Date

Event Data Recorder (EDR) Performance Elements Appropriate for Adoption in 1958 and 1998 Agreement Resolutions or Regulations

[Note: the performance elements contained in this working draft closely conform to those contained in the current version of FMVSS part 563

In addition, this document has been re-formatted to more closely conform to UNECE style – however, there are probably some "style/format" errors which will be caught and corrected before to is finalized]

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**Event Data Recorder (EDR) Performance Elements
Appropriate for Adoption in 1958 and 1998 Agreement
Resolutions or Regulations**

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0. Foreword

The performance elements contained in this document provide uniform specifications for vehicles equipped with Event Data Recorders (EDRs) concerning the minimum collection, storage, and retrievability of motor vehicle crash event data. It also contains specifications for vehicle manufacturers to make tools and/or methods commercially available so that crash investigators and researchers can retrieve data from EDRs.

The purpose of these performance elements is to ensure that EDRs record, in a readily usable manner, data valuable for effective crash investigations and for analysis of safety equipment performance (e.g., advanced restraint systems). These data will help provide a better understanding of the circumstances in which crashes and injuries occur and will facilitate the development of safer vehicle designs.

1. Scope

1.1.   These performance elements apply to all passenger cars and light duty vehicles (vehicle categories according to R.E.: M1, N1. [Should we use harmonized 58/98 agreement categories 1-1, and 2, with a gross vehicle mass (GVM) of 3,855 kilograms or less instead?]

> **Commented [JR1]:** EC: M1 N1 in first phase 2022 (new types) / 2024 (new vehicles), heavy vehicles of categories M2,M3,N2,N3 to follow in a second phase 2025 (new types) / 2028 (new vehicles).

This regulation shall not require additional systems or sensors to be fitted.
If the vehicle is equipped with the sensor or system, then it is mandatory to record the data element in at least the specified format.

Retro-fitted or aftermarket hardware are out of scope.

Vehicle Identification Number (VIN) and associated vehicle details are out of scope of this Regulation and shall be subject to regional and national law.

Location data is out of scope of this Regulation and shall be subject to regional and national law.

The Data Storage System for Automated Driving is defined in the Automated Lane Keeping System (ALKS) Regulation XXXX. A copy of the ~~data~~DSSAD (to the extent it falls in scope of this regulation) may be used to fulfill EDR data element, but the time interval shall be limited according to Table XXXX.

This regulation shall not govern the retrieval and use of EDR data.

[Remark: reflect in the scope
   -   that EDR regulation does not require systems to be fitted to a vehicle

> **Commented [AE2]:** EC: see above for text proposal

   -   define "mandatory if equipped"

> **Commented [AE3]:** EC: see additional text in definitions

   -   clarify that retro-fitted devices are not in the scope

> **Commented [AE4]:** EC: see above for text proposal

   -   clarify that any requirements on the VIN are excluded from this regulation (subject to national law)

> **Commented [AE5]:** EC: see above for text proposal

   -   US would like it to be clear that nothing in this regulation should require changes to existing architectures.]

2.   Definitions

For the purposes of these performance elements:

2.1   "ABS activity" means the anti-lock brake system (ABS) is actively controlling the vehicle's brakes.

\#   "Accelerator control (pedal) position (percent full)" means the driver-requested acceleration as measured by the throttle position sensor on the accelerator control compared to the fully-depressed position.

\#   "Authorised parties" are individuals, legal entities and authorities, which have been granted access rights, as defined in national or regional legislation, to access and receive data from the EDR.

[2.2   "Front air bag warning lamp status" means whether the warning lamp required by national air bag regulations (if any) is on or off.]

2.3   "Capture" means the process of buffering EDR data in a temporary, volatile storage medium where it is continuously updated at regular time intervals.

\#   "Data transmission" is the process of sending data over a communication medium directly from the vehicle to the independent backend.

2.4   "Delta-V, lateral" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the lateral axis, ~~starting from crash time zero and ending at 0.25 seconds, recorded every 0.01 seconds.~~

2.5   "Delta-V, longitudinal" means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the longitudinal axis, ~~starting from crash time zero and ending at 0.25 seconds, recorded every 0.01 seconds.~~

2.6   "Deployment time, frontal air bag" means (for both driver and front passenger) the elapsed time from crash time zero to the deployment command or for multi-staged air bag systems, the deployment command for the first stage.

2.7   "Disposal" means the deployment command of the second (or higher, if present) stage of a frontal air bag for the purpose of disposing the propellant from the air bag device.

2.8   "End of event time" means the moment at which the ~~cumulative delta V within a 20 ms time period becomes 0.8 km/h or less, or the moment at which the crash detection algorithm of the air bag control unit resets.~~event ends according to changes in delta-V or other signal changes as defined in section \# and depending on event type.

2.9   "Engine RPM" means :

(1)   For vehicles powered by internal combustion engines, the number of revolutions per minute of the main crankshaft of the vehicle's engine, and

(2)   For vehicles not entirely powered by internal combustion engines, the number of revolutions per minute of the motor

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Commented [JR6]: EC: Suggest the definitions could be thinned out. Only definitions given for those terms used in the body text. Any data element definitions could just be given in the table. All definitions need a refresh after work on the data elements table is complete, and after work on the body text is complete too.

Commented [AE7]: EC: ref the data elements table. We need to distinguish between the accelerator pedal demand by the driver, as different from the throttle.

