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Event Data Recorder:

**Guidance on Heavy Duty Vehicles Event Data Recorder Performance
Elements Appropriate for Adoption in the 1958 and 1998 Agreements
Resolutions or Regulations**

Guidance on Heavy Duty Vehicles Event Data Recorder Performance Elements Appropriate for Adoption in 1958 and 1998 Agreements Resolutions or Regulations

**Submitted by the expert from the Informal Working Group on Event
Data Recorder / Data Storage System for Automated Driving ***

The text reproduced below was prepared by the experts from the Informal Working Group on Event Data Recorder / Data Storage System for Automated Driving (EDR/DSSAD IWG) to introduce a proposal of new Guidance on Heavy Duty Vehicles Event Data Recorder Performance Elements Appropriate for Adoption in the 1958 and 1998 Agreements Resolutions or Regulations.

* In accordance with the programme of work of the Inland Transport Committee for 2023 as outlined in proposed programme budget for 2023 (A/77/6 (Sect. 20), table 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

"Guidance on Heavy Duty Vehicles Event Data Recorder Performance Elements Appropriate for Adoption in 1958 and 1998 Agreement Resolutions or Regulations

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0. Foreword

- 0.1. The performance elements contained in this document provide guidance and/or specifications for vehicles fitted with Event Data Recorders (EDRs) specifically the minimum collection, storage, and crash survivability of the motor vehicle crash event data. These performance elements do not include specifications for data retrieval tools and methods which are subject to national or regional level requirements.
- 0.2. 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. 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. In this context, crashes should be understood as involving property damage and/or personal harm, including that of vulnerable road users involved.
- 0.3. Contracting parties may but are not required to make EDR requirements mandatory for M₂, M₃, N₂ and N₃ vehicles.

1. Scope

- 1.1. This guidance applies to all Heavy-Duty Vehicles (HDV)* (i.e., 1958 Agreement M₂, M₃, N₂ and N₃ vehicle categories and 1998 Agreement Category 1-2 vehicles and Category 2 vehicles).

[* For vehicles of categories M₂ and N₂, Contracting Parties that are signatories to both UN Regulation No. 160 and this (new EDR HDV) UN Regulation shall recognize approvals to either Regulation as equally valid.]

[* Requirements of this guidance are deemed to be met if the requirements of UN Regulation No. 160 are fulfilled.]

- 1.2. This guidance is without prejudice to the requirements of national or regional laws.
- 1.3. The following data elements are excluded from the scope: Vehicle Identification Number (VIN), associated vehicle details, location/positioning data, information on the driver, and date and time of an event.
- 1.4. If there is no system or sensor designed to provide the data element to be recorded and stored under section 3, in the format (range, resolution, and sample rate) indicated in Annex 1. "DATA ELEMENTS" or it is not operational at the time of recording, this document requires neither recording of such data nor fitting or making such systems or sensors operational. However, if the vehicle is fitted with an original equipment manufacturer sensor or system designed to provide the data element in the format specified in Annex 1. "DATA ELEMENTS", then it is mandatory to report the data element in the specified format when the sensor or system is operational. In the case the reason for not being operational at the time of recording is a failure of this system or sensor, this failure state shall be recorded by the EDR as defined in the data elements Annex 1. Data elements.

2. Definitions

For the purposes of this Regulation:

