(a) In contact with the steering control and,
(b) Their gaze has been primarily directed to the driving task relevant area long enough to be able to resume the DDT safely.

This requirement is part of the requirements that relate to ADS features that permit a user to take over performance of the DDT. This specific requirement applies to the feature deactivation procedure.

Regarding (a): Where manual steering control is by means of a steering wheel (a) refers to hand(s) on the steering wheel.

Regarding (b):
The driving task relevant area typically consists of multiple zones. Depending on the type of ADS feature and the driving situation it could be suitable to ensure that the user has looked at just one zone or more than one zone.

6.2.4.1. Means shall be provided that facilitate user understanding of the functionality and operation of the system.

This requirement is part of the requirements on information provision to users who can perform the role of the driver.

Different means may be available to the manufacturer to facilitate user understanding of the functionality and operation of the system such as documentation, website materials, etc., which may provide instructions, descriptions, explanations, expectations and overviews.

6.3.	Other ADS Requirements
6.3.5.1.	For vehicles without manual driving controls, suitable means shall be made available, where necessary (e.g., special controls, test modes, ADS functions) to enable the performance of the physical checks required for mandated inspections of other vehicle systems in the jurisdiction of operation (e.g., Periodical Technical Inspection, safety standards inspection, etc.).

The intention of this requirement is to enable technical inspection on ADS vehicles that lack manual controls.

Examples of operations include:

- Operating the braking and steering systems
- Operating the engine at a specific rpm
- Activating exterior lighting and light signalling devices

6.3.6.	[The ADS shall receive all signals transmitted to it by other systems of the ADS vehicle and appropriately manage them.] A list of these signals and how they are managed shall be included in the manufacturer's safety case.

This requirement covers both DDT and non-DDT signals, (whether prescribed by other regulations or not) designed to be transmitted to the ADS. Signals could include logic (true / false), variables (the value of a parameter on a continuous scale, and/or other information.

"Manage" is intended to include a response, including dealing with multiple signals received simultaneously, appropriate to the level of urgency of the signal. Potential responses could include the ADS directly taking action or informing a user or a remote operator.

Examples of signals received from other vehicle systems (if applicable)

- Braking
- Steering
- Lighting
- Powertrain
- Tyre Pressure Monitoring System (TPMS)
- Emission control system
- Fire / smoke in a compartment
- Rechargeable energy storage system warning
- Safety belt unfastened
- Anti-theft
- Doors opened / unlocked
- Anti-pollution
- Passenger stop request
- Opening of emergency exits
- Emergency command for door opening
- Emergency window not locked
- Hatches not closed
- Retractable step not retracted

6.3.7. While an ADSF-2 is active, the ADS shall manage relevant non-DDT-related tasks (which would otherwise be performed by a driver) in accordance with the manufacturer's safety case. Alternatively, where the ADS does not perform such necessary tasks, the safety case shall describe how these tasks are performed.

This requirement requires that for an ADSF-2 where there is not a fallback user who can take responsibility for them, all the non-DDT-related tasks a driver would normally fulfil must be managed. This management may take the form of the ADS fulfilling the task or some other non-ADS method such as the vehicle owner being responsible.

Examples of non-DDT-related tasks (if applicable)

Checking the correct working condition of the vehicle, including:
- Brake wear
- Tyre wear/tear pressure etc
- Fluid levels
- Lamps operation/angle
- Trailer correctly coupled
- Energy level
- Wheel alignment
- Locked status of doors, hood, trunk, liftgate, fuel cap etc
- Broken window, body damage or other safety hazard for occupants or other road users
- Actual mass compatible with maximum mass (including weight by axle)
- Dimensions of the vehicle with load compatible with permitted limits
- Position and situation of the load
- Presence of crew member / on-board operator (if required for that ADS feature)
- Driver warning system
- Driver inducement system
- Absence of temporary general restriction on road use (due to a severe incoming weather event, public safety, curfew, etc.)
- Position of the mobile equipment mounted on the vehicle

Checking passenger safety, including:
- Safety belts
- Airbags (operational status)
- Number of passengers compatible with vehicle capacity
- Presence and number of person with limited mobility on board
- Presence of person with limited mobility waiting for embarkment
- Absence of passengers (in vehicles of Category Y)

Operating non-DDT, safety-relevant elements of the vehicle, including:
- Doors and door locks (doors can be operated automatically, or operated by the on-board or remote operator, or operated locally by the passengers) The doors can be the service doors or the emergency doors
- Tyre wear/tear, pressure, etc.
- Windows and window locks
- Folding roof, retractable hardtop, panoramic roof, etc.
- Seating position, angle
- Retractable steps (bus)
- Ramp, liftgate, etc.
- Trailer coupling

- Windscreen wipers
- Defrosting and demisting the windscreen
- Climate control
- Hatch, trunk
- Emergency exits
- Indoor lights control
- Advance-warning triangles

6.3.8. The performance of the ADS shall not be adversely affected by magnetic or electrical fields.

[Testing for performance under magnetic or electrical fields should include those situations which are relevant for the ADS feature together with its ODD.]

7. Manufacturer requirements

7.1. Safety Management Systems (SMS)

7.1.8.2. The processes for ISMR shall demonstrate the capabilities:
…
(h) To share learnings derived from occurrence analysis which have triggered SMS processes for the continuous improvement of the ADS vehicle safety.

This requirement is an integral part of the manufacturer's Safety Management System (SMS) that is likely to be implemented through their established processes linked to occurrence monitoring reporting and analysis, that results in system updates and improvements.

In general, any occurrence that has been identified during the post-deployment phase is handled within the SMS framework through the relevant manufacturer processes (e.g., safety risk management, engineering change management, software lifecycle management, supplier management, and operational procedures).
In this context, the requirement aims at ensuring that occurrence analysis is not an isolated activity but is undertaken as part of a structured SMS derived process that is traceable from the occurrence to safety decisions, actions, and leads to demonstrable safety improvements (where applicable).

The following flowchart provides an example which is intended to clarify the interconnections among Manufacturer's processes.

[It is worth clarifying that an occurrence does not always lead to the identification of a safety learning or a corrective/preventive action. In addition, not all the identified corrective/preventive action must be implemented to close the occurrence. As with improving any engineering system the decision of what to fix and how depends on an overall judgment of the consequences and impact of making a change.]

7.1.8.5.5. The manufacturer shall achieve the following objectives from the monitoring activity:
(e) Discover trends that suggest the emergence of unacceptable risks,
(f) Ensure that remedial actions are put in place when an unacceptable risk is discovered or predicted by trends,
(g) Confirm the effectiveness of any remedial action, and
(h) Enable the development of new or the revision of existing scenarios derived from ISMR activities.

7.1.8.5.5. (a) Verify the safety performance (i.e., Safety Performance Indicators) and confirm the in-service safety level of the system (i.e., metrics and thresholds),

The Regulation mandates the manufacturer to define and monitor Safety Performance Indicators (SPIs) for the ADS throughout their lifetime in line with SMS best practices.
SPIs are measurable metrics that can be used to monitor, assess, and demonstrate the ADS compliance with Regulation during the operational phase. SPIs are generally use-case dependent and can be broadly classified into lagging and leading.
Lagging SPIs measure safety outcomes after the relevant event has taken place (reactive) and are normally linked to high-severity occurrences.
Those may be, for instance:

- Collision rate per million km
- Injury and / or fatality rate
- Property damage claims

Leading SPIs measure precursors (proactive) and safety-relevant events with the main aim to confirm that the actual safety performance of the ADS does not deviate from the expected safety performance documented in the safety case. Leading SPIs may be, for instance:

- near-miss frequency (TTC, or other safety metrics thresholds reached)
- safety envelope violations
- ADS fallback response and takeover request rates
- safety-critical scenario exposure
- perception system misclassification/failure rates
- fail-safe activation success rate

7.2.	Test environments
Guidance	Guidance on approaches for the verification, and validation, including criteria to evaluate the correlation between test results and the manufacturer's data in simulation toolchains within the simulation credibility framework
7.2.1.4.1.	The manufacturer shall document and provide the rationale for their confidence in the competency of: (a) The personnel who developed the simulation toolchain(s) and its components, (b) The personnel who assessed the simulation toolchain(s) and its components, and (c) The personnel who used the simulation toolchain(s) to perform the testing with the purpose of validating the system.
8.3.3.4.13.	In case of track testing according to paragraph 8.3.3.3., the approval authority or its designated technical service shall compare the information generated during real-world testing with the information from track testing to ensure there is an appropriate level of correlation of the results, including the performance of the ADS.

The Regulation requires that simulation toolchains used to support the ADS safety case undergo verification and validation (V&V). Verification and validation address different but complementary questions:

- Verification: Was the model implemented correctly?
- Validation: Does the model adequately represent the real-world system (RWS) of its intended use?

Both activities may be carried out in a proportionate way depending on the criticality of the simulation toolchain and its use the safety case.

V&V is a widely supported topic in industry standards and existing regulations. Some useful references that may guide the V&V activities are:

- ASME V&V 10 Standard for Verification and Validation in Computational Solid Mechanics,
- ISO 19364, 19365 → explicitly target vehicle dynamics model validation.

The following text provides practical methodologies derived from the cited standards to fulfil the V&V requirements set out by the Regulation.

Verification
Verification concerns the correctness of the implementation of the conceptual and mathematical models forming the simulation toolchain. Its objective is to ensure that numerical, logical, or software errors do not undermine the credibility of simulation outputs.

Verification may include the following complementary activities.

Code verification
Code verification aims to demonstrate that the implemented software correctly represents the intended conceptual and mathematical models.

Methodologies may include, where appropriate:
- Convergence testing: execution of tests to demonstrate the convergence to a stationary value while iterating spatial/temporal discretization;
- Order of accuracy: execution of tests aiming at assessing whether the solution/discretization error converges with the expected rate;
- Comparison with a known analytical solution: whenever a known (analytical) solution is known it should be compared to the corresponding simulation model code realization;
- Unit testing: execution of a series of low-level tests and comparison of the implemented (coded) model with the conceptual/mathematical models;
- Model (code) coverage: execution of virtual tests to determine that all logical branches within the model are executed;
- Static testing: checking of compilation warnings and errors, consistency analysis in the usage of the computer language;
- Dynamic testing: code execution to investigate memory leaks.

Calculation verification
Calculation verification deals with the estimation of numerical errors affecting the toolchain.
Practical methodologies supporting calculation verification may include:
- Float operation: evaluate the impact of the uncertainty of underflow/overflow and rounding errors;
- Solver tolerances: evaluate the impact of the uncertainty of different solver tolerances. To achieve the maximum credibility, the applicant shall perturb the solution until convergence is achieved;
- Sampling intervals: evaluate the impact on uncertainty/accuracy of sampling interval. To achieve the maximum credibility, the applicant shall perturb the solution until convergence is achieved.

Sensitivity analysis
Sensitivity analysis aims to quantify how input data and parameters affect output values and identify which have the greatest impact. The analysis also provides information that is useful in assessing whether the toolchain and its components can continue to satisfy the acceptance tests and criteria when subjected to small variations of the inputs and parameters.

Practical methodologies supporting sensitivity analysis can include:
- Qualitative sensitivity screening;
- Local (one-at-a-time) quantitative sensitivity analysis;
- Global sensitivity analysis (e.g., variance-based methods);
- Structured peer review of modelling assumptions.

Validation

Validation within the overall simulation toolchain credibility framework aims at verifying that the degree of discrepancy between the simulation-generated data and the corresponding real-world system (RWS) is acceptable for the intended use.

