**DSSAD GUIDANCE DOCUMENT**

Committee proposals are in blue. Secretariat notes are in red. UK proposals in purple. EC proposals in green. EME proposals in orange. Japanese proposals in pink. Canadian proposals in teal.

Additional proposals to EDR-DSSAD-IWG-29-04 from the UK are given **black bold** for additional character and ~~black strikethrough~~ for deleted characters

**1. Introduction:**

*DSSAD refers to a capability of a vehicle to monitor the performance of its Automated Driving System (ADS). This document provides recommendations to enable evaluations of ADS performance.*

*This document has been prepared to support WP.29 deliberations under the 1958, 1997, and 1998 Agreements.*

**2. Terms and Definitions:**

This section defines terms used in this document. Use of these terms and their definitions is recommended in the development of legal requirements related to ADS and ADS vehicles.

*Source: WP.29 GRVA Guidelines and recommendations for Automated Driving System safety requirements, assessments, and test methods to inform regulatory development.*

2.1 ***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.[[1]](#footnote-2)

2.2 ***(ADS) Function*** means an ADS hardware and software capability designed to perform a specific portion of the DDT.

2.3 ***ADS feature*** means an ADS designed specifically for use within an Operational Design Domain (ODD).

2.4 ***ADS vehicle*** means a vehicle equipped with an ADS.

2.5 ***Driver*** means a human user who performs in real time part or all of the DDT and/or DDT fallback for a particular vehicle.

2.6 ***Dynamic Driving Task (DDT)*** means the real-time operational and tactical functions required to operate the vehicle.

2.6.1. When the ADS is in operation, the DDT is always performed in its entirety by the ADS which means the whole of the tactical and operational functions necessary to operate the vehicle (i.e., the ADS performs “the entire DDT” as stated in the definition of an “Automated Driving System” under paragraph 2.1.). These functions can be grouped into three interdependent categories: sensing and perception, planning and decision, and control.

2.6.1.1. Sensing and perception include:

* Monitoring the driving environment via object and event detection, recognition, and classification.
* Perceiving other vehicles and road users, the roadway and its fixtures, objects in the vehicle’s driving environment and relevant environmental conditions.
* Sensing the ODD boundaries, if any, of the ADS feature.
* Positional awareness.

2.6.1.2 Planning and decision include:

* Predicting actions of other road users.
* Response preparation.
* Maneuver planning.

2.6.1.3 Control includes: ·

* Object and event response execution
* Lateral vehicle motion control
* Longitudinal vehicle motion control.
* Enhancing conspicuity via lighting and signaling.

2.7 ***ADS fallback response*** means a system-initiated deactivation of the ADS or an ADS-controlled procedure to place the vehicle in a minimal risk condition.

2.8 ***Fallback user*** means a user designated to perform the DDT pursuant to an ADS fallback response.

2.9 ***Minimal Risk Condition (MRC)*** means a stable and stopped state of the vehicle that reduces the risk of a crash.

2.10 ***Operational Design Domain (ODD)*** means the operating conditions under which an ADS feature is specifically designed to function.

2.11 ***System-initiated deactivation of the ADS*** means a procedure by which the ADS initiates the transfer of performance of the DDT from the ADS to a vehicle user.

2.12 ***User initiated deactivation of the ADS*** means a procedure by which the user initiates the transfer of performance of the DDT from the ADS to a vehicle user.

2.13 ***(ADS) User*** means a human user of an ADS vehicle.

2.14 ***Failure*** means the termination of an intended behaviour of an element ~~(system, component, software)~~ or an item ~~(system or combination of systems that implement a function of a vehicle)~~.

2.15 ***(DSSAD) Triggering Event*** means a time stamped data element which triggers the recording and storing of time series data elements

2.16 ***Emergency manoeuvre*** is a manoeuvre performed by the system in case of an event in which the vehicle is at imminent collision risk and has the purpose of avoiding or mitigating a collision.

2.17 ***Imminent collision risk*** describes a situation or an event which leads to a collision of the vehicle with another road user or an obstacle which cannot be avoided by a braking demand with lower than 5 m/s2.

2.19 ***ODD exit*** means:

(a) the presence of one or more ODD conditions outside the limits defined for use of the ADS feature, and/or

(b) the absence of one or more conditions required to fulfil the ODD conditions of the ADS feature.