- [2.1. “*Accelerator pedal position*” means the ratio of the throttle pedal opening (driver’s operation) measured as a percentage.]
- [2.2. “*Accident emergency call status*” means the operating status of the emergency call system.]
- [2.3. “*Adaptive cruise control status*” means the control status of the adaptive cruise control system.]
- [2.4. “*Antilock braking system*” means (add definition)]
- [2.5. “*Antilock brake system status – tractor*” indicates the status of the antilock brake system on the vehicle/tractor.]
- [2.6. “*Antilock brake system status – trailer*” indicates the status of the antilock brake system on trailer(s).]
- [2.7. “*Automatic emergency braking system*” means (add definition).]
- [2.8. “*Automatic emergency braking system status*” means the system state of the automatic emergency braking system.]
- [2.9. “*Brake status parking*” indicates the status of the switch that is installed to detect whether or not the parking brake has been applied.]
- [2.10. “*Blind spot warning system status*” means the operating status of the blind spot warning system.]
- [2.11. “*Brake status service*” indicates the status of the switch that is installed in the brake system to detect whether the service brake has been applied.]
- [2.12. “*Crash [impact mitigation] system activation notification*” indicates the detection and type of crash by the installed crash mitigation system.]
- [2.13. “*Cruise control states*” means the control status of the adaptive cruise control system.]
- [2.14. “*Delta-V, longitudinal*” means the cumulative change in velocity, as recorded by the EDR of the vehicle, along the longitudinal axis.]
- [2.15. “*Distance to forward vehicle*” means the distance to the preceding vehicle situated within 250m in the same lane and moving in the same direction.]
- [2.16. “*Electronic Stability control*” means (add definition).]
- [2.17. “*Engine hours*” means the number of hours that the engine has been operating from the time of the first use of the control unit to the time of the event trigger.]
- [2.18. “*Engine load*” means the per cent of available engine torque being generated.]
- [2.19. “*Engine speed*” means the rotational speed of the engine output shaft.]
- 2.20. “*Event*” means a crash or other physical occurrence that causes the trigger threshold to be met or exceeded.
- 2.21. “*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 an event (e.g. vehicle speed versus time) or during a crash event (e.g. delta-V versus time), intended for retrieval after the crash event. For the purposes of this definition, the event data does not include audio and video data.
- [2.22. “*Event data recording complete*” indicates whether a complete set of data that the event data recording device is designed to capture was successfully recorded by and stored in the device.]
- [2.23. “*Event date*” means the date when the event occurred.]
- [2.24. “*Event time*” means the time when the event occurred.]

- [2.25. “HD EDR” means event data recorder for heavy duty vehicles.]
- [2.26. “*HD EDR unit hardware part number*” means the part number for the HD EDR unit.]
- [2.27. “*HD EDR unit software part number*” means the part number/version number for the HD EDR software.]
- [2.28. “*Ignition cycle, crash*” means the number (count) of power mode cycles at the time when the [crash or triggered] event occurs.]
- [2.29. “*Ignition cycle download*” means the number (count) of power mode cycles at the time when the data was downloaded since the first use of the EDR.]
- [2.30. “*Lane departure warning system state*” indicates the status of the lane departure warning system.]
- [2.31. “*Latitude*” means the vehicle position using GPS at the time of the event.]
- [2.32. “*Longitude*” means the vehicle position using GPS at the time of the event.]
- [2.33. “*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.]
- [2.34. “*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.]
- [2.35. “*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.]
- [2.36. “*Non-zero crash type*” means (add definition).]
- [2.37. “*Odometer*” means the total vehicle distance travelled at the time of the event trigger.]
- [2.38. “*Pre-crash acceleration, lateral*” means (add definition).]
- [2.39. “*Pre-crash acceleration, longitudinal*” means (add definition).]
- [2.40. “*Rear axle ratio*” is the ratio of the transmission output shaft speed to the tyre rotation rate.]
- [2.41. “*Retarder torque mode*” means the state signal which indicates which retarder torque mode is currently generating, limiting, or controlling the retarder torque.]
- [2.42. “*Roll angle*” means (add definition).]
- [2.43. “*Rollover protection engine control*” means the stability control of engine retarder for rollover protection.]
- [2.44. “*Roll rate*” means (add definition).]
- [2.45. “*Safety restraint system*” means (add definition).]
- [2.46. “*Safety restraint system status*” mean the operating status of the safety restraint system(s).]
- [2.47. “*Seat belt status (driver)*” indicates whether the driver’s seat belt is buckled.]
- [2.48. “*Seat belt status (passenger)*” indicates whether the passenger’s seat belt is buckled.]
- [2.49. “*Speed of forward vehicle*” means the velocity of the preceding vehicle situated within 250m in the same lane and moving in the same direction.]
- [2.50. “*Stability control braking*” means the stability control of wheel brakes for the rollover protection or the yaw control.]
- [2.51. “*Steering wheel angle*” means the angle of the steering shaft connected to the driver control.”]