The validation analysis may be carried out using correlation methodologies. A collection of examples is provided in the table below.

Correlation approach	**Description**	**Example**
Graphical	Qualitative evaluation of the signals	• Plotting simulation output vs. RWS output
Scalar data	Quantitative evaluation of scalar quantities deriving from either native scalar outputs or from time-series data following aggregation	• Comparison of minimum distance to an object at the end of a test (native scalar data) • Aggregation of time-series using mean/median and other operators
Time-series	Quantitative evaluation of the discrepancies between two time-series using distance operators	• L_2 norm, Normalized Root Mean Square Error • Sprague and Geers and Dynamic Time Warping • Frequency domain approaches
Statistical testing	Quantitative verification of whether the null hypothesis “the model is an accurate representation of the real-world phenomena” cannot be rejected using statistical testing tools	• T-test or KS-test

7.2.1.4.1. The manufacturer shall document and provide the rationale for their confidence in the competency of:
(a) The personnel who developed the simulation toolchain(s) and its components,
(b) The personnel who assessed the simulation toolchain(s) and its components, and
(c) The personnel who used the simulation toolchain(s) to perform the testing with the purpose of validating the system.

[The simulation credibility framework recognises that modelling and simulation (M&S) activities rely not only on technical tools and processes but also on the competence of the personnel who develop, assess, and use the simulation toolchain(s). Inadequate competence may introduce risks such as inappropriate modelling assumptions, incorrect parameterisation, insufficient validation, or misinterpretation of simulation outputs. These risks may compromise the credibility of evidence supporting the safety case.

The regulation acknowledges that different levels of competency might be required depending on role-specific considerations.

Personnel developing the simulation toolchain
Relevant competences for developing simulation models may include:
- Knowledge of modelling theory relevant to the simulated phenomena (e.g., vehicle dynamics, traffic behaviour, sensor modelling);
- Understanding of numerical methods and software implementation practices;
- Experience in verification methods and model validation techniques;
- Awareness of uncertainty sources and their propagation within the simulation environment;
- Familiarity with ADS functionalities and safety-relevant performance requirements.

Personnel assessing the simulation toolchain
Assessment activities require the ability to critically review modelling assumptions, validation strategies, and statistical understanding of the results. Relevant competences may include:
- Capability to evaluate model adequacy with respect to its intended use;
- Experience in reviewing verification and validation activities;
- Understanding of limitations and potential misuse of simulation results;
- Ability to challenge assumptions and identify methodological weaknesses.

Personnel using the simulation toolchain(s) for validation testing
Users responsible for generating safety-case evidence may demonstrate:
- Understanding of the intended use and limitations of the toolchain;
- Ability to configure scenarios and parameters appropriately;
- Competence in interpreting outputs and associated uncertainties;
- Knowledge of statistical methods used to derive conclusions from simulation campaigns.

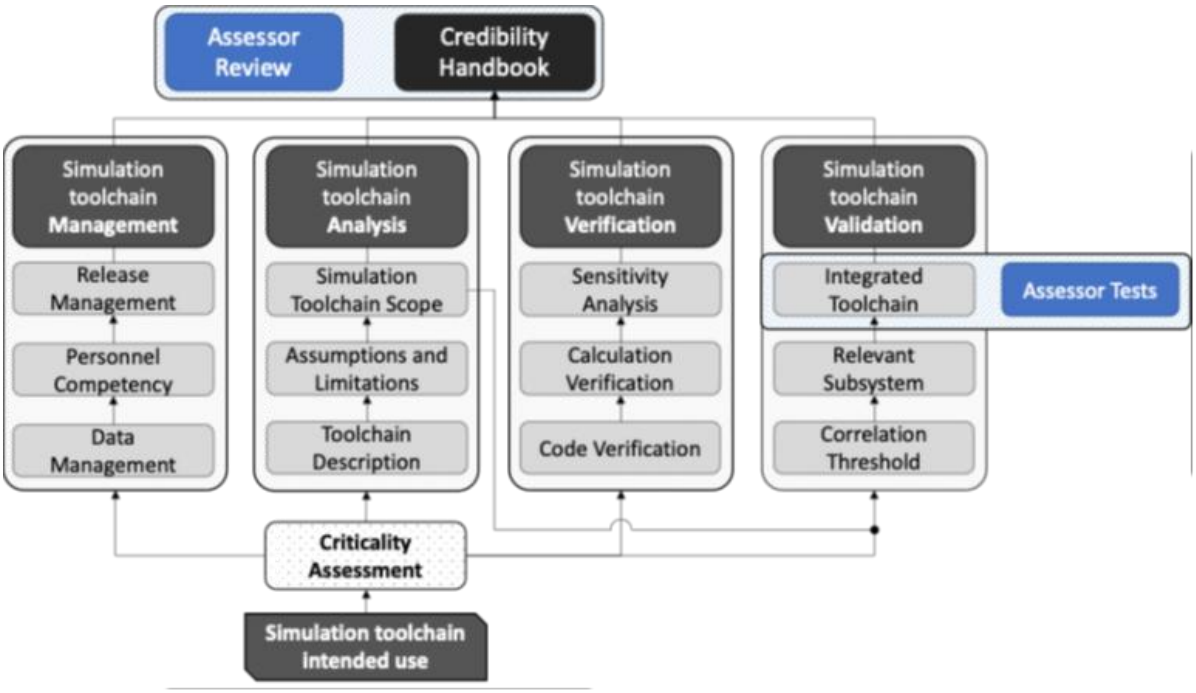
Documentation
Depending on the role, the competency of the personnel may be supported by documenting:
- Educational background and specialized training relevant to modelling and simulation;
- Relevant personnel accreditation (e.g., ISO 9001, IATF 16949);
- Documented experience in comparable M&S or safety-critical applications;
- Participation in verification, validation, or scenario-based assessment activities;
- Records of initial and recurrent training;
- Demonstrated involvement in peer review or internal assessment processes.

The depth and formality of competence demonstration may be proportionate to the criticality of the simulation toolchain(s), as determined by the criticality assessment within the simulation credibility framework.]

7.2.1.9.1. The manufacturer shall review the error estimates of the simulation toolchain(s) to assess their criticality and the effect these would have on the manufacturer's claims about their safety case.

[As part of the simulation credibility framework, the regulation requires the manufacturer to identify the criticality of the various simulation toolchains and their usage within the overall testing strategy.

The identification of the criticality by the manufacturer is part of the overall simulation credibility framework assessment. The assessment also includes simulation toolchain management, analysis, verification, and validation as shown in the chart below. Depending on the identified criticality level, different acceptance thresholds may be set for the different simulation toolchains and their associated usage. Based on ECE/TRANS/WP.29/2024/39, the chart below provides a graphical representation of criticality assessment and its link with the requirements of the regulation.



Criticality is the degree to which safety-relevant decisions rely on evidence generated by the simulation toolchain(s), and the potential impact of incorrect or misleading simulation results on the safety of drivers, passengers and other road users, damage to cargo, road infrastructure or to the ADS' operational capabilities.

A risk-informed approach is an appropriate method to assess criticality. To derive the criticality level of a simulation toolchain using a risk-informed method, the manufacturer may consider the following variables:

a) The consequences on human safety (e.g., severity classes in ISO 26262-8:2018) if the simulation toolchain provides incorrect, incomplete, or misleading results;

b) The degree to which the simulation toolchain(s) influence the safety case, such as:

- Exploratory use
- Virtual evidence complementing physical testing
- Virtual evidence partially replacing physical testing;
- Primary evidence for safety case arguments and compliance demonstration.

The table below provides an example criticality assessment matrix to demonstrate this analysis. Manufacturers may adjust this matrix to their particular use case.

Safety Case impact	Significant				
	Moderate				
	Minor				
	Negligible				
		Negligible	Minor	Moderate	Significant
		Decision consequence			

From the perspective of the criticality assessment, some possible cases for assessment might be:

- The simulation toolchain(s) features the highest criticality level and may follow the full credibility assessment (e.g., high safety case impact and high decision consequence).
- The simulation toolchain(s) features an intermediate criticality level and may follow a less stringent credibility evaluation with justified deviations (e.g., moderate safety case impact and minor consequence).
- The simulation toolchain(s) features a low criticality level and may be exempted from the full application of the credibility framework (e.g., negligible safety case impact and minor/negligible decision consequence).

Alternative solutions for the criticality evaluation of the simulation toolchain(s) are also possible. Relevant best practices might include:

- ISO 26262 Tool Confidence Level (TCL) → structured tool confidence classification based on error detection and usage
- NASA-STD 7009B → NASA's credibility assessment of modeling and simulation (M&S);
- Quality Management System (QMS) derived approaches such as IATF 16949 → process assurance and traceability mechanisms.]

7.3. Safety case for an ADS

Note:
The document uses the terminology "assessor" to refer to the actor performing the safety case assessment and the confirmatory testing. Under UNR, "assessor" should be understood as the "Type-Approval Authority or the Technical Service on its behalf". Under GTR, the "assessor" will be defined by the applicable approval/certification regime.

Guidance Remote interactions (7.3.1.4.3 (b), 7.3.1.11, 7.3.1.12, 7.3.1.16.1 (c))

There were several discussions around the remote topic during the development of the regulations and the writing of the interpretation. It was clear that remote driving would not be possible in the current version of the regulation given it is a separate topic with wider implications. The text also intended to capture safety-relevant situations where there was input remotely rather than situations where a user requested non-safety relevant support/assistance.

The group reviewed existing definitions in SAE J3016-2021 (SAE/ISO PAS 22736:2021) and in EU 2022/1426 and the possibility of introducing new definitions but did not reach consensus.

For example:

- SAE J3016-2021 defines remote assistance but restricts it to humans and providing advice to the ADS, while the discussions saw the possibility of assistance by systems and humans and providing assistance to users and the ADS.
- EU 2022/1426 defines remote intervention operator linking to the EU2022/1426 definition of on-board operator, which deviates from the approach used in this regulation.

In this light, certain terms were used in the text to try and represent the understanding and move forward but which might not align exactly with the strict definitions/uses of those terms in other documents. Manufacturers might wish to use the concepts and terms in those other documents but should note the differences between their use/intent in those documents and in this regulation. Experts have noted that some of the standards are in the process of being updated and new ones created. The terms and definitions in those new documents could better reflect the intent of this regulation and might be used as reference in future iterations of the regulation.

Who/what is it?
The group discussed the possibility that the ADS might communicate remotely with a human or another system (e.g. a system with more powerful computation or additional information such as sensors mounted on infrastructure). The basic concept is that some exchange of information and/or an interaction occurs with an external source.

Use of "remote supervision centre".
The group discussed the possibility of a centre, housing systems, humans or both intended to provide information remotely and/or monitor the status of vehicles or fleets. The current wording being used for this concept is "remote supervision centre" but was not intended to mean a centre that is restricted to supervision - it could house agents that monitor vehicles/fleets, assist the ADS/users or provide assistance upon request. Further, the ADS should not require "supervision" in the sense of "supervise" in J3016:2021 which is only intended for much less capable driver assistance systems.

Intervention or interaction?
The group had debates around using the terms "intervention" and "interaction", the intent was that the ADS (or a user) would request for remote "assistance" in certain situations leading to an interaction. However, not all interactions are of interest (i.e. only those that are safety-related) which are likely to be only interventions. However, intervention was not intended to have the meaning that a remote person be monitoring the ADS and decide to intervene, the initial request for intervention was intended to originate from the ADS (or its users). The document uses both terms in different places but generally the intent is the same – safety-relevant, ADS/user-initiated interactions with a remote entity.