Commented [AE8]: FSD 02-12:
The national legal regulations must be applied for the corresponding requirements and the scope of the respective access rights.

Commented [AE9]: FSD 02-12

Commented [AE10]: EC: Not needed in the definitions, because this can be defined in the data elements table.

Commented [AE11]: EC: Not needed in the definitions, because this can be defined in the data elements table.

Commented [AE12]: EC: moved event definitions to a new section to aid interpretation.

shaft at the point at which it enters the vehicle transmission gearbox.

(3)   [For vehicles not powered by internal combustion engines at all, the number of revolutions per minute of the output shaft of the device supplying motive power].

2.10   "Engine throttle, percent full" means the ~~driver requested acceleration as measured by the throttle position sensor on the accelerator control compared to the fully depressed position~~percentage ratio of the engine throttle opening.

2.11   "Event" means a crash or other physical occurrence that causes the trigger threshold to be met or exceeded~~[, or an air bag to be deployed, whichever occurs first.]~~, as defined in section X Note: this was removed from the "comparison chart" – Need to confirm if this is necessary?

2.12   "Event data recorder" (EDR) means a device or function in a vehicle that records the vehicle's dynamic, time-series data during the time period just prior to a ~~crash~~ event (e.g., vehicle speed vs. time) or during a crash event (e.g., delta-V vs. time), intended for retrieval ~~after the crash event~~. For the purposes of this definition, the event data do not include audio and video data. [should we delete "crash" throughout this EDR definition? It concerns an "event" here according to the definition of event above]

2.13   "Frontal air bag" means an inflatable restraint system that requires no action by vehicle occupants and is used to meet the applicable national frontal crash protection requirements.

\#   "Generic scan-tool" means a vehicle- and manufacturer-independent external test equipment used for standardised off-board communication with the vehicle.

2.14   "Ignition cycle, crash" means the number (count) of power cycles applied to the recording device at the time when the crash event occurred since the first use of the EDR.

2.15   "Ignition cycle download" means the number (count) of power cycles applied to the recording device at the time when the data was downloaded since the first use of the EDR.

\#   "Independent backend" is a backend server that is sovereign to the manufacturer, supplier, infrastructure operator, vehicle owner and prosecution authorities and is managed by an authority or organisation defined by national legislation. It stores and maintains the data elements transmitted by the EDR in accordance with national or regional legislation and makes the data available to authorised parties.

2.16   "Lateral acceleration" means the component of the vector acceleration of a point in the vehicle in the y-direction. The lateral acceleration is positive from left to right, from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.

Commented [JR13]: EC: ref the data elements table. We need to distinguish between the accelerator pedal demand by the driver, as different from the throttle.

Commented [JR14]: FSD 02-12: An event may also be the input of a signal that the driver generates to store EDR data manually on demand.

EC response to above: With a time interval of -5s this is unlikely to record useful data. if the recording interval is -30s to T0, then we agree. Manual recording would be open to abuse by the driver, or unintentional overwrite, so there should be some interlock that requires the manual record to only be allowed after a period of time, such as one hour.

Commented [AE15]: EC: more generic to not mention timeframe of retrieval, and this is under national law anyway.

Commented [AE16]: EC: agree

Commented [AE17]: FSD 02-12

Commented [AE18]: FSD 02-12

2.17	"Longitudinal acceleration" means the component of the vector acceleration of a point in the vehicle in the x-direction. The longitudinal acceleration is positive in the direction of forward vehicle travel.
2.##	"Mandatory, if equipped" means it is mandatory to record the data element if the vehicle is equipped with the relevant sensors or system. Data elements from optional fit systems are also mandatory to record if those systems have been selected by the driver.
2.18	"Maximum delta-V, lateral" means the maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the lateral axis, starting from crash time zero and ending at 0.3 seconds.
2.19	"Maximum delta-V, longitudinal" means the maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the longitudinal axis, starting from crash time zero and ending at 0.3 seconds.
2.20	"Maximum delta–V, resultant" means the time-correlated maximum value of the cumulative change in velocity, as recorded by the EDR or processed during data download, along the vector-added longitudinal and lateral axes.
2.21	"Multi-event crash" means the occurrence of 2 up to three events, the first and last of which begin not more than 5 seconds apart.
2.22	"Non-volatile memory" means the memory reserved for maintaining recorded EDR data in a semi-permanent fashion. Data recorded in non-volatile memory is retained after a loss of power and can be retrieved with EDR data extraction tools and methods.
2.23	"Normal acceleration" means the component of the vector acceleration of a point in the vehicle in the z-direction. The normal acceleration is positive in a downward direction and is zero when the accelerometer is at rest.
2.24	"Occupant position classification" means the classification indicating that the seating posture of a front outboard occupant (both driver and right front passenger) is determined as being out-of-position.
2.25	"Occupant size classification" means, for front passenger, the classification of an occupant as an adult and not a child, and for the driver, the classification of the driver as not being of small stature. [text is slightly different that Part 563 but tries to keep the meaning]
#	"Over the air (OTA) interface" means an interface that can establish a wireless connection with the independent backend and allow data transfer thereto wirelessly instead of using a cable or other local connection.
2.33	"Pedestrian Impact Event" is a physical occurrence that causes a Pedestrian Impact trigger threshold to be met or exceeded, or any deployable protection device to be deployed, whichever occurs first. For the purposes of recording event data, only one Pedestrian Impact Event can be in progress at any given time.
2.26	"Pretensioner" means a device that is activated by a vehicle's crash sensing system and removes slack from a vehicle safety belt system.
2.27	"Record" means the process of saving captured EDR data into a non-volatile device for subsequent retrieval.
#	"Recorded" means the data is recorded in non-volatile memory for the purpose of subsequent downloading.