- [2.52. “*Time to collision with relevant object*” means the duration after which the predicted travelling paths of the host vehicle and the relevant object lead to a distance of 0m between both.]
- [2.53. “*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.]
- [2.54. “*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.]
- [2.55. “*Time, maximum delta-V, resultant*” 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 and longitudinal axis.]
- 2.56. “*Time zero*” is the time reference for the EDR data timestamps of an event.
- [2.57. “*Tyre pressure monitoring system status*” means the operating status of the tyre pressure monitoring system.]
- [2.58. “*Tyre size*” is the tyre size in revolutions per km.]
- 2.59. “*Trigger threshold*” means the appropriate parameter has met the conditions for recording an EDR event.
- [2.60. “*Trigger threshold activated*” indicates which trigger threshold was activated to cause the recording of the event.]
- [2.61. “*Vehicle dynamic control system state*” means the operational state of the vehicle dynamic control state.]
- [2.62. “*Vehicle configuration*” means the Parameter Group Number (PGN) 65259 and PGN 65242 for available Electronic Control Unit (ECU) hardware and software part numbers.]
- [2.63. “*Vehicle make*” means the name of the vehicle manufacturer.]
- [2.64. “*Vehicle model*” means the vehicle’s model name/number.]
- [2.65. “*Vehicle safety system manifest*” is a manifest of the significant active safety systems fitted to the vehicle.]
- [2.66. “*Vehicle speed*” means the longitudinal speed of the vehicle that is calculated or estimated from the Vehicle Speed Sensor (VSS).]
- 2.67. “*VRU Proxi System*” means a set of sensors and/or logic which provides warning of vulnerable road users in close proximity. (e.g. UN Regulations Nos. 159 and 151)
- 2.68. “*Vulnerable road user secondary safety system*” means a deployable vehicle system outside the occupant compartment designed to mitigate the injury consequences to vulnerable road users during a collision.
- [2.69. “*Vulnerable road user secondary safety system status*” indicates the operating status of the vulnerable road user secondary safety system.]
- [2.70. “*Yaw control of engine retarder*” means the stability control of engine retarder for yaw control.]
- [2.71. “*Yaw control of wheel brakes*” means the stability control of wheel brakes for yaw control.]

[3. Specifications

Requirements for vehicles fitted with an EDR include data elements, data format and data capture.

- 3.1. Data elements

- 3.1.1. Each vehicle fitted with an EDR shall record the data elements specified as mandatory and those required under specified minimum conditions during the interval/time and at the sample rate specified in Annex 1.
- 3.2. Data format
 - 3.2.1. Each data element recorded shall be reported as specified in Annex 1, Table 1.
- 3.3. Data capture

The EDR shall capture data which shall be written to non-volatile memory when any of the triggers in paragraph 3.3.1. occur [~~with the exception of last stop which may have a delay~~].

The EDR non-volatile memory buffer shall accommodate the data related to at least five different events.

The data elements for every event shall be captured and recorded by the EDR, as specified in paragraph 5.1. in accordance with the following conditions and circumstances:

 - 3.3.1. Conditions for triggering recording of data

An event shall be recorded by the EDR if one of the following threshold values is met or exceeded. [Triggers that occur such that an overlap of data between events would result may be excluded.]

 - 3.3.1.1. Sudden Deceleration: Change in longitudinal vehicle velocity between 8.0 km/h/s and 22.5 km/h/s and persists beyond that threshold for at least 0.5 seconds.
 - 3.3.1.2. [Last Stop: The vehicle speed is reported as 0 [~~(which may wait for 15 seconds or less after)~~]. The last stop trigger cannot reoccur until the vehicle speed reaches a speed of 24.0 km/h (14.9 mph) or more for a minimum of 6 seconds. The act of turning the ignition off [or on] will not directly trigger a last stop event.]
 - 3.3.1.3. Activation of an active [or passive] safety system is showed in the table below:

<i>System</i>	<i>Trigger</i>
Safety Restraint System	Non-zero crash type
Antilock Braking System	Antilock Braking System active
Automatic Emergency Braking	Automatic Emergency Braking active
Electronic Stability Control	Yaw control or Roll Over (foundation) Brake control

- [3.3.2. Conditions for triggering locking of data

The EDR shall capture data which shall be written to non-volatile memory when any of the triggers in paragraph 3.3.1. occur.