The ADS should always be in control of the DDT, while it may ask for suggestions in how to resolve/navigate a difficult situation, it could decide to take a different course of action than suggested remotely in the interest of safety (or as the situation evolves).

7.3.1.3. The system description shall describe how the Operational Design Domain has been defined for each ADS feature and explain the boundaries of each of the conditions in which the feature is designed to operate. This shall include at least the following:
(a) Geographic limitations,
(b) Roadway characteristics (e.g., road type, road conditions, speed limit),
(c) Environmental conditions (e.g., weather, illumination), and
(d) Dynamic elements (e.g., kinds of other road users).

The manufacturer could choose to define the ODD of its ADS features in a variety of ways depending on their system design, use case, and the expected operating conditions in the intended area of operation. The four categories in the regulation are expected to be broken down one or more levels to appropriately define the operating domain.

Each ADS feature should have its own ODD, which could be defined by the same set of attributes with different boundary conditions (e.g. a highway feature could be restricted to highways while a parking feature could be limited to certain parking lots; the highway feature might not be capable of operating in heavy rain while the parking feature might have no such restriction).

The boundaries of each condition refer to the limits of attribute values beyond which the ADS is outside its ODD (e.g. the ADS feature could be designed to operate only in traffic circumstances in which it can maintain a speed between 20km/h (lower boundary) and 50km/h (upper boundary); The ADS feature would be outside of its ODD in traffic situations not within that speed range).

Certain ODD attributes may be interdependent – for example, the distance at which the ADS can detect objects may be impacted by weather (e.g. fog, rain, snow, dirt, sensor performance reduction etc.). The impact of reduced capability may lead the ADS to travel at lower speeds and/or avoid certain roads that may require better detection capabilities. The links/dependencies between ODD parameters and their respective values, if any, should be identified as part of the ODD definition.

The ODD should be defined in a manner that its attributes can be measured/tracked by the ADS directly or indirectly, onboard or offboard to determine if the current operating conditions are within the defined boundaries. (i.e. The ADS needs to know if it is within its ODD).

The ODD defines conditions under which the ADS feature is designed to operate, which might or might not include geographic limitations (sometimes referred to as a geo-fence). These geographic limitations could be used to prevent a feature from operating in an area that has traffic laws for which the ADS was not designed (i.e. outside the ODD) or in certain areas where there is additional complexity that has not been designed for (e.g. different road user behaviour or traffic flows).

These geographic limitations are distinct from the area of operation (not mentioned in the regulation) that reflect a manufacturer's choice of where to operate in light of either available vehicle supply or operational support capacity, or the boundary of an area of permissible operation approved by a government authority. The manufacturer could choose to include area of operation restrictions within its ODD definition.

A single ODD could be substantiated in many areas, that is, all these areas fit the ODD definition and bounds. [It is also possible that a new area falls within the existing ODD bounds and therefore deployment in that area (i.e. expanding the area of operation) might not require modification to the ODD, rather confirmation that the new area is within the ODD with no new attributes or attribute values. As such, removal or modifications of the area of operation would not on require modification to the ODD as long as the conditions and environment in the new area(s) of operation, including road traffic flows have been considered in the ODD. However, a modification of the area of operation that entails operation in an area with different traffic laws or traffic behaviour than those for which the ADS's ability to comply has been demonstrated in the safety case (i.e. outside the ODD) would require an amendment to the safety case demonstrating the ADS's ability to comply

with those different local/regional/national rules and traffic behaviour in the new areas area of operation.] For clarity, the area of operation, including the reasons for using that area of operation could be provided as reference (e.g. operational considerations, capability restrictions etc.) and an explanation for the existence of geographic limitations within the ODD definition could be included to clarify the reason for the use of those limitations (e.g. required local/regional approvals, local/regional traffic rules, etc.).

ODD definition standards/best practices:
- ISO 34503 (BSI/PAS 1883)
- AVSC00002202004

For example, an ADS feature could be designed to operate on any controlled access highway with speeds up to 120 km/h (which would constitute a road type ODD condition), but the manufacturer could choose to operate the system in just one geographic area (area of operation), either due to limited vehicle availability or the need to obtain government approval in other geographic areas (i.e. the area is within the ODD, but outside the area of operation).

7.3.1.4.2.	The outlines shall include the components/functions of the ADS and other vehicle systems that are relevant to meeting the requirements of this Regulation.
7.3.1.4.2.1.	The outlines shall show interconnections between the components/functions of the ADS and those components/functions and other systems via: (a) A circuit diagram for the electrical transmission links, (b) A piping diagram for pneumatic and/or hydraulic transmission equipment, and (c) A simplified diagrammatic layout for mechanical linkages.

In this context, other vehicle systems could include shared components or functions (e.g. sensors, map data, GNSS) that might also be used for assistance systems, user monitoring, positioning etc. It could also include information that originates from outside the vehicle if they are used to meet the requirements of the regulation (e.g. certain information could be used to detect ODD boundaries such as weather reports, traffic reports, construction zones etc.).

The electrical transmission links could also capture methods for transmitting signals via electrical wire, fibre optics or wireless means. The manufacturer could decide to use a different type of diagram for these purposes as long as the information is present.

Additional information with regards to wireless links could be included (e.g. frequency, bandwidth, approx. range, link speed/capacity, resistance to interference/obstructions)

Information could be used to detect ODD boundaries such as weather reports, traffic reports, construction zones, etc.

Additional information on wireless links might include frequency, bandwidth, approximate range, link speed or capacity, resistance to interference or obstructions, etc.

7.3.1.4.3. The outlines shall include how the following functions and aspects are addressed:
(a) Sensing and perception of events and objects,
(b) Decision-making and planning,
(c) Remote supervision and remote monitoring by a remote supervision centre (if applicable),
(d) Information display/user interface,
(e) The data storage system (e.g., Data Storage System for Automated Driving), and
(f) Redundancies of relevant components and/or connections.

The list consists of items to include for the outline in the safety concept. Some items included in this list might not be separate components or systems.

7.3.1.9. The system description shall indicate the categories of other road users with whom the ADS is designed to interact (e.g., pedestrians, cyclists, etc) and describe the nature of their interactions with the ADS.

7.3.1.10. The system description shall identify the ADS users with whom the ADS is designed to interact and describe the nature of their interactions with the ADS.

While the ADS Performance of DDT requirements set out appropriate interaction and collision avoidance rules for other road users, it does not require the manufacturer to explain what those interactions might be. The requirement in 5/7.3.1.9 attempt to bridge this gap by requiring the identification of road users categories the ADS can interact with and the nature of those interactions. The ADS could be designed with ways to communicate with other road users via light or sound.

Similarly, while the ADS requirements - Interactions between the ADS and its User(s) section set out appropriate interaction requirements with ADS users, it does not require the manufacturer to explain what those interactions might be nor which users are considered in the particular ADS design. The requirements in 5/7.3.1.10 attempt to bridge this gap by requiring the identification of the users and the nature of their interactions.

- The ADS could have light projections on the road to signal its intentions.
- The ADS could use the vehicle horn to warn animals, pedestrians or other vehicles of its presence.
- The ADS could be capable of indicating it is yielding to another vehicle or pedestrian via sound, symbol, light flashes or other methods.

7.3.1.14. The system description shall describe the range of end states constituting a mitigated risk condition that can be achieved by the ADS feature, including:
(a) The conditions that might trigger an attempt to reach a mitigated risk condition,
(b) The processes by which the ADS feature attempts to reach a mitigated risk condition, and
(c) The evaluation of risk related to mitigated risk condition end states.

[Placeholder for guidance on expectations concerning the end states, including processes and criteria used by the ADS to evaluate available options, external signalling of a fallback in process, and fallbacks to an MRC when performed by an ADSF-1 or ADSF-2.]

7.3.1.16. The system description shall describe how the ADS feature responds to failure situations, including at least one or more following means (as applicable):
(a) Fallback (or fail-safe) operation using a partial system.
(b) Redundancy using separate systems.
(c) Diversity of systems performing the same function.
(d) Removal of some or all automated driving function(s).

7.3.1.16.1.	If a partial performance mode of operation is used under certain fault conditions (e.g., in case of severe failures), the system description shall describe: (a) Conditions for activation of that mode (e.g., type of failure), (b) Resulting ADS feature behaviour and capabilities (e.g., achievement of a mitigated risk condition immediately), and (c) Warning strategy to the user/remote supervision centre (if applicable).
7.3.1.16.2.	If a second (backup) or a diverse means to realize the performance of the dynamic driving task is used, the system description shall describe: (a) The principles of the change-over mechanism, (b) The logic and level of redundancy and any built-in checking features, and (c) The resulting limits of effectiveness.
7.3.1.16.3.	If the chosen response to a system failure entails the removal of an ADS function, the system description shall describe how it is done in compliance with the relevant provisions of this regulation. It shall also describe how all the corresponding output control signals associated with this function are inhibited.

While the ADS performance of DDT requirements set out requirements for performance in failure situations, the safety case seeks additional information to determine how the ADS responds to such failures. Section ODD.16. / 7.3.1.16 refer to four means, which are not fully aligned with the 3 more detailed sub-paragraphs. This difference reflects a structural inconsistency rather than an additional obligation and may be considered for clarification in future regulatory iterations.

The listed means describe a possible approach for nomenclature and categorization. Manufacturers could use alternative nomenclature and categorization aligned with their failure management strategies. These strategies could yield different outcomes depending on the situation at hand (i.e. depending on system design, failure impact and risk assessment, the same means could result in fail-operation, fail-degraded, or fail-safe behaviour). A potential mapping is below:

(a) Fallback (or fail-safe) operation using a partial system.
    a. This could be consistent with the intent of *.3.1.16.3 if the currently active feature requires the use of those functions and must execute a fallback
        i. fail-safe
(b) Redundancy using separate systems.
    a. Depending on the capabilities of the separate system and assessed risk, this could result in a system that:
        i. fails operational (could be consistent with the intent of *.3.16.2) or
        ii. fails degraded (could be consistent with the intent of *.3.16.1 and/or *.3.16.2)
(c) Diversity of systems performing the same function.
    a. Depending on the capabilities of the diverse systems and assessed risk, this could result in a system that:
        i. fails operational (could be consistent with the intent of *.3.16.2) or
        ii. fails degraded (could be consistent with the intent of *.3.16.1 and/or *.3.16.2)
(d) Removal of some or all automated driving function(s).
    a. This could be consistent with the intent of *3.1.16.3 if the currently active feature can continue without those functions
        i. fail operational (does not impact current active feature) or
        ii. fail degraded

Depending on how the system is impacted by the fault/failure and the requirements from 4.1.4.3. / 6.1.4.3, the following information could be provided, where relevant:

1. Fallback (or fail-safe) operation using a partial system – This could describe a fault which prevents the ADS feature from performing the DDT in accordance with the requirements of 4/6.1 resulting in a fallback response and prevention of feature from activation 4.1.4.3/6.1.4.3 (a)).
    a. A description of types of failures that could lead to this situation and how the ADS responds to the failure situation
2. Fail-Degraded – This could describe a fault for which the ADS can adapt its performance of the DDT in accordance with the severity of the fault (4.1.4.3 / 6.1.4.3 (b)). The ADS DDT Performance requirements (4/6.1) can still be met with defined performance limits (e.g. lower operating speed, limitations on road types, avoiding certain intersections/manoeuvres etc.)
    a. Describe what failures lead to performance limits (conditions for activation) and what those limits might be (ADS behaviour and capabilities) and how the transition between full operation and degraded operation occurs (change over mechanism)
    b. The adapted performance (partial performance mode) might have been considered when defining the ODD boundaries (e.g. reduced visibility leading to lower operating speed).
    c. Describe the warning strategies & intended warning recipients
3. Fail-Operational – The could describe a failure that does not cause any reduction of DDT performance (i.e. "fail operational" due to redundancy or design)
    a. A description of what types of failures could lead to this situation (conditions for activation), how the ADS responds to the failure situation (change over mechanism) and any resulting limits of effectiveness of the ADS or its remaining redundancies.
    b. The manufacturer could describe any warning strategies and longer-term mitigation measures (e.g. schedule maintenance to repair/replace component within an appropriate interval) as part of, or alongside built-in checking features

7.3.2.6.	The safety concept shall describe the conditions that the automated driving system is reasonably likely to encounter on its trip(s), including, but not limited to, environmental and geographical conditions, and/or the presence or absence of certain traffic or roadway characteristics, and explain how those expected conditions compare to the ODD of the ADS as described pursuant to paragraph 7.3.1.3.