Commented [AE19]: EC: Don't want to use the word purchased, because some systems might be freely available or at cost; we should not unintentionally restrict the scope.

Also don't want to include a reference to 'at time of new build' because it might be possible to add systems or increase funcationality [over the air] by a software update. The EDR should collect data for the latest version of the vehicle performance.

Commented [AE20]: EC: Not needed in the definitions, because this can be defined in the data elements table.

Commented [AE21]: EC: Not needed in the definitions, because this can be defined in the data elements table.

Commented [AE22]: China 02-20.
WP29-179-XXX (EDR-DSSAD) Comparison table V1

Commented [AE23]: FSD 02-12 suggested "generic scan tool via the electronic vehicle interface"

Commented [AE24]: FSD 02-12

Commented [AE25]: EC: FSD suggestion was to 'non-reversible', but we suggest that reversible pedestrian protection should be included. Examples seen in the market from Daimler of mechanical pop-up bonnet that can be reset by the driver.

Commented [AE26]: FSD 02-12

"Rollover Event" is a physical occurrence in which the occupant protection control algorithm initiates deployment of a rollover occupant protection system. For purposes of recording event data, only one Rollover Event can be in progress at a given time.

> **Commented [AE27]:** FSD 02-12

2.28 "Safety belt status" means the feedback from the safety system that is used to determine that an occupant's safety belt (for both driver and ~~right~~ front passenger) is fastened or unfastened.

2.29 "Seat track position switch, foremost, status" means the status of the switch that is installed to detect whether the seat is moved to a forward position.

Sensor for detecting crash-impulses against the vehicle" means a device which is mandatory for vehicles that are - due to mass-differences - not able to detect collisions with vulnerable road users automatically by changes in acceleration or delta-V.

> **Commented [AE28]:** FSD 02-12
> EC: not sure this is necessary because the scope here is M1N1.

2.30 "Service brake, on and off" means the status of the device that is installed in or connected to the brake pedal system to detect whether the pedal was pressed. The device can include the brake pedal switch or other driver-operated service brake control.

2.31 "Side air bag" means any inflatable occupant restraint device that is mounted to the seat or side structure of the vehicle interior, and that is designed to deploy ~~in a side impact crash~~ to help mitigate occupant injury and/or ejection.

> **Commented [AE29]:** Japan 02-15
> EC: agree

2.32 "Side curtain/tube air bag" means any inflatable occupant restraint device that is mounted to the side structure of the vehicle interior, and that is designed to deploy ~~in a side impact crash or rollover~~ and to help mitigate occupant injury and/or ejection.

> **Commented [AE30]:** Japan 02-15
> EC: agree

2.33 "Speed, vehicle indicated" means the vehicle speed indicated by a manufacturer-designated subsystem designed to indicate the vehicle's ground travel speed during vehicle operation.

2.34 "Stability control" means any device that complies with national, "Electronic stability control systems".

2.35 "Steering input" means the angular displacement of the steering wheel measured from the straight-ahead position (position corresponding to zero average steer angle of a pair of steered wheels).

2.36 "Suppression switch status" means the status of the switch indicating whether an air bag suppression system is on or off.

2.37 "Time from event 1 to ~~2~~n" means the elapsed time from time zero of the first event to time zero of the ~~second~~ nth event.

> **Commented [JR31]:** EC: to allow for up to 3 events, or greater in the future.

2.38 "Time, maximum delta–V, lateral" means the time from crash time zero to the point where the maximum value of the cumulative change in velocity is found, as recorded by the EDR, along the lateral axis.

2.39 "Time, maximum delta-V, longitudinal" means the time from crash time zero to the point where the maximum value of the cumulative change in velocity is found, as recorded by the EDR, along the longitudinal axis.

2.40 "Time, maximum delta–V, resultant" means the time from crash time zero to the point where the maximum delta–V resultant occurs, as recorded by the EDR or processed during data download.

2.41   "Time to deploy, pretensioner" means the elapsed time from crash time zero to the deployment command for the safety belt pretensioner (for both driver and ~~right~~ front passenger).

2.42   "Time to deploy, side air bag/curtain" means the elapsed time from crash time zero to the deployment command for a side air bag or a side curtain/tube air bag (for both driver and ~~right~~ front passenger). [should this be outboard front passenger?]

2.43   "Time to first stage" means the elapsed time between time zero and the time when the first stage of a frontal air bag is commanded to fire.

2.44   "Time to nth stage" means the elapsed time from crash time zero to the deployment command for the nth stage of a frontal air bag (for both driver and ~~right~~ front passenger).

