# Requirements for In-Service Monitoring and Reporting for the Automated Driving System (ADS)

* 1. **General**

In-service monitoring and reporting (ISM) addresses [manufacturer] monitoring and reporting of ADS safety performance in the field. ISM applies to occurrences which endanger or which, if not corrected, would endanger a vehicle, its occupants or any other person, and more generally to all occurrences relevant to the safety performance of the ADS. Annex 1 provides a list of examples of these occurrences.

ISM enables the identification of unreasonable risks related to the use of ADS vehicles on public roads and to evaluate its safety performance during real-world operation.

* 1. ISM requires manufacturers to collect and analyse safety-relevant information related to their ADS vehicles operation in the field and report data on safety concerns and performance metrics [to the safety authority].
  2. ISM provides safety authorities with manufacturer information to complement information that may be gathered from other sources.
  3. The ISM should also fuel the scenarios catalogue through the identification of new scenarios relevant to the ADS safety that may happen with automated vehicles in the field.
  4. Another important outcome of ISM should be the development of safety recommendations for the whole community, based on the analysis of the ADS safety performance during operation. The learnings derived from key safety accidents/incidents but also good practices will be shared in the form of safety recommendations in order to allow the whole stakeholders’ community to learn from operational experience feedback, fostering continuous improvement of the technology safety level and of the legislative requirements.
  5. For example, ISM may be seen as an extension of the Real-World Testing method, providing information on ADS performance under real-world conditions. ISM attention to user-interactions metrics can provide information useful for improving ADS HMI, usability, and driver education.
  6. Even when the safety (according to safety metrics and methodologies defined by FRAV) of the assessed automated driving system is deemed acceptable at the type approval stage for the service of the vehicle, certain aspects of the safety performance of the automated driving system during its lifetime remain the responsibility of the manufacturer. ISM enables the identification of any concern posing a safety risk in need of remedy that may occur after type approval.
  7. **Objectives**

The aim of ISM is to contribute to the improvement of road safety by ensuring that relevant information on safety is collected, reported, stored, protected and disseminated.

* 1. Summarizing the introductory explanation above, the ISM aims to fulfill three main objectives:

1. Identify safety risks related to ADS performance in need of remedy, including instances of non-compliance with ADS safety requirements (objective 1),
2. Fuel the Scenario Catalogue through the identification of new scenarios relevant to the ADS safety (objective 2),
3. Share information and recommendations to promote continuous improvement of ADS safety performance (objective 3).
   1. ISM collection and elaboration of information related to ADS safety performance will also facilitate the evaluation of the impact of ADS use on road safety.
   2. **Definitions**

‘*Occurrence’* means an operational interruption, defect, fault or other irregular circumstance (including an accident or incident) involving a vehicle equipped with an automated driving system;;

* 1. "*Safety Critical Occurrence*" means each safety relevant occurrence involving anaccident or incident) in which the ADS is engaged at the time of the event and because of which:
     + 1. at least one person suffers an injury that requires medical assistance as a result of being in the vehicle or being involved in the event,
       2. the ADS vehicle, other vehicles or stationary objects sustain a physical damage that exceeds a certain monetary threshold or any vehicle involved in the event experiences an airbag deployment.
  2. “*Safety Relevant Occurrence*” means each occurrence that is related to the ADS safety performance, including instances preceding an actual safety critical event or undertaken to prevent a safety critical event (e.g. near-miss events).
  3. “Automated Driving System (ADS)” means the vehicle hardware and software that are collectively capable of performing the entire Dynamic Driving Task (DDT) on a sustained basis.
  4. “ADS feature” means an application of an ADS designed specifically for use within an Operation Design Domain (ODD).
  5. “ADS function” means an application of ADS hardware and software designed to perform a specific portion of the DDT.
  6. “Dynamic driving task (DDT)” means all of the real-time operational and tactical ADS functions required to operate the ADS-equipped vehicle in on-road traffic.
* The DDT excludes strategic functions such as trip scheduling and selection of destinations and waypoints.
* The DDT functions can be logically grouped under three main categories:

1) Sensing and Perception

2) Planning and Decision

3) Vehicle Control.