The main objective of this paragraph is to compare the ODD (design – defined in 5/7.3.1.3) with the expected operating conditions [(also known as target operational domain)] which might not be identical. (e.g. the ODD could be divided highway with no pedestrian access, but it is expected that pedestrians might be encountered in the case of a vehicle breakdown or emergency). This requirement is intended to demonstrate that the manufacturer has identified the expected operating conditions, identified any gaps between the ODD and those conditions, and can justify within its safety case that there are no unreasonable risks due to those gaps.

The expected operating conditions should have been identified via safety and/or engineering processes and the ODD properly defined considering those conditions to avoid unnecessary risks or ODD exits for conditions that are expected with a certain frequency.

The wording is intended to exclude consideration for very unlikely events (e.g. space debris falling) but include events that are expected even if in relatively low frequency (e.g. animal crossing the roadway)

7.3.2.7.	The safety concept shall describe measures or strategies, where applicable, implemented to: (a) Prevent or mitigate abuse, misuse, and errors by occupants that could affect safe performance of the DDT (e.g., occupants attempting to access driving controls), (b) Prevent, mitigate, or deter harm to occupants caused by external sources (e.g., unauthorised persons attempting to access a vehicle with occupants), and (c) Prevent, mitigate, or deter abuse and misuse of the vehicle or its systems from external sources. (e.g., objects placed on vehicles during operation, attempts to damage a vehicle).
7.3.2.9.	The safety concept shall include a list of safety risks to passengers (e.g., safety belts not fastened, passengers not seated) and a description of how they are managed for all passengers while an ADS feature is active.
7.3.2.10.	The safety concept shall describe the strategies in place to avoid operating the vehicle when the general working condition of the vehicle is not satisfactory (e.g., condition of tyres, brakes, lighting, status of external loads, steering). These strategies may include technological solutions, physical inspections or other relevant solutions.

These paragraphs are aimed at tasks that a driver would normally perform but which must be managed either by the ADS or some other means when a feature is performing the DDT.

Clarification of abuse, misuse and errors for 7.3.2.7

- Errors – action (or lack of action) by the user without intention to cause harm (e.g. pressing a wrong button, believing the ADS feature is still active after deactivation, attempting to override the system by using inappropriate means due to lack of understanding)
- Abuse – action (or lack of action) by the users with intent to circumvent protections or cause harm (e.g. trying to bypass gaze monitoring through use of a mask, attempt to bypass physical barriers around driving controls, causing damage to a vehicle, placing objects in front/on the vehicle to stop it from functioning)
- Misuse – action (or lack of action) by the users to use the system in an unintended way (e.g. ignoring system initiated deactivations in order to finish watching a movie while the vehicle achieves an MRC, holding onto the vehicle to be towed while on a skateboard)

Potential examples of measures or strategies for 5/7.3.2.7
- Dedicated controls for ADS
- Disabling driving controls
- Installing physical barriers around driving controls
- Making noise/light (honking horn, loudspeaker, alarm, hazard lights, high beams)
- Locking doors
- Calling emergency services/remote supervision centre

Potential examples of measures or strategies for 5/7.3.2.9 (see also 4/6.3.7)
Potential safety risks:
- occupants are not seated or wearing seat belts (depending on vehicle design)
- doors are not closed
- capacity of vehicle is exceeded (weight, passenger limit)

Potential ways to manage (as appropriate):
- Detection sensors (weight, door, seat belt, seat position, cabin camera)
- Attendant intervention (in-vehicle, at stops, remote)
- Warning strategies (labels, audio, visual indicators)

Potential examples of considerations and strategies for 5/7.3.2.10 (see also 4/6.3.7)
Potential considerations:
- Brake, tire wear, wheel alignment
- Fluid levels
- Lamps operational
- Trailer coupling, loads secured
- Body or window damage
- Sensor occlusion (dirt, ice, snow)
- Vehicle component malfunctions (steering, speedometer, vibrations/noise)

Potential strategies:
- Periodic inspections (before dispatch or at stops)
- Sensors (weight, camera, wear, fluid)
- Vehicle attendant or verified by driver prior to activating ADS
- Design strategies (e.g. sensors cleared by wipers, washer fluid, or defroster)

7.3.2.8.	The safety concept shall describe strategies to limit sudden ODD exits and frequent activation and deactivation situations.

As there is risk in performing a fallback response (whether transition to driver or achieving an MRC) and that an ODD exit requires a fallback response, the ADS should have strategies to reduce the overall risk to the extent possible when operating in situations near the boundaries of the ODD.

The ADS is required to recognise the conditions and boundaries of its ODD and anticipate foreseeable exits.

This requirement seeks to understand the strategies used to reduce the possibility of:

Sudden ODD exits - this is intended to describe situations that cause an ODD exit with no time to warn a fallback user the transition is coming, or to adjust operating parameters to avoid the exit. (e.g. sudden heavy rain, unanticipated construction zone/road closure/collision ahead)

Potential strategies:
- monitor weather forecasts for upcoming conditions that may be outside the ODD
- limit operation on certain roadways during certain times of day/events.

- monitor roadway status information

Frequent activation and deactivation situations (i.e. operating very near the boundaries of the ODD (e.g., there is an ODD exit but the user can almost immediately reactivate the system, after activation, the system shortly has another ODD exit).

Potential strategies
- hysteresis
- only allowing activation of feature if well within ODD limits

7.3.2.14.	The safety concept shall describe the manufacturer's approach to scenario selection to cover the reasonably foreseeable situations and conditions that the ADS will encounter including how the following aspects are covered: (a) The selection of sufficient scenarios in which the ADS needs to initiate a fallback response (e.g., approaching the ODD boundaries), (b) Reasonably foreseeable situations that are not deemed to be preventable by the ADS (e.g. related to unsafe behaviour by other road users or by infrastructural failures), and (c) The use of appropriate techniques to explore the parameter space when choosing concrete scenarios.
7.3.2.15.	7.3.2.15. The safety concept shall describe how the manufacturer has determined the suitability of processes, resources, and competent personnel in place to: (a) Design and undertake the testing that produces the evidence supporting the ADS safety case, (b) Select scenarios that combine static and dynamic elements of a test track for correctly reproducing the situations selected for track testing, (c) Identify test routes that capture predictable aspects of the ODD (e.g., road types and geometries), elements found in the related nominal situations (e.g., other road users, signs, and signals), and typical dynamic conditions (e.g., high/low traffic densities). (d) Ensure that the test routes 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, (e) Assess the behavioural competencies demonstrated by the ADS for each scenario against the DDT performance requirements under paragraph 6.1., and (f) Assess the capability of the ADS to ensure the safety of users and the safe use of the ADS.
8.3.2.1.2.	The approval authority or its designated technical service shall verify that the combined coverage of the testing results from all pillars (virtual, track, real world) is sufficient to support the ADS safety case claims.

The regulation requires the manufacturer to generate and select scenarios to ensure the coverage of appropriate nominal, critical and failure and reasonably foreseeable situations. It is expected that the appropriate coverage is obtained through a mixture of virtual testing, proving ground testing, and real-world testing. The regulation also mandates the assessor to verify the resulting combined coverage.

This guidance is provided based on available best practices concerning the quantitative evaluation of the coverage. The target recipient of this guidance is both the manufacturer creating the safety case and the assessor verifying the safety case.

Coverage is understood throughout the regulation as the extent to which a set of scenarios covers the relevant aspects of an ODD for the safety argumentation of the ADS. The concept of coverage is multi-dimensional. For instance, coverage could be evaluated based on the following items and their interdependencies*:

- Operational Environment: evaluates the presence of relevant ODD attributes leveraging standardized taxonomies. An example may include using ISO 34503 and demonstrating that all the applicable ODD attributes for the ADS are encompassed in the scenario suite.
- Behavioural competency: evaluates the presence of certain behaviours produced by either the ego-vehicle or other road users, leveraging standardized taxonomies. An example may include using BSI Flex 1891 and demonstrating that all applicable behavioural competencies are included within the scenario suite.
- Scenario-type/category: calculates the presence of certain a functional/logical scenario type within the scenario suite. Examples can be cut-in, cut-out or pedestrian crossing as applicable for the specific ADS.
- Rules of road compliance: checks that applicable rules of the road within the ODD are present in the scenario suite.

*No single item alone can robustly document coverage.

7.3.2.1.5. The safety concept shall describe how the manufacturer has determined the suitability of processes, resources, and competent personnel in place to:
(a) Design and undertake the testing that produces the evidence supporting the ADS safety case,
(b) Select scenarios that combine static and dynamic elements of a test track for correctly reproducing the situations selected for track testing,
(c) Identify test routes that capture predictable aspects of the ODD (e.g., road types and geometries), elements found in the related nominal situations (e.g., other road users, signs, and signals), and typical dynamic conditions (e.g., high/low traffic densities).
(d) Ensure that the test routes 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,
(e) Assess the behavioural competencies demonstrated by the ADS for each scenario against the DDT performance requirements under paragraph 6.1., and
(f) Assess the capability of the ADS to ensure the safety of users and the safe use of the ADS.

In the context of this requirement ‘sufficient’ refers to the scope of the tests that have been performed on the fall-back response.

With respect to the number and type of scenarios, the manufacturer is encouraged to describe the reasoning behind their choice of scenarios and the justification for the overall number chosen. It is acknowledged that the number and diversity of relevant scenarios are inherently dependent on the intended use case and its operational design domain.

7.3.3.1. The safety case shall include a series of claims for each of which there must be at least one supporting argument.

The safety case is composed of a series of claims supported by arguments and evidence. The manufacturer could use different notations, concepts or terminology as long as the safety case explains how it corresponds to claims, arguments and evidence and that an appropriate mapping to the requirements of the regulation can be described (e.g. ISO/IEC/IEEE 15026-2). There are several ways to approach documenting claims, arguments and evidence the examples given below is not the only possible approach.

[Examples to be provided.]

7.3.3.7.	Each requirement defined under paragraphs 7.3.3.2, 7.3.3.4, 7.3.3.6, and as may be defined by the manufacturer shall have at least a claim.