2.45   "Time zero" means whichever of the following occurs first:

> (1)   For systems with "wake-up" air bag control systems, the time at which the occupant restraint control algorithm is activated; or
>
> (2)   For continuously running algorithms,
>
> > (i)   The first point in the interval where a longitudinal, cumulative delta-V of over 0.8 km/h is reached within a 20 ms time period; or
> >
> > (ii)   For vehicles that record "delta-V, lateral," the first point in the interval where a lateral, cumulative delta-V of over 0.8 km/h is reached within a 5 ms time period; or
>
> (3)   ~~Deployment of a non-reversable deployable restraint.~~ An air bag deployment. [non-reversable deleted according to earlier discussions in IWG. We may have to see how to include non-airbag deployable safety systems (e.g., pop up bonnets for pedestrian safety]

2.46   "Trigger threshold" means a change in vehicle velocity, or other signal input, as defined in section X. in the longitudinal direction, that equals or exceeds 8 km/h within a 150 ms interval. For vehicles that record "delta-V, lateral," trigger threshold means a change in vehicle velocity in either the longitudinal or lateral direction that equals or exceeds 8 km/h within a 150 ms interval or a change in longitudinal or lateral acceleration, which is able to determine an impact to the vehicle.,

2.47   "Vehicle roll angle" means the angle between the vehicle y-axis and the ground plane.

2.48   "Volatile memory" means the memory reserved for buffering of captured EDR data. The memory is not capable of retaining data in a semi-permanent fashion. Data captured in volatile memory is continuously overwritten and is not retained in the event of a power loss or retrievable with EDR data extraction tools.

2.49   "X-direction" means in the direction of the vehicle's X-axis, which is parallel to the vehicle's longitudinal centerline. The X-direction is positive in the direction of forward vehicle travel.

2.50   "Y-direction" means in the direction of the vehicle's Y-axis, which is perpendicular to its X-axis and in the same horizontal plane as that axis. The Y-direction is positive from left to right, from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.

Commented [JR32]: EC: suggest that this is better contained in a section of text alongside trigger definitions.

Commented [AE33]: FSD 02-12

Commented [AE34]: EC: suggest that most of this is better contained in a section of text for trigger definitions.
Could delete all this text highlighted by the comment as long as a generic definition of trigger threshold is given – see text inserted.

| 2.51 | "Z-direction" means in the direction of the vehicle's Z-axis, which is perpendicular to the X and Y-axes. The Z-direction is positive in a downward direction. |

Event definitions

| 3.1 | Events shall be defined as in SAE J1698-1 section 4. The events shall only be recorded for vehicles equipped with the relevant systems. |

The , with the following additions shall be required:.

3.1.1	A cyclist event shall be recorded if it meets the thresholds for a pedestrian impact event.
3.1.2	The beginning of a Pedestrian Impact Event (time zero) is defined by a reversible pedestrian protection system deployment. This may include a cyclist event if that causes a th
3.1.3	~~The beginning of an Event (time zero) is defined by an activation of an Autonomous Emergency Braking System.~~

3.   Performance Specifications

Performance specifications for vehicles equipped with an EDR include data elements, data format, data capture, and crash test performance and survivability.

| 3.1 | Data elements |

| 3.1.1 | Data elements ~~required~~ that are mandatory if equipped for all vehicles. Each vehicle equipped with an EDR shall record all of the data elements listed in Table 1, during the interval/time and at the same rate specified. |

Table   1.   [Content of this paragraph to be discussed in ~~Tokyo~~Washington]

Data elements ~~required~~ that are mandatory if equipped for all vehicles equipped with an EDR

Data element	Recording interval/time[1] (relative to time zero)	Data sample rate (samples per second)
Delta-V, longitudinal	0 to 250 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	100
Maximum delta-V, longitudinal	0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	N/A

Commented [AE35]: EC: New section created for event definitions, to bring each of the terms together to aid interpretation. This content for this section is currently well defined in SAE J1698-1 and matches the definitions from the first draft from OICA.

Commented [AE36]: FSD 02-12: An event may also be the input of a signal that the driver generates to store EDR data manually on demand.

EC response to the above: With a time interval of -5s this is unlikely to record useful data. if the recording interval is -30s to T0, then we agree. Manual recording would be open to abuse by the driver, or unintentional overwrite, so there should be some interlock that requires the manual record to only be allowed after a period of time, such as one hour.

Commented [AE37]: DE: desire to include all VRUs

Commented [AE38]: EC: some pop-up bonnets for pedestrian protection are reversible by the driver, and should not be excluded.

Commented [AE39]: EC: Should include an AEB activation as a trigger. This is required to understand pedestrian protection.

For EC, GSR has wording that limits to collision only, therefore AEB could not be used as a trigger. However this could be handled at national level with a statement in the data access and retrieval text that states 'AEB event triggered data shall not be retrieved from the EDR'.

Commented [AE40]: EC: Can we use an A4 or A3 landscape page to consolidate the tables 1-3 into one table only – as per the data elements table in excel that we've all been using?
EC: Comments as per the data elements table, so not recorded individually here. These tables must be updated to match the final version of the data elements table as agreed by the group.
EC: Recommend that the data elements table should be moved to an Annex, it is too long to sit in the body text of the regulation.

Commented [AE41]: EC: Suggest move to Annex. Suggest add columns for range, accuracy, and resolution.
EC: Comments as per the data elements table, so not recorded individually here. These tables must be updated to match the final version of the data elements table as agreed by the group.

