



Summary Project Report

Regulatory preparation for ADS approval

Technical advice on DSSAD data
element specification for the
UN ADS Regulation

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May 2025



Department
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Preparing next-generation DSSAD for future automated vehicles

The UK Government is participating in a UN working group focused on defining the dataset requirements for automated vehicle safety performance monitoring and incident investigation, contributing to the development of the specification for the Data Storage System for Automated Driving (DSSAD).



Following UN Regulation No. 157 (ALKS) and UN Regulation No. 171 (DCAS), the forthcoming UN regulation on Automated Driving Systems (ADS) will set out requirements to govern the safety performance of vehicles equipped with ADS features.

This project supports the specification of a dataset that enables understanding of ADS safety performance. Such a dataset is essential for understanding whether there are potential safety concerns regarding the performance of the ADS. These data will also provide feedback to regulators to assess whether the safety claims of the vehicle and its authorised ADS features are valid, and whether the associated safety case procedures have been properly followed. Additionally, they will support continuous improvement of the approval and authorisation process.

How can DSSAD data support this?

- By capturing the timing of control transitions (e.g. from ADS to human driver), DSSAD helps determine operational responsibility at the time of an incident.
- By recording ADS-initiated procedures (e.g. fallback to Minimal Risk Condition), DSSAD allows assessment of whether the system followed the correct response protocols.
- By logging ADS-initiated lighting, signalling and braking, determine the interactions with other road users and response to developing road traffic situations

Together, this data enables reconstruction of the system behaviour before, during, and after a triggering event—contributing to safety performance monitoring.

The challenge:

Defining a dataset that enables understanding of safety-critical events including collisions, near misses and emergency manoeuvres

The Role of DSSAD

A key feature of vehicles equipped with Automated Driving Systems (ADS) is the Data Storage System for Automated Driving (DSSAD). This system functions similarly to an aircraft “black box” recorder, logging time-stamped data flags that provide critical information such as:

- Whether the vehicle was under the control of the ADS
- When an emergency manoeuvre was initiated and the ADS transitioned to a Minimal Risk Condition (MRC)
- Whether the ADS issued a takeover request to the user-in-charge, and what actions were taken to prevent takeover if assessed as unsafe
- Detection of a collision
- Detection of severe system failure (e.g. faults in the ADS, sensors, or vehicle systems)
- System-initiated fallback transitions or unexpected system hand-overs

In the event of an incident, these time-stamped data flags help reconstruct the sequence of actions taken by the ADS before, during, and after the triggering event (e.g. a collision or a system-initiated fallback).

For example, if the ADS was in control at the time of an incident, the DSSAD record can confirm this, establishing that the vehicle manufacturer—or in Great Britain, the Authorised Self-Driving Entity (ASDE)—would be legally liable, rather than the user-in-charge on-board.

When a triggering event occurs, the system also activates time-series data recording, which captures more detailed operational data. This supports the reconstruction of the incident by answering key questions such as “what happened?” and “how did the ADS respond?” It allows regulators to compare the actual system behaviour against the expected performance in the given situation.



Overall, DSSAD is not only a post-incident diagnostic tool, but also a critical enabler of transparent accountability, regulatory oversight, and public trust in the deployment of automated vehicles. It ensures that system behaviour can be reliably assessed and attributed, forming the foundation for continuous safety improvement in real-world operations.



Conventional EDR vs. DSSAD

Although conventional Event Data Recorders (EDRs) already exist in vehicles, they typically only record data when a crash is severe enough to deploy air bags. Less severe incidents – such as collisions with pedestrians or cyclists – may not trigger an EDR recording.

In contrast, DSSAD is designed to capture a broader range of events, including those involving vulnerable road users (VRUs) and system fallbacks, while also recording:

- The vehicle operator's status and control inputs
- Operational environment parameters
- System health and fault states

This enables DSSAD to provide a comprehensive dataset for assessing safety performance and incident causality, forming a key component of the overall safety assurance framework for ADS.