The claims, arguments and evidence presented in the safety case needs to demonstrate that:
1. the ADS meets the requirements of the regulation and
2. that it is free of unreasonable risks

To demonstrate it meets the requirements, there should be at least one claim (or subclaim) that presents argumentation and evidence that each requirement is met. The applicable requirements are:
- section 4/6 as described in 5/7.3.3.2 b),
- identified through the application of SMS process as described in 5/7.3.3.4, and,
- suitability of testing approaches as described in 5/7.3.3.6

To demonstrate that the ADS is free of unreasonable risk, the manufacturer might have claims beyond those set out in the requirements of this regulation. There should be at least one claim (or subclaim) that presents argumentation and evidence that the ADS is free of unreasonable risks.

7.3.3.9.	Evidence supporting argumentation shall consist of test results or analysis (e.g., system layout and schematics, photographs, required documentation, etc.) as appropriate.

Evidence supporting a claim is not restricted to testing results. It could include any supporting documentation the manufacturer believes supports its argumentation that the claim is met. The evidence should be relevant to the claim as explained in the argumentation rather than a series of unrelated documents without explanation. Examples of possible non-testing evidence:
- Testing procedures/protocols
- Diagrams / schematics
- Photographs / video
- Certificates
- Analysis information
- Research studies/publications
- Internal standards
- Reviews / inspections

7.4.	Post-deployment safety
7.4.3.	The manufacturer shall provide initial notifications, short-term reports, and periodic reports to the relevant authority.

The dissemination of information is intended to be limited to the (relevant) authorities for whom such information is relevant. The type of information (e.g. notification, short term and periodic report) provided to each authority can depend on factors such as the authority's role in approving, verifying compliance or conducting market surveillance of the considered ADS; the area of operation of the considered ADS; and the need to access such information to discharge safety-related responsibilities as defined by the applicable laws.

This example is intended to provide guidance an on an acceptable way to comply with the requirements UNR 3.2.3. (f).

The following scheme is without prejudice with the applicable law and does not create any obligation for manufacturers and authorities. It is only intended to suggest a harmonized and balanced approach for the dissemination of the initial notification, short term reporting and periodic report which identify appropriate relevant authorities for each type of occurrence reporting.

Relevant Authority	Initial Notification	Short term report	Periodic Report
Granting Type Approval Authority*	X	X	X
Authorities in the territory where the occurrence(s) occurred*	X	X	X**
Authorities within the ODD (outside the occurrence territory) *		X***	X**

* Including regional economic integration organization authorities, if applicable.
** The regulation does not preclude the possibility to provide country specific information at the agreement of the manufacturer and receiving authority
*** Limited to the corrective actions identified in the Short-Term template

7.4.4. The manufacturer shall provide the supporting data underpinning the report by means of an agreed data exchange mechanism upon request by the relevant authority.

Concerning the requirement 7.4.4., the relevant authority is intended as Granting Type Approval Authority (GTAA) and Authorities in the territory where the occurrence occurred for short term report and GTAA for periodic reporting.

7.4.5. The manufacturer shall provide the relevant authority with a description of the data processing (for example: filtering and conditioning) procedure and agree on the steps undertaken to deliver the data supporting the report.

Concerning the requirement 7.4.5. the relevant authority is intended as the Granting Type Approval Authority (GTAA) and the other Authorities that receive the occurrence report. However, the agreement on the step to be taken, to provide the data is only undertaken with the GTAA.

7.5. Other manufacturer requirements

8. Compliance assessments

8.1. Audit of the Safety Management System

8.1.5.1. The approval authority or its designated technical service shall verify that the safety policy covers following aspects:
(a) Definition of the principles and objectives upon which the SMS is built, operated, and maintained,
(b) General recognition of the inherent risks of ADS-related activities throughout their life cycle, including the risks of the parties involved,
(c) Organisational structure and the safety governance elements and their appropriateness for the needs of the organisation,
(d) Evidence of the commitment to safety, and
(e) Description of the means/approaches to engage people within the organisation in the culture of safety.

The SMS begins with the organisational safety policy and objectives. A policy defines the principles upon which the SMS is built and operated. It outlines the strategy for achieving an acceptable level of safety within the organisation. A Safety Policy can be considered as the foundation of the SMS. It defines the organization's safety philosophy, commitments, governance, and states the goal of having sufficient resources to assure safety. A safety policy also helps the organization to engage its people in the culture of safety. The intention of this requirement is to ensure that the safety policy provides a clear, structured, and organisation-wide foundation for the SMS, reflecting both strategic intent and operational realities

8.1.5.1. (a) Definition of the principles and objectives upon which the SMS is built, operated, and maintained,

This element aims to ensure that the safety policy defines the core principles and objectives that underpin the SMS, providing direction for how safety is managed, measured, and continuously improved. The safety policy is expected to outline safety objectives that support the monitoring of safety performance. These objectives can be measurable where appropriate and address both organizational performance and the in-service safety of the ADS, while being linked to key SMS activities such as risk management, safety assurance, and safety promotion.

8.1.5.1. (b) General recognition of the inherent risks of ADS-related activities throughout their life cycle, including the risks of the parties involved,

This element intends to ensure that the organization acknowledges the inherent risks associated with ADS activities across the lifecycle, including those arising from all involved parties. Thus, the safety policy is expected to acknowledge the safety relevance of organizations involved, including suppliers, software providers, and service providers. It may also recognize potential safety risks associated with ADS operations and the need for appropriate oversight of third-party contributions. This reflects the expectation of a realistic and system-wide understanding of safety risks.

8.1.5.1. (c) Organisational structure and the safety governance elements and their appropriateness for the needs of the organisation,

This provision highlights the need for a clearly defined governance framework, ensuring that roles, including those of the key people, such as the accountable executive and the SMS manager, their responsibilities, and the decision-making structures are appropriate to the organization's size and function, and that the governance framework supports effective safety management.

8.1.5.1. (d) Evidence of the commitment to safety, and

The intention is to ensure that safety is visibly supported at the highest organizational level, demonstrating leadership commitment and accountability as a key enabler of an effective SMS. The safety policy is expected to demonstrate management commitment to safety, typically through approval by the accountable executive, and to support the promotion of safety and the continuous improvement of the SMS.

8.1.5.1. (e) Description of the means/approaches to engage people within the organisation in the culture of safety.

This element emphasises that safety depends on people. The policy therefore describes how the organisation engages personnel to ensure that safety is actively supported across all relevant safety functions.
The safety policy is expected to promote a positive safety culture, encouraging transparent reporting, learning from safety events, and accountability, while outlining behaviours that are considered unacceptable

Examples:

- How an organization defines safety objectives that incorporates their specific structure and activities.
- A safety policy that acknowledges a broad range of hazards, including those arising from software, data or organisational practices.
- How an organization incorporates safety roles and responsibilities in its organization structure to support effective governance.
- The way senior leaders demonstrate their commitment to safety, by being visible and actively engaging in review activities and communications.
- The approaches an organization uses to encourage engagement with safety culture, such as regular discussions, briefings and feedback channels.

References for Implementation

Some useful references in this regard are:

- JRC140978 APPENDIX 1 - Technical Guidance on Safety Management System
- AVSC00007202107 - 5.1,
- ISO 9001:2015 - 5.2, ISO 21434:2021- 5.4.1, ISO 10013:2021 - 4.2.2 and 4.2.3, ISO 26262-2:2018 5.4.2.1, 5.4.2.2, ISO 21448, ISO 45001:2018, ISO 55001:2024,
- CAP 795 Ch.3, EASA Management System Assessment Tool, Safety ICAO Doc 9859 AN/474 Safety Management Manual,
- ERA Guide on SMS requirements, Regulation (EU) No 376/2014
- [GB/T 34590 Road vehicles - Functional safety]
- [GB/T 43267 Road vehicles - Safety of the intended functionality]

8.1.6.1. The approval authority or its designated technical service shall verify that the risk-management processes cover following aspects:

(a) Reactive and proactive practices for risk management are in place,
(b) The risk management activity is not limited to the ADS itself but includes risk arising from organisation/people which can affect the SMS effectiveness or the safety of the ADS,
(c) The risk management activity includes risks from third parties, and
(d) The risk management activity covers and is performed over the entire lifecycle.

Safety risk management is the core activity that supports the SMS and contributes to achieving the safety objectives and the intended results of the Organization, as well as the effectiveness of other organizational processes. The term safety risk management, as opposed to the more generic term risk management, is meant to restrict itself to the management of safety risks (e.g., without consideration of factors such as financial, legal, economic, or reputational risks).

8.1.6.1. (a) Reactive and proactive practices for risk management are in place,

This provision aims to ensure that organizations do not rely solely on incident response but also implement forward-looking risk identification and prevention mechanisms. The combination of reactive (event-based) and proactive (predictive and preventive) practices reflects the expectation of a mature SMS capable of anticipating risks, not only responding to them.

8.1.6.1. (b)	The risk management activity is not limited to the ADS itself but includes risk arising from organisation/people which can affect the SMS effectiveness or the safety of the ADS,

The requirement highlights that safety risks are not confined to the ADS technology itself. The intention is to ensure that risk management also addresses organisational structures, human performance, and internal processes, in order to identify hazards, perform risk analysis, design, implement and monitor effective safety controls. Recognizing that these factors can significantly influence both SMS effectiveness and operational safety outcomes.

In this perspective, safety risk management covers both organizational safety risks such as process deficiency (i.e., process-oriented safety risk) and operational risks (i.e. product and deployment support-oriented safety risk) due to hazards, which could reasonably be encountered during the operations of the ADS.

8.1.6.1. (c)	The risk management activity includes risks from third parties, and

Risk management is also expected to include risks arising from third parties, such as suppliers, software providers, service providers, or other organizations whose activities could influence the safety of the ADS. This reflects the expectation that organizations address risks introduced by external actors, acknowledging that safety depends on the broader ecosystem, not only internal activities.

8.1.6.1. (d)	The risk management activity covers and is performed over the entire lifecycle.

Risk-management activities are expected to be applied throughout the entire ADS lifecycle, including development, production, deployment, and post-deployment phases, ensuring that risks are continuously identified, assessed, and managed. The intention is to ensure that risk management is applied consistently across all lifecycle phases, avoiding gaps and ensuring ongoing control of risks.

Examples:

- Proactive practices such as using hazard identification exercises or safety risk assessments.
- Reactive practices like incident reviews are part of the continuous safety improvement processes lifecycle.
- Including risks arising from sources including organizational practices, communication and human performance.
- Partners and suppliers sharing relevant safety information as part of third-party risk management.
- Full lifecycle risk management, including updating risk assessments and when there are new operational contexts and new technologies emerge.

References for Implementation

Some useful references in this regard are:

- JRC140978 APPENDIX 1 - Technical Guidance on Safety Management System
- ISO 31000:2018 6.3-6.6,
- AVSC00007202107 5.2,
- ISO 26262-2:2018 5.4.3,
- CAP 795 Ch.4, EASA,
- Management System Assessment Tool, Regulation (EU) No 748/2012.

8.1.7.1. The approval authority or its designated technical service shall verify that the safety-assurance processes cover the following aspects:
(a) Periodic independent internal audits and external audits,
(b) Processes for the management of the supply chain and any other involved organisation(s) that could affect the safety of the ADS,
(c) Change management processes are in place,
(d) Processes for corrective actions to maintain an acceptable level of safety are in place,
(e) The corrective action applies to the ADS as well as SMS,
(f) Monitoring practices to measure overall safety performance are in place,
(g) The monitoring practices apply to the ADS as well as to the SMS, and
(h) Independent functions for carrying out the compliance assessment and audit are in place.