Time, maximum delta-V	0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	N/A
Speed, vehicle indicated	-5.0 to 0 sec	2
Engine throttle, % full (or accelerator pedal, % full)	-5.0 to 0 sec	2
Service brake, on/off	-5.0 to 0 sec	2
Ignition cycle, crash	-1.0 sec	N/A
Ignition cycle, download	At time of download[3]	N/A
Safety belt status, driver	-1.0 sec	N/A
Frontal air bag warning lamp, on/off[2]	-1.0 sec	N/A
Frontal air bag deployment, time to deploy, in the case of a single stage air bag, or time to first stage deployment, in the case of a multi-stage air bag, driver.	Event	N/A
Frontal air bag deployment, time to deploy, in the case of a single stage air bag, or time to first stage deployment, in the case of a multi-stage air bag, right front passenger.	Event	N/A
Multi-event, number of event	Event	N/A
Time from event 1 to 2	As needed	N/A
Complete file recorded (yes, no)	Following other data	N/A

[1] Pre-crash data and crash data are asynchronous. The sample time accuracy requirement for pre-crash time is -0.1 to 1.0 sec (e.g., T = -1 would need to occur between -1.1 and 0 seconds.)

[2] The frontal air bag warning lamp is the readiness indicator specified in national air bag requirements, and may also illuminate to indicate a malfunction in another part of the deployable restraint system.

[3] The ignition cycle at the time of download is not required to be recorded at the time of the crash, but shall be reported during the download process.

3.1.2 Data elements required that are mandatory if equipped for vehicles under specified conditions. Each vehicle equipped with an EDR shall record each of the data elements listed in column 1 of Table 2 for which the vehicle meets the condition specified in column 2 of that table, during the interval/time and at the sample rate specified in that table.

Commented [AE42]: EC: Because the group agreed all elements are 'mandatory if equipped' so we can delete this column

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Table 2.

Data elements ~~required~~ that are mandatory if equipped for vehicles under specified minimum conditions

Data element name	Condition for requirement	Recording interval/time[1] (relative to time zero)	Data sample rate (per second)
Lateral acceleration	If recorded[2]	N/A	N/A
Longitudinal acceleration	If recorded	N/A	N/A
Normal acceleration	If recorded	N/A	N/A
Delta-V, lateral	If recorded	0–250 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	100
Maximum delta-V, lateral	If recorded	0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	N/A
Time maximum delta-V, lateral	If recorded	0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	N/A
Time for maximum delta-V, resultant.	If recorded	0–300 ms or 0 to End of Event Time plus 30 ms, whichever is shorter.	N/A
Engine rpm	If recorded	-5.0 to 0 sec	2
Vehicle roll angle	If recorded	-1.0 up to 5.0 sec[3]	10
ABS activity (engaged, non-engaged).	If recorded	-5.0 to 0 sec	2
Stability control (on, off, or engaged).	If recorded	-5.0 to 0 sec	2
Steering input	If recorded	-5.0 to 0 sec	2
Safety belt status, right front passenger (buckled, not buckled).	If recorded	-1.0 sec	N/A
Frontal air bag suppression switch status, right front passenger (on, off, or auto).	If recorded	-1.0 sec	N/A
Frontal air bag deployment, time to nth stage, driver[4].	If equipped with a driver's frontal air bag with a multi-stage inflator.	Event	N/A

Commented [AE43]: EC: All elements are mandatory if equipped, which means Table 2 should be deleted entirely.
EC: Comments as per the data elements table, so not recorded individually here. These tables must be updated to match the final version of the data elements table as agreed by the group.

Frontal air bag deployment, time to nth stage, ~~right~~ front passenger[4].	If equipped with a right front passenger's frontal air bag with a multi-stage inflator.	Event	N/A
Frontal air bag deployment, nth stage disposal, driver, Y/N (whether the nth stage deployment was for occupant restraint or propellant disposal purposes).	If recorded	Event	N/A
Frontal air bag deployment, nth stage disposal, ~~right~~ front passenger, Y/N (whether the nth stage deployment was for occupant restraint or propellant disposal purposes).	If recorded	Event	N/A
Side air bag deployment, time to deploy, driver.	If recorded	Event	N/A
Side air bag deployment, time to deploy, ~~right~~ front passenger.	If recorded	Event	N/A
Side curtain/tube air bag deployment, time to deploy, driver side.	If recorded	Event	N/A
Side curtain/tube air bag deployment, time to deploy, ~~right~~ side.	If recorded	Event	N/A
Pretensioner deployment, time to fire, driver.	If recorded	Event	N/A
Pretensioner deployment, time to fire, ~~right~~ front passenger.	If recorded	Event	N/A
Seat track position switch, foremost, status, driver.	If recorded	-1.0 sec	N/A
Seat track position switch, foremost, status, ~~right~~ front passenger.	If recorded	-1.0 sec	N/A
Occupant size classification, driver	If recorded	-1.0 sec	N/A
Occupant size classification,	If recorded	-1.0 sec	N/A

~~right~~ front passenger.			
Occupant position classification, driver.	If recorded	-1.0 sec	N/A
Occupant position classification, ~~right~~ front passenger.	If recorded	-1.0 sec	N/A

[1] Pre-crash data and crash data are asynchronous. The sample time accuracy requirement for pre-crash time is -0.1 to 1.0 sec (e.g. T = -1 would need to occur between -1.1 and 0 seconds.)

[2] ~~'If recorded'' means if the data is recorded in non-volatile memory for the purpose of subsequent downloading.~~

[3] 'vehicle roll angle'' may be recorded in any time duration; -1.0 sec to 5.0 sec is suggested.

[4] List this element n - 1 times, once for each stage of a multi-stage air bag system.