2.XX ***Detected objects*** shall mean objects detected by the perception system of the vehicle and classified by the ADS as relevant for the purpose of performing a dynamic driving task. Objects with a negative relative velocity shall be deemed relevant.

OR

2.XX ***Detected objects***means transient objects (such as road users or parked vehicles) and permanent objects (such as bridge pillars, trees, lamp posts or [lane markings]) detected by the perception system of the vehicle and classified by the ADS as relevant for the purpose of performing the DDT.

~~2.XX~~ ***~~Time-to-Collision (TTC) trigger~~*** ~~means longitudinal and lateral calculation of the Time-to-Collision (TTC), which is the relative Euclidean distance divided by the relative Euclidean velocity between the vehicle and the detected object, calculated based on the fused sensor data.~~

2.XX ***Visual Images*** means video or series of photos that are produced in the visual spectrum that provides the ground truthor confirmation of the environment surrounding the vehicle during an event.

2.XX ***Electronic Communication Interface*** means a standardized connection point that can be accessed directly via the ADS or via the manufacturer’s database to acquire DSSAD data.

2.XX ***Digital map*** means a layered database providing information to the ADS on the [road infrastructure] on which ADS relies partly or entirely to perform the DDT.

3. **Data Storage and Security**

3.1 The data storage system should be sufficient to record and store the DSSAD time stamped data elements and time series data elements listed in Paragraph 6.

3.2 The DSSAD shall be protected against both unauthorized access and manipulation.

3.3 In the case of the data intended to be stored off-board the vehicle cannot be transmitted, it should remain stored on the vehicle.

**4. Data Format:**

4.1 Each data element listed in Paragraph 6 shallbe available in **accordance with Paragraph 5. The output shall be provided in an open standard format (e.g. JSON, CSV, XML),** **with the exception of ‘sensor data’,** ~~a standardised~~ and **the data shall be in a** readable**[[2]](#footnote-3)** form~~at~~**,** **aside from ‘sensor data’ and ‘visual images’**.

4.2 **Information required to interpret the output to correlate it with respect to the data elements required in Paragraph 6 shall be provided by the manufacturer to an authorised entity on request at no cost.**

4.3 Time stamp data format

4.3.1. Time stamp data shall be recorded in a clearly identifiable way with following data:

4.3.1.1. The time stamped data element, as listed in paragraph 6.2.1.

4.3.1.2. The additional information noted in 6.2 for each time stamped data element as appropriate.

4.2.1.3. Date (Resolution: yyyy/mm/dd);

4.2.1.4. Timestamp

4.2.1.4.1 Resolution: hh/mm/ss timezone e.g. 12:59:59 UTC;

4.2.1.4.2 Accuracy: +/- 1.0 s.

4.2.1.5. Location:(GNSS) longitude + latitude + altitude; shall be recorded in decimal degrees and to at least [5] decimal places, but shall be unrounded.]

4.2.2. A single timestamp may be allowed for multiple elements recorded simultaneously within the time resolution of the specific data elements. If more than one element is recorded with the same timestamp, the information from the individual elements shall indicate the chronological order.

**5. Data Accessibility**

~~5.1 All of the stored data defined in Section~~ **~~Paragraph~~** ~~6 of this guidance document should be readily accessible to~~ **~~authorised~~** ~~entities as defined~~ **~~specified~~** ~~under national law~~**~~[, through a request which is in accordance with national law]~~**~~.~~

~~5.2 The manufacturer should ensure the data is promptly available in a format that is standardized and readable as outlined in item 4.1. Information on how to interpret the data must be freely available, and interpretation shall not require any proprietary tools or systems.~~

5.3 The DSSAD data (whether stored on or off-board the vehicle) shall be available and **readily** retrievable through an electronic communication interface that complies with a publicly available interface standard. It is recommended to use an internationally recognized standard.[[3]](#footnote-4)

5.4 ~~The manufacturer should ensure there is a method to access the data via the electronic communication interface and provide an information package about its usage to authorized entities. The~~ **A description of the functioning of** **the** **electronic communication interface and the** method of accessing **and outputting the** data via this interface shall be documented by the manufacturer and provided upon the request of **/ to** the regulatory authority ~~including any tools or software which are required for access~~. ~~The regulatory authority should not require any proprietary tools or systems to access the data.~~