The intention of this requirement is to ensure that organizations have robust mechanisms to verify, monitor, and continuously improve safety performance. The regulatory text emphasizes that Safety assurance is not a one-time verification activity, but a continuous, evidence-based process aimed at ensuring that safety measures remain effective over time.

Safety assurance refers to the set of activities used to monitor whether risk control measures remain effective and whether safety objectives are being met over time. It provides systematic processes that give confidence that organizational activities, and products, continue to meet established safety requirements.

Safety assurance typically includes collecting and analyzing safety information, such as through audits, evaluations, employee reporting, and operational data. These activities help organizations identify new hazards, assess system performance, and determine opportunities for safety improvements.

Through regular system assessments and analysis, safety assurance supports the continuous evaluation and improvement of safety performance for both the organization and the products it provides.

8.1.7.1. (a) Periodic independent internal audits and external audits,

This element ensures the presence of independent and periodic verification mechanisms to assess compliance and effectiveness of the SMS.

8.1.7.1. (b) Processes for the management of the supply chain and any other involved organisation(s) that could affect the safety of the ADS,

The requirement highlights that safety assurance is expected to extend beyond the organization to include involved parties, reflecting a system-of-systems perspective.

8.1.7.1. (c) Change management processes are in place,

This provision ensures that changes are systematically assessed and managed, recognizing that modifications can introduce new risks.

8.1.7.1. (d) Processes for corrective actions to maintain an acceptable level of safety are in place,

The intention is to ensure that organizations have processes to identify, implement, and track corrective actions to maintain safety at an acceptable level.

8.1.7.1. (e) The corrective action applies to the ADS as well as SMS,

This clarifies that corrective actions may address both technical aspects (ADS) and organizational/systemic aspects (SMS).

8.1.7.1. (f)	Monitoring practices to measure overall safety performance are in place,

This element ensures the use of performance monitoring practices to track safety outcomes over time.

8.1.7.1. (g)	The monitoring practices apply to the ADS as well as to the SMS, and

Monitoring is expected to cover both the ADS and the SMS, ensuring a comprehensive view of safety performance.

8.1.7.1. (h)	Independent functions for carrying out the compliance assessment and audit are in place.

The requirement aims to ensure that compliance and audit activities are carried out independently, supporting objectivity and credibility of the assessment.

Examples of good audit practice:

- Examination of both documentation and practical implementation of safety processes.
- Assessment of how organizations coordinate safety information sharing with suppliers and partners.
- Review of change management activities and outcomes triggered by operational issues, software development updates and internal audits, improvements and product reviews.
- Reviews of root cause analysis and corrective actions.
- Review of impact and consequences of revised procedures and updated technical controls.
- Review of the approach and output from various monitoring procedures including operational data, safety reports and performance indicators.

Examples for Implementation
Some useful references in this regard are:

- JRC140978 APPENDIX 1 - Technical Guidance on Safety Management System
- ISO 26262-2/8:2028, ISO 9001 2015,
- AVSC00007202107, 5.3
- EASA Regulation (EU) No 748/2012, CAP 795 ch.5, EASA Management System Assessment Tool

8.1.8.1. The approval authority or its designated technical service shall verify that the safety-promotion processes cover the following aspects:

(a) There is an appropriate level of competence of the personnel to perform their duties,
(b) The competence is promoted through training,
(c) Means for internal and external safety communications are in place, and
(d) Process for continuous improvement.

The intention of this requirement is to ensure that safety is actively supported by people, competencies, and communication, recognizing that organizational culture is a key enabler of SMS effectiveness.

The regulatory text aims to highlight that technical measures alone are insufficient to ensure safety, and that a supportive organizational culture is essential.

Safety Promotion focuses on developing and maintaining a positive safety culture across the organization. It includes activities that raise safety awareness, strengthen safety knowledge, and encourage active participation in safety-related processes.

Typical safety promotion actions may include SMS training, safety communication and awareness initiatives, sharing safety lessons learned, and ensuring that personnel competencies are appropriate for the various activities. By promoting open communication and engagement, safety promotion encourages all members of the organization to contribute to improving safety performance.

8.1.8.1. (a)	There is an appropriate level of competence of the personnel to perform their duties,

This provision ensures that staff have the necessary knowledge and skills to perform their safety-related responsibilities.

8.1.8.1. (b)	The competence is promoted through training,

The requirement highlights that competence is expected to be actively developed and maintained through structured training.

8.1.8.1. (c)	Means for internal and external safety communications are in place, and

This element ensures the existence of effective communication channels, both internally and externally, to support awareness and information sharing.

8.1.8.1. (d)	Process for continuous improvement.

The intention is to ensure that safety promotion contributes to ongoing learning and improvement, reinforcing the adaptive nature of the SMS.

Examples may include, but are not limited to:

- How the organizational competency needs differ by role and may be supported through diverse training approaches.
- The range of organizational training using diverse methods and different formats such as written guidance, demonstrations, mentoring and workshop as appropriate.
- Communications that share lessons learned from incidents or audits.
- Mechanisms that enable employees to raise safety concerns or propose improvements.
- How organizations update SMS processes and practices based on practical insights.

Examples for Implementation
Some useful references in this regard are:

- JRC140978 APPENDIX 1 - Technical Guidance on Safety Management System
- ISO 26262-2:2018 5.4.4., ISO 9001:2015 7.2,
- AVSC00007202107 5.4.,
- CAP 795 Ch.6, Regulation (EU) No 748/2012, EASA Management System Assessment Tool

8.2. Assessment of the test environments

8.3. Assessment of the safety case

8.3.1.4. (b) The approval authority or its designated technical service shall review the manufacturer's safety case for robustness to verify that at least the following criteria have been met:
…
(b) The integrity level used for development, verification, and validation of the ADS and its features is appropriate to reduce the risk below the unreasonable risk threshold,
…

The intent of this paragraph is to verify that the level of robustness and integrity documented in the safety case for the development, verification, and validation of the ADS and its features is appropriate to reduce the risk below the unreasonable risk threshold. This includes documenting the confidence/rigor of the tools, processes and testing used during the development, verification and validation stages in claims that are supported by arguments and evidence.

The intent is not to require that integrity levels be defined, but rather to verify that the development, verification and validation processes used are appropriate and proportional to the risks that have been identified.

In this context, the requirement tries to verify that the tools, methods or tests results meet the level of integrity as deemed necessary for the system in development. The rationale for the acceptable level of accuracy, confidence or repeatability needs to be documented in claims and supported by evidence

For example: In the ISO 26262 approach - Automotive Safety Integrity Level (ASIL):
- Risk is based on severity, exposure and likelihood
- ASIL is based on severity, exposure and controllability.

Higher ASIL levels indicate that a higher degree of rigor was applied and would be appropriate for the elements with highest degrees of risk.

8.3.2.4.1.4. For the specific case of ADS interaction testing, the approval authority or its designated technical service shall:
(a) Verify that the people involved are representative of the expected general population of ADS users and other road users where applicable,
(b) Verify that the results achieved can be considered statistically significant.

For 8.3.2.4.1.4.(a):
For ADS users, representativeness could mean including a range of ADS users whose behaviours, skills, and characteristics reflect those reasonably expected to use the ADS. For example, testing should not be conducted only with engineers. Likewise, if a vehicle is expected to be driven by professional drivers (e.g., a coach) that should also be taken into account.

Other road user representativeness could mean capturing a sufficiently broad range of real-world behaviours and characteristics (e.g., compliant and non-compliant actions, interaction styles, physical and mobility variation) relevant to the ODD, such that the ADS is exposed to realistic interaction scenarios.

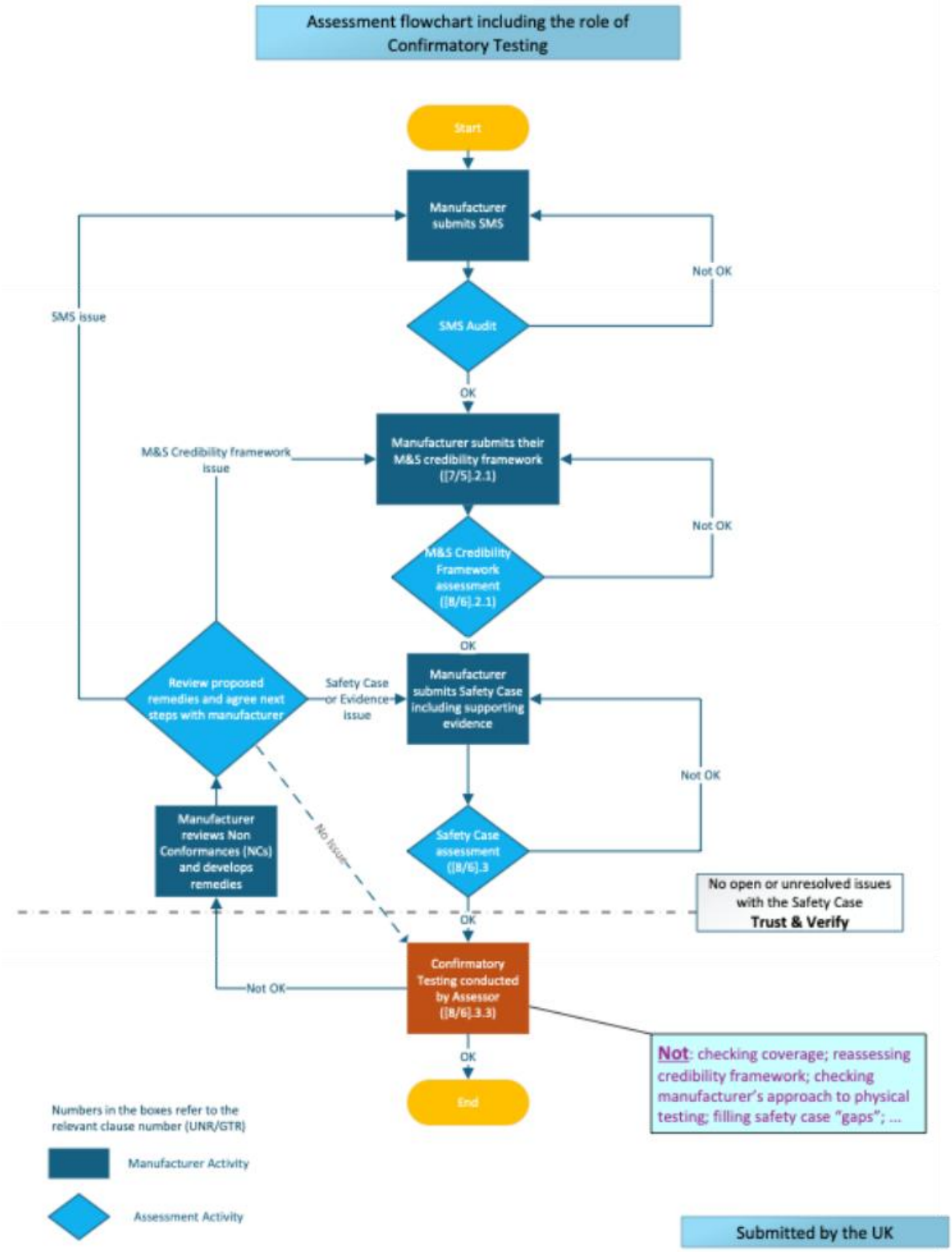
For 8.3.2.4.1.4.(b):
With respect to ‘statistically significant’, statistical methods have been developed to assess whether the sample size is ‘sufficient’. These methods focus on the sample size in terms of the number of participants. The manufacturer is encouraged to provide calculations that determine and explain its choice for the number of participants in their user tests and what assumptions are used in the calculations.