3.2   Data format [To be discussed in ~~Tokyo~~Washington DC]

3.2.1   The data elements listed in Tables 1 and 2, as applicable, shall be reported in accordance with the range, accuracy, and resolution specified in Table 3

> **Commented [AE44]:** EC: Table 3 can be combined with table 1 if the columns for range, accuracy, and resolution are added to Table 1. It will be a long table, but simpler to understand and we are already used to looking at this format.
> EC: Comments as per the data elements table, so not recorded individually here. These tables must be updated to match the final version of the data elements table as agreed by the group.

Table   3.

Reported data element format

Data element	Minimum range	Accuracy[1]	Resolution
Lateral acceleration	At option of manufacturer.	At option of manufacturer.	At option of manufacturer.
Longitudinal acceleration	At option of manufacturer.	At option of manufacturer.	At option of manufacturer.
Normal Acceleration	At option of manufacturer.	At option of manufacturer.	At option of manufacturer.
Longitudinal delta-V	-100 km/h to + 100 km/h.	±10%	1 km/h.
Lateral delta-V	-100 km/h to + 100 km/h.	±10%	1 km/h.
Maximum delta-V, longitudinal.	-100 km/h to + 100 km/h.	±10%	1 km/h.
Maximum delta-V, lateral	-100 km/h to + 100 km/h.	±10%	1 km/h.
Time, maximum delta-V, longitudinal.	0–300 ms, or 0-End of Event Time plus 30 ms, whichever is shorter.	±3 ms	2.5 ms.

Time, maximum delta-V, lateral.	0–300 ms, or 0-End of Event Time plus 30 ms, whichever is shorter.	±3 ms	2.5 ms.
Time, maximum delta-V, resultant.	0–300 ms, or 0-End of Event Time plus 30 ms, whichever is shorter.	±3 ms	2.5 ms.
Vehicle Roll Angle	-1080 deg to + 1080 deg.	±10%	10 deg.
Speed, vehicle indicated	0 km/h to 200 km/h	±1 km/h	1 km/h.
Engine throttle, percent full (accelerator pedal percent full).	0 to 100%	±5%	1%
Engine rpm	0 to 10,000 rpm	±100 rpm	100 rpm.
Service brake	On or Off	N/A	On or Off.
ABS activity	On or Off	N/A	On or Off.
Stability control	On, Off, or Engaged	N/A	On, Off, or Engaged.
Steering input	-250 deg CW to + 250 deg CCW.	±5%	±1%.
Ignition cycle, crash	0 to 60,000	±1 cycle	1 cycle.
Ignition cycle, download	0 to 60,000	±1 cycle	1 cycle.
Safety belt status, driver	On or Off	N/A	On or Off.
Safety belt status, right front passenger.	On or Off	N/A	On or Off.
Frontal air bag warning lamp.	On or Off	N/A	On or Off.
Frontal air bag suppression switch status, right front passenger.	On, Off, or Auto	N/A	On, Off, or Auto.
Frontal air bag deployment, time to deploy/first stage, driver.	0 to 250 ms	±2ms	1 ms.
Frontal air bag deployment, time to deploy/first stage, right front passenger.	0 to 250 ms	±2 ms	1 ms.
Frontal air bag deployment, time to nth stage, driver.	0 to 250 ms	±2 ms	1 ms.

Frontal air bag deployment, time to nth stage, right front passenger.	0 to 250 ms	±2 ms	1 ms.
Frontal air bag deployment, nth stage disposal, driver.	Yes or No	N/A	Yes or No.
Frontal air bag deployment, nth stage disposal, right front passenger.	Yes or No	N/A	Yes or No.
Side air bag deployment, time to deploy, driver.	0 to 250 ms	±2 ms	1 ms.
Side air bag deployment, time to deploy, right front passenger.	0 to 250 ms	±2 ms	1 ms.
Side curtain/tube air bag deployment, time to deploy, driver side.	0 to 250 ms	±2 ms	1 ms.
Side curtain/tube air bag deployment, time to deploy, right side.	0 to 250 ms	±2 ms	1 ms.
Pretensioner deployment, time to fire, driver.	0 to 250 ms	±2 ms	1 ms.
Pretensioner deployment, time to fire, right front passenger.	0 to 250 ms	±2 ms	1 ms.
Seat track position switch, foremost, status, driver.	Yes or No	N/A	Yes or No.
Seat track position switch, foremost, status, right front passenger.	Yes or No	N/A	Yes or No.
Occupant size classification, driver.	5th percentile female or larger.	N/A	Yes or No.
Occupant size classification, right front passenger.	Child	N/A	Yes or No.
Occupant position classification, driver.	Out of position	N/A	Yes or No.
Occupant position classification, right front passenger.	Out of position	N/A	Yes or No.
Multi-event, number of event.	1 or 2	N/A	1 or 2.

| Time from event 1 to 2 | 0 to 5.0 sec | 0.1 sec | 0.1 sec |
| Complete file recorded | Yes or No | N/A | Yes or No. |

[1] Accuracy requirement only applies within the range of the physical sensor. If measurements captured by a sensor exceed the design range of the sensor, the reported element shall indicate when the measurement first exceeded the design range of the sensor.

3.2.2   Acceleration Time-History data and format: the longitudinal, lateral, and normal acceleration time-history data, as applicable, shall be filtered either during the recording phase or during the data downloading phase to include:

3.2.2.1   The Time Step (TS) that is the inverse of the sampling frequency of the acceleration data and which has units of seconds;

3.2.2.2   The number of the first point (NFP), which is an integer that when multiplied by the TS equals the time relative to time zero of the first acceleration data point;

3.2.2.3   The number of the last point (NLP), which is an integer that when multiplied by the TS equals the time relative to time zero of the last acceleration data point; and

3.2.2.4   NLP—NFP + 1 acceleration values sequentially beginning with the acceleration at time NFP * TS and continue sampling the acceleration at TS increments in time until the time NLP * TS is reached.