In line with emerging UN regulatory expectations, DSSAD implementations must also meet standards for:

- **Data retention:** ensuring relevant data is stored for a defined period
- **Accessibility:** allowing authorised parties to retrieve data in a secure and standardised format
- **Security and privacy:** preventing tampering and protecting personal or sensitive information



Approach to specifying DSSAD data elements

To support the development and implementation of UN regulations for specific automated driving functions—such as UN Regulation No. 157 on Automated Lane Keeping Systems (ALKS), UN Regulation No. 171 on Driver Control Assistance Systems (DCAS), and forthcoming regulations on Automated Driving Systems (ADS)—the scope of vehicle data recording has been expanded to include systems like the Data Storage System for Automated Driving (DSSAD).

A UN Informal Working Group on EDR/DSSAD has been convened under the Working Party on Automated/Autonomous and Connected Vehicles (GRVA) to develop requirements for DSSAD data elements in support of ADS safety performance monitoring.

TRL was commissioned by the UK Department for Transport (DfT) to provide technical support on the specification and justification of these DSSAD data elements. The outputs of this work were submitted as part of the UK's contribution to the Informal Working Group, to support the ongoing discussions on data requirements for DSSAD at the international level.

Why TRL

We have been involved in the development and testing of automated vehicles (AVs) for over 10 years. We have extensive knowledge of how AVs use LIDAR, radar, cameras and many other sensors to perceive the world around them, how the ADS combines this information to understand the driving environment and make decisions about how drive in that environment, and the data that the systems store. We also have decades of experience performing forensic collision investigations for research and legal claims.





TRL's Approach

1 We determined which data elements available in an automated vehicle might be useful for the purpose of the DSSAD.

This analysis framework also serves as a tool to assess whether the proposed data element list meets the core objectives of DSSAD:

- Provide sufficient evidence for determining system responsibility
- Understanding incident context
- Highlighting key safety performance issues.

2 We worked with our collision investigation specialist colleagues to prioritise which elements should be considered 'must haves' and which could be considered 'nice to haves'.

Scenario-based explanations and requirement justifications

To support understanding of the need for each priority data element, we developed worked examples of plausible incident scenarios. These illustrate how different aspects of the DSSAD specification are essential for reconstructing what occurred and determining the ADS's response in each case.

This approach provides the UN Informal Working Group with a more tangible, real-world context for why each data element is necessary, and how they can collectively be used for ADS safety performance monitoring, evaluation, and incident investigation.

3 We drafted a specification for each priority data element that balances the information needed for understanding an incident event with minimising data recording overhead for vehicle manufacturers.

4 We conducted a review of international standards and recommended design practices on data recording in automated vehicles, to confirm the availability of the priority data elements and the feasibility of the proposed recording specification.



5 We developed a framework for use of DSSAD time-series dataset to support evaluation of ADS safety performance. The framework outlines the type of information each data element category provides and illustrates how different categories interact to deliver a comprehensive understanding of system behaviour. It enables identification of potential inconsistencies between the ADS's intended behaviour, its actual execution, and the associated safety claims.

What lies ahead

The DSSAD data element specification developed during this project supports the UK Department for Transport's (DfT) contribution to the UN EDR/DSSAD Informal Working Group (IWG). The EDR/DSSAD IWG will submit its recommendations to the ADS IWG and the Working Party on Automated/Autonomous and Connected Vehicles (GRVA), informing future UN regulations on the data to be collected for understanding safety-critical incidents involving self-driving vehicles.

In a UK context, the specification also lays the groundwork for future incident investigation processes. As secondary legislation under the AV Act is finalised, Great Britain will introduce frameworks for automated vehicle type-approval and the authorisation of Authorised Self-Driving Entities (ASDEs), No-User-In-Charge Operators (NUICOs), and automated passenger services. Having a clear and tested specification for the data required in incident investigations will be essential in advance of deployment.

The DSSAD data element specification produced through this work contributes directly to the development of safety assurance mechanisms for Automated Driving Systems (ADS). By enabling consistent recording of operational context and system responses, the specification helps ensure that incident data can support effective regulatory oversight and post-event analysis. This will be critical for assessing whether systems meet the safety expectations set out in the AV Act 2024 and for enabling data-informed system improvements.

Through this work, the project has provided a concrete, standards-aligned basis for incident data collection that supports both UK regulatory readiness and international harmonisation efforts.





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