* 1. “Operational Design Domain (ODD)” means the operating conditions under which an ADS feature is specifically designed to function.
  2. “ODD exit” means:

1. the presence of one or more ODD conditions outside the limits defined for use of the ADS feature, and/or
2. the absence of one or more conditions required to fulfil the ODD conditions of the ADS feature.
   1. “Transfer of Control (TOC)” means a transfer of dynamic control of the vehicle from the ADS to the fallback user.
   2. “TOC request” means a warning issued by the ADS to the fallback user that the latter is needed to engage in dynamic control of the vehicle.
   3. “TOC response” means the fallback user engagement in the dynamic control of the vehicle pursuant to a TOC request.
   4. **In-service monitoring**

The manufacturer should set up a monitoring program aimed at collecting and analysing vehicle data, and data from other sources, to get evidence on the in service safety performance of the ADS, in accordance with the Safety Management System Requirements set by the Audit Pillar.

* 1. Vehicle data collection

Presently, EDR and DSSAD are tasked with data collection and storage onboard the ADS-vehicle. This section would address data elements that may be collected and uploaded by the manufacturer from ADS vehicles for aggregation and processing in order to report performance metrics defined under the Reporting section.

* 1. Other manufacturer-accessible sources of data indicative of ADS performance

Manufacturers may be expected to collect data relevant to typical operations such as dealer reports, customer reports, etc.

* 1. **In-service reporting**

The sole purpose of occurrence reporting is the prevention of accidents and incidents and not to attribute blame or liability.

* 1. Recommended Reporting by the manufacturer

The manufacturer should report, as required by the Authority, both on short and longer term safety performance of the ADS vehicle operation as indicated in the following.

* 1. Reporting of safety concerns in need of remedy as identified by the manufacturer, including:
* Reporting indications of failure to meet safety requirements
* Reporting of other safety-relevant performance issues

This short- term reporting is due within a month, when collected data provide evidence of a significant safety issue

Occurrences relevant to this short-term reporting are listed in Annex 1.

* 1. Periodic reporting of performance metrics to the safety authority

Annex 1 provides a list of safety-relevant and safety critical occurrences aligned with FRAVhigh level requirements, that represent the generic areas of interest that SG3 intends to define in greater detail, taking into account both the usefulness of each suggested reporting element to the safety authorities, the capacity of the authorities to review the volume of data reported, and the feasibility of storing, collecting and reporting the various elements.

All occurrences listed in Annex I are relevant for the periodic reporting.

The periodic report should be delivered every [six months/one year], and should provide evidence of the ADS performance in safety relevant occurrences in the field. In particular, it should demonstrate that

1. the ADS respects the performance requirements set by FRAV and as elaborated and set in the test methods developed by VMAD;
2. any newly discovered significant ADS safety performance issues have been adequately addressed
   1. The ISM reports should be made available, as required by the Authority, in two parts:
3. The In-service Data Report, that contains information relevant to the requirements set in (a) and (b) above;
4. Supporting data used to elaborate the information provided into the In-service Data Report, exchanged with the Authority by means of an agreed data exchange file.

Any pre-processing of data should be notified to the Authority in the In-service Data Report and should be completed before the data exchange file is generated.

* 1. Where feasible, a consistent approach to technical reporting requirements should be developed by contracting parties, and their relevant domestic authorities.
  2. The Authority where necessary may verify the provided information and, if needed, require the ADS manufacturer to remedy any detected conditions constituting an unreasonable risk to safety.
  3. **Recommendations on areas outside the scope of WP.29/VMAD/SG3**
  4. Reporting from other sources

The effectiveness of the ISM pillar will be determined by the availability of data on ADS safety performance. This means that limiting the reporting requirements to manufacturers only will also limit the type of occurrences that can be covered by ISM, and consequently the level of safety improvement achievable through operational experience feedback. Indeed other transport sectors extend the operational reporting mechanism also to drivers, operators, users, traffic managers, and any other person connected to the vehicle operation. Discussion on this matter requires exchanges between WP.29 and WP.1.