8.3.3.1. Confirmatory testing conducted or required by the approval authority or its designated technical service shall use one or more test methods and pre-defined and repeatable test protocols to confirm that the evidence provided by the manufacturer accurately represents the ADS performance. The confirmatory tests shall cover a range of driving conditions representative of the ODD, including at least and as appropriate:

(a) Failure situations,
(b) Behaviours in the presence of vulnerable road users,
(c) Situations with a large number of other road users, traffic disturbance, unlikely road infrastructure, uncommon road conditions, and/or atypical environmental conditions,
(d) User interactions,
(e) Compliance with traffic rules,
(f) Collision avoidance and mitigation,
(g) ODD boundaries and fallbacks to MRC, and
(h) Conditions that trigger DSSAD and ISMR functions.

The ADS assessment process under this Regulation is centred on the evaluation of a manufacturer's safety case. The confirmatory testing is the last part of the assessment and is conducted once the safety case and the evidence provided by the manufacturer have been assessed and accepted. Up to this point, all evidence has been provided by the manufacturer, so the confirmatory testing is used to "confirm" or verify that the evidence (including considerate variations of the same), provided by the manufacturer, is trustworthy.

The flowchart below illustrates a hypothetical ADS certification/approval process with the different steps of the assessment process and clarifies the stage at which confirmatory testing takes place. The flowchart is only provided as an explanatory visual aid and is not intended to be a prescriptive procedural requirement. The approach shown does not include all the activities and does not preclude different strategies, including undertaking some steps in parallel where appropriate.


Assessment flowchart including the role of Confirmatory Testing
Start
Manufacturer submits SMS
Not OK
SMS Audit
SMS issue
OK
Manufacturer submits their M&S credibility framework ([7/5].2.1)
M&S Credibility framework issue
Not OK
M&S Credibility Framework assessment ([8/6].2.1)
OK
Review proposed remedies and agree next steps with manufacturer
Safety Case or Evidence issue
Manufacturer submits Safety Case including supporting evidence
Not OK
Manufacturer reviews Non Conformances (NCs) and develops remedies
No issue
Safety Case assessment ([8/6].3
No open or unresolved issues with the Safety Case
Trust & Verify
OK
Confirmatory Testing conducted by Assessor ([8/6].3.3)
Not OK
OK
End
Not- checking coverage; reassessing credibility framework; checking manufacturer's approach to physical testing; filling safety case "gaps"; ...
Numbers in the boxes refer to the relevant clause number (UNR/GTR)
Manufacturer Activity
Assessment Activity
Submitted by the UK

Confirmatory testing conducted by the assessor is a targeted and proportionate activity aimed at providing confidence in the credibility and internal consistency of the evidence supplied in support of the safety case. It takes place after the latter has been assessed. The confirmatory testing is intended to verify selected evidence and is not meant to replicate in its entirety or replace the manufacturer's validation and verification campaign. Confirmatory testing consists of representative samples of scenarios and operating conditions that are part of the safety case.

The assessor can accept, allow, or introduce variations to the tested scenarios or conditions, where this is considered necessary to verify that the manufacturer's evidence is representative and is able to support the safety case. Such variations are expected to be reasonable and compatible with the limitations/abilities of the toolchains* and allow comparison with the results provided by the manufacturer or be assessable against the expected behaviour of the system. In this context, reasonable means that the ADS is tested in scenarios/situations that are likely to occur in the real world, rather than in unrealistic situations that do not conform to the logic of the real world.

Variations may include, for example, adjustments to the initial conditions, parameter ranges, or environmental assumptions within the bounds or at the boundaries of the declared ODD but may also consider the behaviour at ODD exit or outside the ODD. Variations may also arise inherently from the nature of the testing environment. Considering the real-world confirmatory testing, the assessor is unlikely to be able to replicate the manufacturer's test method, protocols and/or results.

The real-world confirmatory testing may be conducted on test routes different from those of the manufacturer, provided that the route selection is suitable for the ADS and is representative of the ODD. The selection allows the manufacturer's results to be assessed inside, at, or crossing the boundaries of and outside the ODD. Similarly, while carrying out proving ground testing, it might not be possible to control all the variables, and there might be stochastic effects in the controlled variables. The variations (planned or otherwise) that occur during the confirmatory testing help to verify the overall robustness and consistency of the manufacturer's results.

* It is expected that the assessment of the credibility and suitability of the simulation toolchains takes place before the confirmatory testing to ensure the assessor is aware of any potential limitation and can make an informed choice about the verification tests that can be performed.

8.3.3.1.1. The approval authority or its designated technical service shall ensure that the physical testing (proving ground and/or public road) facilities and environment and the virtual testing environment as applicable are suitable to conduct the testing and confirm the evidence provided by the manufacturer to support the safety case in accordance with the requirements under paragraph 7.2.

[This provision does not require accredited facilities.]

Relevant standards supporting the assessment of the laboratories could include:

- ISO/IEC 17025 Testing and calibration laboratories → sets the requirements for competence, impartiality, and consistent operation of testing and calibration laboratories. Applied to ADS testing, it ensures that measurements (are traceable, validated, and reproducible—so results are technically reliable and defensible for approval/certification purposes. However, there is no obligation for the manufacturer or third-party organization involved in the testing to be accredited according to ISO/IEC 17025.
- DOT HS 813 083 - Advanced Test Tools for ADAS and ADS.

8.3.3.3.8.	The approval authority or its designated technical service shall select scenarios where the behaviour or position of other road users requires the ADS to react to their movement or presence.
8.3.3.3.9.	The approval authority or its designated technical service shall use track testing to also confirm that user(s)-related aspects are in line with the ADS safety case.

The applicability and relevance of specific scenarios selected as part of the confirmatory testing depend on the ADS feature, its ODD, and the scenarios used to demonstrate the safety case.

When selecting the list of scenarios/situations for confirmatory testing, the assessor may consider the following general guiding principles to establish the relevance:

- The ADS system description and its safety concept: this guiding principle aims at ensuring that the intended use(s) of the ADS and its architecture are considered when planning confirmatory testing;
- The safety claims presented in the safety case: this aims at ensuring meaningful and robust confirmatory testing through the selection of tests relevant to safety claims in the safety case.

[The choice of tests with hazards or mitigation strategies helps to provide reassurance that some of the more critical manufacturer tests have been confirmed as trustworthy.]

Confirmatory testing may be undertaken using virtual testing. The testing performed is expected to be within the scope and capability of the toolchain that is being used. As with other confirmatory testing it can be within, at the boundary of or outside the ODD.

8.3.3.4.9.	The approval authority or its designated technical service shall ensure that the selection of test routes utilises appropriate strategies to enhance the probability of ADS encountering situations that involve a large number of other road users, unlikely road infrastructure, or abnormal geographic/environmental conditions, by examining when and where specific elements (e.g., high- or low-density traffic) typically occur. It is understood that it may not be possible to encounter all traffic situations during a real-world test.

During real-world confirmatory testing, the ADS may encounter lower-probability or unusual elements that may or may not have been reasonably foreseeable. Such naturally occurring situations do not represent exhaustive edge-case testing but may be considered as one element among the others being relevant to verifying safety-critical behaviours, assumptions, or fallback strategies claimed in the safety case. If the ADS does not behave in an appropriate manner, then the event is identified and recorded for further investigation and resolution by the manufacturer.

In real-world testing, the assessor could include as much variability as reasonably possible to verify the ADS performance and could include as many lower probability or unusual scenarios as reasonably possible without creating a risk for the occupants or other road users.

8.3.3.4.14.1.	The real-world test drive shall cover the functions required to perform the entire DDT in the ODD pursuant to the outcomes of the safety case analysis.
8.3.3.4.14.2.	The test should be terminated only when all relevant parts of paragraph 8.3.3.4.14.1, excluding safety-critical and failure-related scenarios, have been monitored and assessed.

Confirmatory testing concludes once sufficient confidence has been obtained that the manufacturer's test evidence is trustworthy. The duration and extent of confirmatory testing are determined by the adequacy of the evidence collected, rather than by predefined numerical thresholds. Factors dictating the duration of the confirmatory testing might include:

- Complexity of the ODD,
- Different behavioural capabilities of the ADS, or
- Amount of claims/evidence within the safety case.

This does not mean that metrics, such as the number of scenarios executed, parameter variations applied, or operating time accumulated, may not be used as supporting information as to when sufficient confirmatory testing has been undertaken. However, such indicators are understood as aids in making a decision and not as mandatory termination criteria.

The assessor can extend confirmatory testing if needed.

Guidance	Scenario selection and allocation

Existing legal and regulatory frameworks for ADS may be used as non-binding references to inform the identification of applicable scenarios for specific ADS use-cases, where relevant. [Such references might include, for example:

- GB/T 41798 Intelligent and connected vehicles—Track testing methods and requirements for automated driving functions.
- DOT HS 812 623 - A Framework for Automated Driving System Testable Cases and Scenarios.
- GB/T 47025 Intelligent and connected vehicle-Simulation test methods and requirements for automated driving function.]

Relevant standards that can support scenario identification include:

- ISO 34502 - Road vehicles — Test scenarios for automated driving systems — Scenario based safety evaluation framework
- ISO 34504 - Road vehicles — Test scenarios for automated driving systems — Scenario categorization
- ISO 34505 - Road vehicles — Test scenarios for automated driving systems — Scenario evaluation and test case generation
- ISO 23374-1:2023 - Intelligent transport systems — Automated valet parking systems (AVPS) — Part 1: System framework, requirements for automated driving and for communications interface, Section 10: Test scenarios for automated vehicle operation.

Scenario allocation across simulation, proving ground testing, and real-world testing may be guided by the characteristics of the scenario, including its safety criticality, interaction complexity, technical feasibility in the given testing environment, and statistical frequency within the ODD.

Some concrete metrics to document the scenario allocation process might be:[*]

- Required minimum fidelity
- Test complexity
- Safety hazard to personnel involved
- Real-time needs
- Test throughput
- Need for a controllable environment.

[*] https://ccam-sunrise-project.eu/wp-content/uploads/2025/08/D8.1_Final-report-to-vehicle-safety-bodies_V1.0.pdf

8.4. Post-deployment safety assessment

8.4.4.	The approval authority or its designated technical service shall ensure the confidentiality of sensitive and business confidential reported information in the short-term template.

As stated in ECE/TRANS/WP.29/2024/39 (i.e., Integration Document for ADS), 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.

Concerning the information sharing, ECE/TRANS/WP.29/2024/39 recommends the exchange of information among relevant Authorities to support the evaluation of the occurrences. At the same time, ECE/TRANS/WP.29/2024/39 states that the dissemination of information should be limited to what is strictly required for the purpose of its users (i.e., Relevant Authority), to ensure appropriate confidentiality of that information.

In particular, the information should be only used for safety related activities and not for any other purpose.

It is not intended for ISMR information to be shared publicly, excluding for aggregated road safety statistics or to support any future activities on harmonised scenario sharing mechanisms. If authorities publish such ISMR information it is expected that the information is anonymised (i.e., to avoid the identification of individual manufacturers, vehicles, systems, or operators) and where possible aggregated.

This interpretation applies to any authority receiving information under this Regulation, whether acting as a Type Approval Authority or as another relevant authority. It does not restrict the exchange of information between authorities where required or permitted by law, or the publication of information for safety purposes where required or permitted by law (e.g.: recalls, investigations), nor does it override obligations arising from applicable laws, including freedom of information, data protection, or privacy legislation.