**5.5 Instructions concerning the method for accessing and outputting the data via the electronic communication interface shall be provided by the manufacturer for free upon request ~~of an authorised entity.~~**

**5.6 If the data is intended to be stored on-board the vehicle, then the following applies.**

**5.6.1 The data elements concerning the activation and deactivation of the feature in paragraph 6.2.1. shall be available via the vehicle’s interface where controls are provided for manual driving.**

**5.6.2 If retrieval of the data requires manufacturer specific tools or software then these shall be provided ~~to an authorised entity,~~ free of charge. Alternatively, the manufacturer shall make available to an authorised entity the software, webservice interfaces, or necessary details and support to produce software to enable the creation of tools for the data retrieval.**

**5.7. If the data is intended to be stored off-board the vehicle, then the following applies.**

**5.7.1. An authorised entity shall not have to install any manufacturer specific systems or software to retrieve the data.**

5.8 The stored data should be retrievable even when the main onboard vehicle power supply is not available.

5.9 The stored data elements should be retrievable even after an impact of a severity level set by relevant regulations.

5.9.1. Alternatively, only for heavy-duty vehicles, the stored data should be deemed retrievable if the DSSAD withstand mechanical shocks in the component test at a severity level specified in relevant regulations (e.g. Annex 9C of the 03 series of amendment to UN R100), and be mounted cab/passenger compartment or in a position of sufficient structural integrity to protect against physical damage that would prevent the retrieval of data at least in front and side impacts of a severity corresponding to the mechanical shock aforementioned.

**6. Data Elements:**

6.1 The DSSAD should record and store the data elements listed below**.** This requirement shall be without prejudice to applicable laws governing access to data, availability, and privacy and data protection.

6.2 Data elements of time-stamp data

6.2.1. The following table details the data elements of time-stamp data to be recorded, along with any additional information and recording condition.

|  |  |  |
| --- | --- | --- |
| **Event** | **Additional Information** | **Recording condition** |
| Activation of the feature | ADS feature is activated by the:   1. system, or 2. user |  |
| Deactivation of the feature | ADS feature is deactivated by the   1. system, or 2. user | Whilst the feature is active |
| ODD exit |  |  |
| Start of ADS fallback to user, if applicable | System-initiated deactivation of the ADS initiated due to:   1. Planned event, 2. Unplanned event, 3. ~~Detection that fallback user is not available,~~ 4. System failure, 5. Input to the driving controls, or 6. Exit of ODD. | Whilst the feature is active |
| Start of ADS fallback to an MRC | MRC resulting from:   1. exit of ODD, 2. ADS failure, 3. collision detected, 4. ~~Absence of a~~ **Detection that** fallback user **is not available**, if applicable, or 5. failure in the transition of control to the user, if applicable. | Whilst the feature is active |
| User input to the driving controls, if applicable**, or application of the passenger stop request[[4]](#footnote-5)** | Application of:   1. brake control, 2. acceleration control, 3. steering control, ~~or~~ 4. direction indicator**, or** 5. **passenger stop request**. | Whilst the feature is active |
| Prevention of user takeover, if applicable | Prevention of user takeover (if applicable) due to:   1. Unintentional ~~driver~~ **user** input, 2. The current situation being unsuitable, 3. The current situation being unsafe, or 4. The ~~driver~~ **user** not being suitably engaged. | Whilst the feature is active |
| **Detection that fallback user is not available** |  | **Whilst the feature is active** |
| Start of Emergency Manoeuvre |  | Whilst the feature is active |
| End of Emergency Manoeuvre |  | Whilst the feature is active |
| Event Data Recorder (EDR) trigger input[[5]](#footnote-6) |  | Whilst the feature is active |
| Detected collision |  | Whilst the feature is active |
| ~~[Failure to achieve an originally-intended end state of MRC][[6]](#footnote-7)~~ **Achievement of MRC** | **Designation of MRC:**   1. **Lay-by** 2. **…** 3. **[Other category defined in the safety concept]** | Whilst the ~~system~~ **feature** is active |
| Detected severe failure[[7]](#footnote-8) | The failure could include the following:   1. ADS 2. Sensor 3. Other vehicle systems (mechanical, electrical, etc.) | Whilst the feature is active |
| [Interaction with remote operator, if applicable][[8]](#footnote-9) |  | Whilst the ~~system~~ **feature** is active |
| [Communication with remote operator, if applicable]6 |  | Whilst the ~~system~~ **feature** is active |
| ~~[Proximity conflict]~~ |  |  |

6.2.2. Leading metrics such as ‘proximity conflict’ shall be considered further as a time stamp data in future iterations of the guidance document, to provide indications of unsafe driving behaviour of the ADS.

