

FRAV Task: Response to the Request from EDR/DSSAD

Input for FRAV consideration towards responding to the EDR/DSSAD
request for FRAV views on data recording for ADS vehicles

FRAV Starting Points

1. **ADS should drive safely.** (Ensure safe behavior of the ADS as “the driver”)
2. **ADS should interact safely with the user.** (Ensure safe use of ADS and safe interactions with the user such as transfers of control, user override, etc.)
3. **ADS should manage safety-critical situations.** (Differentiate between normal driving and emergency situations to ensure safe responses to the latter)
4. **ADS should safely manage failure modes.** (Ensure safe responses to system malfunction, physical damage, etc.)
5. **ADS should maintain a safe operational state.** (Ensure safety throughout the useful life of the ADS, such as safety critical updates, response to obsolescence)

FRAV’s starting point indicate areas where data relevant to ADS performance and user interactions seem relevant to safety.

Basic principles/observations

- Data recording requirements should address the diversity of ADS applications.
 - FRAV's "high-level approach" aims to cover all ADS.
 - Requirements should allow for differences in configurations (e.g., ADS may have different degrees of user interactions, if any at all).
- Data recording should support analysis of in-use ADS performance.
 - VMAD has agreed on an "in-service monitoring/reporting pillar" involving data collection.
 - FRAV's safety requirements for ADS should support the VMAD objectives.
- Data recording should support crash event reconstruction and analysis.
 - EDR/DSSAD has agreed that EDR addresses crash event reconstruction and analysis.
 - VMAD's "in-service" pillar also refers to this aspect.

Two basic reasons for ADS data collection

- Accident (crash) analysis
 - Was the ADS driving safely at the time of the crash (correctly performing the DDT)?
 - Did the crash event involve a safety-critical situation (were other road users or elements factors in the crash)?
 - Was the ADS operating in a safe state (managing any failure modes, acceptable software version, etc.)?
- General (non-crash) ADS fleet performance (links to VMAD in-use performance)
 - Aggregated data to enable analysis (indications of inferior performance)
 - Identify possible areas for further research or investigation

Contexts for crash analysis and operational performance data collection differ.

Three levels of data

- Basic vehicle performance data (same data as collected by conventional vehicle EDR)
- ADS DDT performance data
 - Since ADS is driver, data on ADS OEDR and driving performance in crash event
 - General aggregated ADS DDT performance data (e.g., frequency of evasive maneuvers, MRC stops,...)
- User interactions where applicable to the ADS vehicle design
 - ADS-user interactions relevant to crash event
 - Aggregated user interactions data (e.g., frequency of user interventions, ADS requests/warnings to user, ...)

ADS have vehicle dynamics like all vehicles; however, ADS performance as the driver and ADS user interactions appear relevant.

Data Elements Matrix

Purpose of Data Collection	Applicability of Data	Data Set	General Description
Accident analysis/ reconstruction	All vehicles	A	Data on vehicle state/performance
	Conventional vehicles (no ADS)	B	Data on actuation of manual driver controls
	Vehicles equipped with an ADS	C1	ADS data on DDT performance
	Vehicles equipped with an ADS designed to interact with a user	C2	Data on user behavior/interactions with ADS
Evaluation of system operations/research/ assistance with accident analysis (L3-L5)	Vehicles equipped with an ADS	D1	Non-crash ADS operational performance data
	Vehicles equipped with an ADS designed to interact with a user	D2	Non-crash user interactions with ADS

Elements in the data sets are mutually exclusive (i.e., no duplication) and may be combined depending upon the vehicle configuration, for example:

- Conventional (manual only) vehicle → A + B
- ADS with human driver controls → A + B + C1 + C2 + D1 + D2
- Driverless passenger vehicle → A + C1 + C2 + D1 + D2
- Driverless commercial vehicle (no occupants) → A + C1 + D1

Open questions

- All vehicles presumably are equipped with EDR
 - Basic data set applicable to all vehicles
 - EDR focus on crash and crash-like events
 - Would ADS data relevant to crash and crash-like events be additional EDR data applicable to an ADS vehicle?
- If EDR is intended to address crash events, would DSSAD address operational performance?
 - Aggregated, anonymous data providing indicators of performance across ADS fleets?

Basic recommendations

- Differentiate data requirements (ref. data elements matrix)
 - Crash versus non-crash (operational) data
 - Event reconstruction versus in-service monitoring
 - ADS driving performance versus ADS interactions with users
 - Applicable across all ADS versus applicable to some ADS
- Define clear data sets based on applicability to ADS configurations
 - Under the NATM, FRAV and VMAD need to know which data requirements apply to which ADS vehicles
- Ensure alignment with the FRAV and VMAD work
 - Terminology, safety objectives, NATM methods and procedures, etc.
 - Prioritize data sets and specifications to facilitate alignment with safety requirements