3.3   Data capture

The EDR shall store the captured data in the vehicle.   **Commented [AE45]:** FSD 02-12

The EDR shall capture and record the data elements for events in accordance with the following conditions and circumstances:

3.3.1   In ~~a frontal air bag deployment crash~~an event, capture and record the current ~~deployment~~ data. ~~In a side or side curtain/tube air bag deployment crash, where lateral delta-V is recorded by the EDR, capture and record the current deployment data. The memory for the air bag deployment event shall be locked to prevent any future overwriting of the data.~~   **Commented [JR46]:** EC: Include all events, and give a priority.

3.3.2   In an event that does not meet the criteria in paragraph 3.3.1, capture and record the current event data, up to ~~two~~ three events, subject to the following conditions: [To be discussed in the group. I am not sure if this meets the expectations of covering also non-airbag deployment events.]   **Commented [JR47]:** EC: Change to three events

3.3.2.1   If an EDR non-volatile memory buffer void of previous-event data is available, the current event data is recorded in the buffer.

3.3.2.2   If an EDR non-volatile memory buffer void of previous-event data is not available, the manufacturer ~~may choose to either~~shall overwrite any previous event data ~~that does not deploy an air bag~~according to the priorities of 3.3.1 with the current event data with the oldest data being erased first~~., or to not record the current event data.~~   **Commented [JR48]:** EC: Most recent events should always be recorded.

3.3.2.3   EDR buffers containing previous frontal, side, or side curtain/tube air bag deployment-event data shall not be overwritten by the current event data.

3.3.2.4   Prioritisation (subject to requirements of national and regional law) of event data is:

a)   Airbag deployment

b)   Front, side, or rear impact event

c)   Pedestrian protection system deployment

d)   Rollover event

e)   Active safety system

f)   Vehicle stop event

#

3.4   ~~Crash t~~Test performance and survivability [Do we need a separate section for "test procedures"]

3.4.1   Occupant protection tests

3.4.1.1   Each vehicle subject to the requirements of national and regional frontal crash test regulations, shall conform with the specifications in paragraph 3.4.~~3~~4.

3.4.1.2   Each vehicle subject to the requirements of national and regional side impact crash test regulations, that meets a trigger threshold or has a frontal air bag deployment, shall conform with the specifications of paragraph 3.4.~~3~~4.

3.4.1.3   The data elements required by paragraph 3.1, except for the ''Engine throttle, percent full,'' ''engine RPM,'' and ''service brake, on/off,'' shall be recorded in the format specified by paragraph 3.2, and exist at the completion of the crash test~~, and~~.

3.4.2   Pedestrian protection tests

3.4.2.1   Each vehicle subject to the requirements of UNECE Regulation 127 or similar ~~N~~national or regional pedestrian protection test regulations, shall record the data elements required by paragraph X in the format specified by paragraph X and exist at the completion of the test. This only applies for vehicles fitted with an active pedestrian protection system that would deploy during the test,

3.4.2.2   If the vehicle is equipped with an active pedestrian protection system that will not be triggered during the UNECE Regulation 127 test, then these may be tested using a methodology agreed with the Technical Service, either:

a) by use of a simulated input of a trigger signal to the vehicle

b) by use of a simulated input of a trigger signal to the EDR on a test bench

c) testing evidence provided by the manufacturer

d) [testing according to Annex A].

3.4.2.3   If the vehicle is not equipped with an active pedestrian protection system then it shall be tested according to Annex A.

Commented [AE49]: FSD 02-12 suggested:
If no event described under 5.2.1. or 5.2.2 is recorded or buffered, it shall be possible to trigger the data capture manually.
EDR memory buffers containing previous deployment-event data, shall not be overwritten neither by the current manual triggering event data nor by a non-deployment event.
Notwithstanding paragraph 5.2.3, any stop of the vehicle shall trigger a storage of data elements identical to a non-deployment event.
These data elements shall be deleted automatically, if the vehicle was moved over a distance exceeding 300 meters and no manual storage according to paragraph 5.2.3 was triggered.

EC: response to the above is to require that the manual record can only occur after a period of one hour.

Commented [AE50]: EC: Hoping to avoid this by implementing tests already defined elsewhere.

Commented [AE51]: EC: added some sections to help organise the text

Commented [DH52]: EC: Does it matter that there are two? Ditto side impact
Do we need to specify the regs? Could argue that R12 (steering column) is frontal crash (it is for protection in a frontal crash); Ditto R129 for CRS… Where does the OEM or type approval authority draw the line?

Commented [AE53R52]: Agree, and suggest perhaps this list should be held at national/regional level to maintain.

Commented [AE54]: EC: purpose here is to check that the EDR triggers in a pedestrian impact. With a goal of not adding additional tests unless necessary, we may use the R127 tests and then verify a recording.

R127 states in Annex 3, 3.2: All devices designed to protect vulnerable road users when impacted by the vehicle shall be correctly activated before and/or be active during the relevant test. It shall be the responsibility of the manufacturer to show that any devices will act as intended in a pedestrian impact.

If the device is pre-deployed in the test, or the vehicle has no active system, then these tests will not provide a trigger for an EDR.