6.3 Time series data elements

6.3.1. The following table details the data elements of time-series data to be recorded during a triggering event, along with the data sample rate and resolution.

OR

6.3.1 The following data elements of time-series data shall be recorded in cases referred to in paragraph 6.3.2 with the specified data sample rate and recording interval.

OR

6.3.1 Time series data should be recorded over a specified period at certain sampling rate with an appropriate resolution.

OR

6.3.1. The time series data element should be recorded as referred to in paragraph 6.3.2.

OR

6.3.1. The data elements as listed in paragraph 6.3. shall be recorded when a time stamp data element occurs that is identified as a triggering event in paragraph 6.3.

**6.3.1.1    If there is no system or sensor designed to provide the data element to be recorded and stored under section 6.3, alternative data may be provided if the recorded data has comparable value to the specified data element.**

**6.3.1.2    If there is no signal, or parameter designed to provide the data element in the format (e.g. range, resolution, accuracy, and sample rate) indicated in 6.3, the native format of the sensor shall be recorded.**

6.3.2. The data elements shall be recorded in compliance with paragraph 6.3.1 if the following thresholds are reached or conditions occur:

a) Detected collision

1. EDR trigger input (excluding last stop trigger)
2. [ODD warning]
3. TTC trigger threshold of [0.2s]

OR

6.3.2 The data elements as listed in paragraph 6.3 shall be recorded when a triggering event occurs as defined in paragraph 6.3.

6.3.3. All detected objects relevant to the triggering event shall be recorded.

6.3.3.1. The vehicle manufacturer shall make available to the competent authority, together with the detected objects, the full input received by the ADS from digital maps (from all layers of map data), relevant for the geolocation of the vehicle at the time where those objects were detected. This information shall be provided in a format referred to in paragraph 4.1.

6.3.4. In case sensor data referred to in the table of data elements are recorded, the manufacturer shall demonstrate that the sensor data, possibly together with additional information and tools made available to the competent authority, shall provide information about the ADS performance of equivalent utility as ~~to~~ the information derived from the recording of the detected objects [and detected road infrastructure objects].