9.	Modifications and extension of approval of the vehicle type
10.	Conformity of Production
11.	Penalties
12.	Production definitively discontinued
13.	Names and addresses of Technical Services responsible for conducting approval tests and of Type Approval Authorities
14.	Certificate of compliance for a Safety Management System (SMS)
Annex 1	Communication
7.	ADS feature(s) and overview (for each feature):

The tables included in Section 7 of the certificate are provided for illustrative purposes only. The format of presentation is not prescribed and may be adapted as deemed appropriate. However, all relevant aspects for each section should be comprehensively described.

9.	Cyber Security and Software updates

The form is not designed to be updated for every change, but only for relevant changes affecting the validity of the approval granted to the ADS. Extensions of type approvals according to UN Regulation No. 155 or 156 do not inherently trigger a need to amend the Communication Form.

10.1.	Manufacturers document reference for the Safety Case (including version number)

Changes in the safety case do not automatically require an extension. Only significant changes affecting the validity of the approval granted to the ADS (per §9 on modifications) triggers extension. In all other cases, a revision is deemed to be sufficient.

17.	Annexed to this communication is a list of documents in the approval file deposited at the administration services having delivered the approval and which can be obtained upon request.

"Administration services" is not explicitly defined, but context shows that these are the bodies issuing and holding the approval documentation. Administration services is intended as the approval authority (and its technical services).

Appendix 1	Information document
1.1.	ADS description and drawings (in accordance with paragraph 7.3.1.)

This item is covered in the safety case section of the GID;

1.3.2.	ADS feature(s) performance and limitations including a description of ODD

This item is covered in the safety case section of the GID.

Appendix 2	Addendum to Communication
Annex 2	Arrangements of approval marks
Annex 3	List of Reportable Occurrences by Reporting Type

The ADS regulation includes a list of reportable occurrences. However, the regulation does not provide examples of situations which fall into such occurrences categories.

These examples are intended to provide guidance on situations triggering occurrences listed in the regulation. The following information does not create any obligation for manufacturers and authorities.

1. "ADS operation outside its ODD"
Such an occurrence could be reported when:

- The ADS unintentionally continues to perform the DDT outside declared ODD limits;
- The ADS activates accepts activation outside the declared ODD boundaries;
- The ADS fails to detect its ODD boundaries as defined in the safety case.

Occurrences where the ADS temporarily operates outside the ODD as part of a controlled and designed ODD exit strategy to minimize safety risk may be distinguished from an unintended ODD violation. (For example, ADS slightly delays execution of a fallback response after ODD violation to reduce disruption to the traffic flow).

2. "ADS failure to achieve a mitigated risk condition when necessary"
Such an occurrence could be reported when an MRC is required, but:

- The ADS does not initiate any fallback to MRC when required (e.g., ODD exit, significant ADS failure, collision detected, detection that fallback user is not available, failure of the fallback user to take control following a system-initiated deactivation of the ADS)
- The ADS does not complete the fallback response to an MRC when required

3. "Failure to meet the ADS requirements under paragraph 6 of this Regulation"

Failures include:
- Systematic or repeated deviations from the DDT performance requirements

4. "Performance issues constituting an unreasonable risk to safety"

This occurrence should be understood as deviations, degradations, or limitations in the ADS capabilities that affect its ability to perform its intended driving task safely within the declared ODD and is beyond the expected variability or acceptable degradation. This occurrence is intended to complement more specific reportable occurrences by capturing safety-relevant performance concerns that, based on analysis of their frequency and severity, constitute an unreasonable risk but that may not be directly associated with a single discrete failure or event.

The following are examples of factors that should be considered in determining whether an unreasonable risk may exist, but do not necessarily constitute such a risk:
- Violation of performance thresholds as indicated in the safety case
- An identified reduction in the safety margins
- Exceeding overall hazard exposure thresholds
- An increase in the rate of hazardous event occurrences

These may not be "serious", but the increase suggests some underlying problem.

5. "Uncompleted system-initiated deactivation processes to manual driving"
Such an occurrence could be reported when:
- The system-initiated deactivation is not successfully completed
- The user is not properly engaged i.e. when the deactivation process is complete and the user has not properly taken over control of the vehicle control
- ADS remains partially active resulting in a state where the driving responsibility is unclear.

6. "Communication issues affecting the safety of the ADS"
Such an occurrence could be reported in case of:
- The remote interaction is unavailable
- A V2X service is required but unavailable
- Information latency exceeds safety threshold.

7. "Cybersecurity issues affecting the safety of the ADS"
Such occurrence could be reported in case of:
- Safety-relevant ECU compromised
- Integrity of perception/planning data affected
- ADS control channel manipulated.

Such reporting is expected to be aligned with CSMS procedure where R155 is applied.

8. "System failures that compromise the capability of the ADS to perform the entire DDT"
Such occurrence could be reported in case of:
- A loss in the redundancy of the or a reduction in the capabilities ADS
- A failure in an actuator used by the ADS
- Degradation in the computational capability that affects the performance of the ADS.

9. “Maintenance or repair issues affecting the ADS's intended functionality”
Such an occurrence is expected to be reported in case of:
- Sensor misalignment
- Lack or miscalibration
- Outdated software with safety implications
- Fitted hardware not compliant to safety performance specifications.

10. “Unauthorized modifications to ADS that could affect the intended functionality”
Such an occurrence is expected to be reported in case of:
- Software tampering;
- Sensor tampering; obstruction;
- Third-party hardware interfering with ADS.

11. “Manoeuvres performed to reach MRC”
Such an occurrence is expected to be reported when the ADS starts a fallback to MRC in case of:
- ODD exit
- ADS failure
- Collision detected
- Detection that fallback user is not available when they have no longer met the conditions of paragraph 6.2.2.1.6 of this Regulation (if applicable), or
- Failure of the fallback user to take control following a system-initiated deactivation of the ADS).

12. “Emergency Manoeuvres”
Such an occurrence is expected in case of a situation or an event that leads to a collision of the ADS equipped vehicle with another road user or an obstacle that cannot be avoided by a braking demand lower than 5 m/s^2. This also includes situations where the collision is avoided by a braking demand lower than 5 m/s^2 in combination with steering application, in case the ADS cannot avoid the collision only by a braking demand lower than 5 m/s^2 for the same situation.

14. “Fallback user unavailability”
Such an occurrence is expected to be reported when:
- No response within required time (e.g., warning);
- MRC required due to non-response.

15. “Prevention of takeover under unsafe conditions”
Such an occurrence is expected to be reported when situation is unsuitable or unsafe for the subsequent mode of vehicle operation.

Annex 4 In-Service Reporting Template: Short-term Reporting

This information intended to provide guidance on some items of the short term template.

OCCURRENCE DETAILS
1. “ODD conditions relevant to the occurrence analysis”
The taxonomy presented in ISO 34503 may be used to document the relevant ODD condition in the short-term reporting.

VEHICLE DETAILS

2. "Vehicle approval number"

Vehicle approval number is clearly defined under UNR and/or national or supra-national regulatory frameworks. However, countries using a different scheme from the type-approval one may use an alternative identifier to retain a link between the ADS vehicle and its certification documentation.

3. "Vehicle category"

Vehicle category may use the Consolidate Resolution on the Construction of Vehicles (R.E.3) where applicable.

4. "ADS identifier"

Where UNR 156 applies, the RXSWIN may be used as the ADS identifier. Countries where UNR 156 is not enforced may devise an alternative identifier to retain the traceability of the ADS software version.

5. "ADS licensing authorities"

In case such an information is available and applicable, this field reports the authorities who gave authorization for the ADS vehicle involved in the occurrence to be operated in the area,

WHERE

6. "Roadway description"

An example of how to fill in roadway characteristics:

- Roadway type: Urban arterial
- Roadway surface: Asphalt
- Roadway description: Four-lane divided road with sidewalks on both sides, signal-controlled intersections, moderate traffic volume, and posted speed limit of 50 km/h.

KNOWN OR ALLEGED DAMAGE

7. "Description of damage to the ADS vehicle"

Document ECE/TRANS/WP.29/2024/39 provides a possible categorization for the damage level:

a) destroyed: the damage makes it inadvisable to restore the vehicle;
b) substantial: the vehicle sustained damage or structural failure requiring major replacement;
c) minor: the vehicle can be rendered operational by simple repairs/replacement;
d) none: the vehicle sustained no damage;
e) as reported from third-party sources;
f) unknown: the damage level is unknown.

Location: Annex 3/5
Subject: Periodic reporting template
This information intended to provide guidance on some items of the periodic template

ADS IDENTIFICATION

1. "ADS software version/identifier(s)"

Where UNR 156 applies, the RXSWIN may be used as the ADS identifier. Countries where UNR 156 is not enforced may devise an alternative identifier to retain the traceability of the ADS software version.

2. "Vehicles equipped with ADS"

The periodic reporting template only requires the total number of vehicles equipped with the same approved/certified ADS to be reported. This interpretation does not exclude the possibility for the manufacturer to provide additional granularity regarding different ADS versions if deemed necessary for the safety argumentation.

ADS OPERATION INFORMATION (segmented by ADS feature)
3. "Weather conditions"
The taxonomy presented in ISO 34503 may be used to document weather condition in the periodic reporting.

4. "Average ADS time engagement"

OCCURRENCES ASSESSMENT (segmented by ADS feature)
Occurrences covered under the periodic reporting provisions
Each of the following occurrences is accompanied by an "occurrence safety review" field where it is expected that the manufacturer provides additional explanation for any safety concern identified or any supplementary information to support the correct understanding of the occurrence by the assessor.

ADS MONITORING ASSESSMENT (segmented by ADS feature)
5. "SPIs monitoring analysis"

The list of SPIs presented in 'Guidance on Safety Performance Indicators' may be used to derive suitable indicators. The expectation for this entry in the periodic reporting template is for the manufacturer to report on the actual metrics and to provide an explanation for any discrepancy identified between the safety case's claims and the operational phase.

Annex 5	In-Service Reporting Template: Periodic Reporting
Annex 6	Threshold Definitions
4.1.	The restraint system triggering condition and Delta-V threshold aims at promoting the reporting of occurrences in case one of the following applies: … (c) The applicable Delta-V thresholds to be met according to the EDR system fitted on the vehicle.

Different regulatory schemes are in place concerning EDR depending on the contracting party and on the ADS vehicle category. As such, the concept of 'applicable' firstly refers to the 'if-fitted' nature of the EDR.

Where the EDR is fitted to the ADS vehicle, the 'applicable' Delta-V trigger in the context of a critical occurrence, this is understood as the data recording triggering conditions related to vehicle velocity changes defined in the relevant EDR Regulation applicable to the vehicle category concerned.

This example is intended to provide guidance on an acceptable way to comply with the requirements, for example, depending on the contracting party and on the ADS vehicle category, the following references might apply:

- UN Regulation No. 160 applies to vehicle categories M1 and N1,
- U.S. 49 CFR Part 563 applies to passenger cars, multipurpose passenger vehicles, trucks and buses with a GVWR of 3,855kg or less.
- [GB 39732 applies to vehicle category M1 and GB 44497 applied for vehicle categories M and N.]

For vehicle categories M2, M3, N2, and N3, the UN Regulation No. 169 does not include a representative delta V threshold (neither the last stop nor sudden deceleration triggers are Delta-V thresholds).

The manufacturer could determine its own delta-V trigger for a critical occurrence, including one based on a subset of EDR triggers (e.g., a subset of existing sudden deceleration triggers). However, there is no obligation to do this.