* 1. For example, occurrences related to traffic rules infringement cannot be covered with data collected onboard the vehicle: the ADS will not intentionally infringe the law and therefore, being not aware of the safety-relevant occurrence, will not record any data. Therefore, collaboration not only with the manufacturers but also with local authorities and ADS vehicle users is needed to identify and report this category of occurrences.
  2. Information sharing among safety authorities/Contracting Parties

The final aim of ISM is to improve ADS safety through dissemination of lessons learned in the form of safety recommendations. The resulting safety improvement will be most effective as far as the information sharing takes place not only at local but also at international level. Safety authorities could have the reporting from manufacturers plus other information such as from highway authorities, crash investigations, research, national statistics, etc. A mechanism to share information across safety authorities at super-national level is desirable and could be coordinated by GRVA/VMAD, under WP.29 direction.

**Annex 1 – List of occurrences recommended for reporting**

Reporting of occurrences to satisfy objective 1 is expected to be submitted in the form of aggregated data (per hour of operation or driven km) for ADS-vehicle type and related to ADS operation (i.e. when is ADS activated).

The following list of recommended occurrences has been derived in line with ADS safety requirements set by FRAV. The occurrences have been subdivided into three categories, based on their relevance to the DDT, to the interaction with ADS vehicle users, and to ADS technical conditions. For each occurrence, also its relevance to the short-term and/or periodic longer-term reporting has been flagged in the table below.

* 1. Occurrences related to the ADS performance of the DDT, such as:
     + 1. Safety critical occurrences (as defined above) known to the ADS manufacturer or OEM
       2. Occurrences related to ADS operation outside its ODD
       3. ADS failure to achieve a minimal risk condition when necessary
       4. Communication-related occurrences (where connectivity is relevant to the ADS safety concept)
       5. Cybersecurity-related occurrences
       6. Interaction with remote control centre (if applicable) related to major ADS or vehicle failures
  2. Occurrences related to ADS interaction with ADS vehicle users, such as:
     + 1. Driver unavailability (where applicable) and other user-related occurrences (e.g. user errors, misuse, misuse prevention)
       2. Occurrences related to Transfer of Control failure (reason, share compared to completed TOC)
       3. Prevention of takeover under unsafe conditions
  3. Occurrences related to ADS technical conditions, including maintenance and repair:
     + 1. Occurrences related ADS failure resulting in a request to intervene
       2. Maintenance and repair problems
       3. Occurrences related to unauthorized modifications (i.e. tampering)
       4. Modifications made by the ADS manufacturer or OEM to address an identified and significant ADS safety issue (with appropriate protections for related IP)

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| **OCCURRENCE** | **IMMEDIATE REPORTING**  **[1 Month]** | **PERIODIC REPORTING**  **[1 Year]** |
| 1.a. Safety critical occurrences known to the ADS manufacturer or OEM | X  (in case of unreasonable risk) | X |
| 1.b. Occurrences related to ADS operation outside its ODD | X | X |
| 1.c. ADS failure to achieve a minimal risk condition when necessary | X | X |
| 1.d. Communication-related occurrences |  | X |
| 1.e. Cybersecurity-related occurrences |  | X |
| 1.f. Interaction with remote operator if applicable |  | X |
| 2.a. Driver unavailability (where applicable) and other user-related occurrences |  | X |
| 2.b. Occurrences related to Transfer of Control failure |  | X |
| 2.c. Prevention of takeover under unsafe conditions |  | X |
| 3.a. Occurrences related ADS failure |  | X |
| 3.b. Maintenance and repair problems |  | X |
| 3.c. Occurrences related to unauthorized modifications |  | X |
| 3.d. Modifications made by the ADS manufacturer or OEM to address an identified and significant ADS safety issue |  | X |