6.3.X. The sampling rate and resolution should be selected considering ADS design and feasible data size.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Data element** | **Condition for requirement** | **Resolution** | **Minimum Range** | **Recording interval/time (relative to time stamp)** | **Data sample rate (samples per second)** | **Accuracy** | **Trigger [Event(s) recorded for]** | **Restriction applicable to recording** |
| Visual images | Mandatory |  |  | -10 to 10 sec |  |  |  |  |
| Detected object distance, longitudinal | Mandatory if available |  |  | -10 to 10 sec |  |  |  |  |
| Detected object distance, lateral | Mandatory if available |  |  | -10 to 10 sec |  |  |  |  |
| Detected object relative velocity, longitudinal | Mandatory if available |  |  | -10 to 10 sec |  |  |  |  |
| Detected object relative velocity, lateral | Mandatory if available |  |  | -10 to 10 sec |  |  |  |  |
| Detected object classification | Mandatory if available |  |  | -10 to 10 sec | [TBC] |  |  |  |
| [Detected lane] | Mandatory if available |  |  | **-10 to 10 sec** |  |  |  |  |
| Sensor data[[9]](#footnote-10) | Mandatory if ‘Detected object elements’ are not available |  |  | **-10 to 10 sec** | [TBC] |  |  |  |
| [Geolocation] | Mandatory |  |  | **-10 to 10 sec** | [TBC] |  |  |  |
| ~~Geolocation, vertical~~ |  |  |  | **-10 to 10 sec** |  |  |  |  |
| Geolocation, horizontal |  |  |  | **-10 to 10 sec** |  |  |  |  |
| [Vehicle orientation ~~heading/direction of travel~~] |  |  |  | **-10 to 10 sec** |  |  |  |  |
| ADS-requested gear |  |  |  | **-10 to 10 sec** |  |  |  |  |
| ADS-requested accel demand | Mandatory |  |  | **-10 to 10 sec** | [TBC] |  |  |  |
| ADS-requested service braking demand | Mandatory |  |  | **-10 to 10 sec** | [TBC] |  |  |  |
| ADS-requested parking brake demand | Mandatory |  |  | **-10 to 10 sec** | [TBC] |  |  |  |
| ADS-requested steering demand | Mandatory |  |  | **-10 to 10 sec** | [TBC] |  |  |  |
| [ADS-requested/ **Vehicle-indicated** direction indicator demand] |  |  |  | **-10 to 10 sec** |  |  |  |  |
| ADS-requested/**Vehicle indicated** hazard warning signal |  |  |  | **-10 to 10 sec** |  |  |  |  |
| ADS-requested/**Vehicle indicated** exterior lighting |  |  |  | **-10 to 10 sec** |  |  |  |  |
| ADS-requested/**Vehicle indicated** audible warning signal |  |  |  | **-10 to 10 sec** |  |  |  |  |
| **~~Vehicle-indicated direction indicator status~~** |  |  |  | **-10 to 10 sec** |  |  |  |  |
| **~~Vehicle-indicated hazard warning signal status~~** |  |  |  | **-10 to 10 sec** |  |  |  |  |
| **~~Vehicle-indicated exterior lighting status~~** |  |  |  | **-10 to 10 sec** |  |  |  |  |
| **~~Vehicle-indicated audible warning system status~~** |  |  |  | **-10 to 10 sec** |  |  |  |  |
| Vehicle acceleration, longitudinal | Mandatory |  |  | ~~-[x] to 0 sec~~  **-10 to 10 sec** | [TBC] |  | ~~[Detected collision EDR trigger input]~~ |  |
| Vehicle acceleration, lateral | Mandatory |  |  | ~~-[x] to 0 sec~~  **-10 to 10 sec** | [TBC] |  | ~~[Detected collision EDR trigger input]~~ |  |
| Vehicle acceleration, vertical |  |  |  | **-10 to 10 sec** |  |  |  |  |
| [Yaw rate] | Mandatory |  |  | ~~-[x] to 0 sec~~  **-10 to 10 sec** | [TBC] |  | [Detected collision EDR trigger input] |  |
| ADS-determined vehicle speed | Mandatory |  |  | ~~-[x] to 0 sec~~  **-10 to 10 sec** | [TBC] |  | ~~[Detected collision EDR trigger input]~~ |  |
| Vehicle indicated gear position |  |  |  | **-10 to 10 sec** |  |  |  |  |

1. This definition is based on SAE J3016 and ISO/PAS 22736 (Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles). These standards define levels of driving automation based on the functionality of the driving automation system feature as determined by an allocation of roles in DDT and DDT fallback performance between that feature and the (human) user (if any). The term “Automated Driving System” is used specifically to describe a Level 3, 4, or 5 driving automation system. [↑](#footnote-ref-2)
2. **Readable means that the data is of numerical values and natural language which can be understood to represent a specific data point with a value associated with it (e.g. <<speed>>35<<speed/>>, not hexadecimal or binary).** [↑](#footnote-ref-3)
3. Contracting parties may further define technical specifications for data accessibility under national law. [↑](#footnote-ref-4)
4. **As designated in paragraph [4.2.3.1./6.2.3.1.] of this regulation** [↑](#footnote-ref-5)
5. Excluding any last stop trigger [↑](#footnote-ref-6)
6. [↑](#footnote-ref-7)
7. As specified by 6.3.1.22. in draft ADS Regulation. Example categories: 1. Lay-by/designated parking area, 2. Hard shoulder stop, 3. Soft shoulder stop, 4. Driveway entrance / side road, 5. In-lane stop, 6. Pavement, 7. Other classes yet to be defined (Source: BSI Flex 1888). A failure would be severe if it is one that prevents the ADS from performing the DDT in accordance with the provisions of 5.2 IWG ADS guidance document. [↑](#footnote-ref-8)
8. These items will be offered for future consideration based on technological advancements or conclusions reached by GRVA and its subsidiary bodies (including further discussion with the ADS IWG). [↑](#footnote-ref-9)
9. e.g. camera, radar, LiDAR, used by the ADS for decision making. This shall be documented in the information package provided to the Authorised Entity. This shall include a “Visual Representation“ submitted to the Authorised Entity at the time of providing the DSSAD Data, and shall comply with the requirements of 4.1 and 5.4. [↑](#footnote-ref-10)