Commented [AE55]: EC: this may allow a pragmatic approach where the test house and manufacturer may liaise to select the most appropriate methodology, whilst still allowing some verification that the EDR is recording data in response to the pedestrian protection system.

Commented [AE56]: EC: Annex A is a placeholder for development of a suitable test if/when an appropriate test device and test can be defined. The goal would be to simulate the pedestrian impact with the vehicle in a way that would be representative enough to trigger the EDR.
However probably options a-c are sufficient here, and a new test might not be needed.

3.4.3   Active safety system tests

3.4.3.1   Each vehicle equipped with an active safety system that is defined in Regulation shall record the data elements required by paragraph X in the format specified by paragraph X and exist at the completion of the test.

3.4.3.2   The relevant regulation tests are:

- UNECE Regulation No. 140 Electronic Stability Control (ESC)

- UNECE Regulation No. 141 Tyre Pressure Monitoring Systems (TPMS)

- UNECE Regulation No. 144 Accident Emergency Call Systems (eCall)

- UNECE Regulation No. 152 Autonomous Emergency Braking System (AEBS)

- UNECE Regulation No. XXX Automated Lane Keeping Systems (ALKS)

> **Commented [AE57]:** EC: Once a new regulation comes in to force it should be added to the list in 3.4.3.2

3.4.3.3   The EDR data shall be verified after performing up to two of the regulatory tests as selected by the test authority.

> **Commented [AE58]:** EC: To put a limit on the number of tests and limit the burden for manufacturers.

3.4.3.4   If the vehicle is equipped with active safety systems that are not yet regulated at international or national level, then these may be tested using a methodology agreed with the Technical Service, either:

a) using a test manouevre designed to stimulate activation of the system

b) by use of a simulated input of a trigger signal to the vehicle

c) by use of a simulated input of a trigger signal to the EDR on a test bench.

> **Commented [AE59]:** EC: To maintain independence of testing and to make sure that the vehicle maintains performance across all test types even though there is a limit of two to be selected.

> **Commented [AE60]:** EC: this may allow a pragmatic approach where the test house and manufacturer may liaise to select the most appropriate methodology, whilst still allowing some verification that the EDR is recording data in response to the active safety system. Once a new regulation comes in to force it should be added to the list in 3.4.3.2

3.4.4   Data survivability

The data shall be retrievable by the methodology specified by the vehicle manufacturer under paragraph 3.5 for not less than 10 days after the test, and the complete data recorded element shall read ''yes'' after the test.

When a vehicle is equipped with an over the air (OTA) interface, the following shall apply as appropriate:

> **Commented [AE61]:** FSD 02-12

The EDR shall be fitted with an embedded hardware, allowing authentication on, and access to an over the air (OTA) interface.

> **Commented [AE62]:** FSD 02-12

The system must be able to recognize when a data transmission to the independent backend is successfully completed.

> **Commented [AE63]:** FSD 02-12

After the end of an event, described in paragraph X the EDR shall send dataset of the respective event to the independent server over an end-to-end protected wireless connection.

> **Commented [AE64]:** FSD 02-12

\#   If the sending of data failed or is not possible, then the EDR shall retry sending the data, if a secure and active wireless connection is available.

\#   Notwithstanding paragraph X stored data in the EDR shall be deleted after the EDR has registered a successful data transmission to the independent backend.

3.5   Data retrieval tools

Each manufacturer of a motor vehicle equipped with an EDR shall ensure by licensing agreement or other means that a tool(s) is commercially available that is capable of accessing and retrieving the data stored in the EDR that are required by this part. The tool(s) shall be commercially available not later than 90 days after the first sale of the motor vehicle for purposes other than resale.

Each manufacturer of a motor vehicle equipped with an EDR shall ensure, that the data stored in the EDR that are required are retrievable in line with the requirements of national or regional laws of the Parties, not later than 90 days after the first sale of the motor vehicle for purposes other than resale.

Each manufacturer shall also provide an information package to authorised parties that includes the information on how to grant access and retrive the data stored in the EDR.

[3.6   System deactivation]

It shall not be possible to deactivate the EDR.

[3.7   Malfunction]

\#   The vehicle shall be equipped with a tell-tale that provides a warning to the driver of the occurrence of any malfunction affecting the storage of data elements, the sensing of a trigger or the generation or transmission of control or response signals in the EDR.

\#   The EDR malfunction tell-tale shall be identified by the symbol shown for "EDR Malfunction Tell-tale" below or the text "EDR":

\#   It may be cancelled temporarily but shall be repeated whenever the ignition or the vehicle master control switch is activated (whichever is applicable).

Commented [AE65]: FSD 02-12

Commented [AE66]: FSD 02-12

Commented [AE67]: FSD 02-12 suggestion:
Authorized parties shall be able to retrieve stored data with a generic scan-tool via the electronic vehicle interface from the EDR or through an independent backend (if provided).
For the purpose of type approval, it shall be possible for Type Approval Authorities and Technical Services to access and read data via an electronic vehicle interface.
At roadworthiness testing, including the periodic technical inspection, it shall be possible for responsible authorities to access and read a manually triggered test data set via an electronic vehicle interface to test the storage functionality and plausibility of the data set.

EC: response to the above is that all of this should be defined by National law.

Commented [AE68]: FSD 02-12
EC: agree

Commented [AE69]: FSD 02-12
EC: agree

Commented [AE70]: FSD 02-12
EC: agree