Writing to non-volatile memory for the last stop trigger may be delayed by up to 15 seconds or as part of key-off shutdown process whichever comes first. The write of last stop shall not happen unless the vehicle speed reached a speed of 24.0 km/h (14.9 mph) or more for a minimum of 6 seconds since the last write. However, in case of Power or Communication failure (3.3.3), data recording is not needed.]
- 3.3.3. Conditions for establishment of time zero

Time Zero is established by the occurrence of any of the above triggers [~~whereby the last stop time zero shall be the time when speed is reported as 0~~]

[3.3.4. Overwriting]

3.3.5. Power and Communication failure

Data recorded in non-volatile memory is retained after loss of power. However, data need not be recorded when power or communication is lost to the device hosting the EDR or systems providing data.

[3.6. It shall not be possible to deactivate the Event Data Recorder].

Annex

Data Elements and Format¹

Header refers to items that should have a single value established at trigger or before the event. Data in pre-trigger shall be reported at least 2 values per second for at least 5 seconds before a trigger.

Table 1

List of Data Elements [Note - An Alternative Data Element Table Format Aligned with UN Regulation No. 160 is Under consideration.]

<i>Data Element</i>	<i>Description</i>
[Event Data Recording Complete]	[This data indicates whether a complete set of data that the event data recording device is designed to capture was successfully recorded by and stored in the device.]
Event Date [exclude from scope]	The date when the event occurred.
[Engine Hours]	The number of hours that the engine has been operating from the time of control unit first use to the time of the event trigger.
[Odometer]	Total vehicle distance at the time of the event trigger.
Latitude [exclude from scope]	Vehicle position per GNSS at the time of the event.
Longitude [exclude from scope]	Vehicle position per GNSS at the time of the event.
Event Time [exclude from scope]	The time when the event occurred.
HD EDR Unit Hardware Part #	The part number for the HD EDR unit.
HD EDR Unit Software Part #	The part number/software version number for the HD EDR software.
Vehicle Make	The name of the vehicle manufacturer.
Vehicle Model	The vehicle's model name/number.
Rear Axle Ratio [pending more info from SAE expert]	Ratio of transmission output shaft speed to tire rotation rate.
Tire Size [pending more info from SAE expert]	Tire size in revolutions per km.
Trigger Thresholds	Lists the currently configured trigger threshold(s).
Trigger Threshold Activated	Indicates which Trigger Threshold was activated to cause the recording the event.
Vehicle Configuration	

¹ Format requirements specified below are minimum requirements and manufacturers can exceed them.

<i>Data Element</i>	<i>Description</i>
[Vehicle Safety System Manifest]	Manifest of key vehicle safety systems fitted to the vehicle.
[Ignition cycle, crash]	The number (count) of power mode cycles at the time when the crash event occurred since the first use of the EDR.
[Ignition cycle, download]	The number (count) power mode cycles at the time when the data was downloaded since the first use of the EDR.
Vehicle Speed	The longitudinal speed of the vehicle that is calculated or estimated from the vehicle speed sensor (VSS).
Retarder Torque Mode	State signal which indicates which retarder torque mode is currently generating, limiting, or controlling retarder torque.
Brake Status – Parking	Indicates the status of the switch that is installed to detect whether or not the parking brake has been applied.
Brake Status – Service	Indicates the status of the switch that is installed in brake system to detect whether the service brake has been applied. This switch is usually used to turn on the brake lamps.
Engine Speed	Rotational speed of the engine output shaft.
Engine Load	Per cent of available engine torque being generated.
Accelerator Pedal Position	Ratio of the throttle pedal opening (driver's operation) in per cent.
Anti-lock Braking System (ABS) Brake Control Status – Tractor	Indicates the status of the ABS Brake control system on the vehicle/tractor, active or not active.
ABS Brake Control Status – Trailer	Indicates the status of the ABS Brake control system on Trailer(s), active or not active. Active if ABS Brake control is active for any trailer.
ACC Mode	Control status of Adaptive Cruise Control (ACC).
Cruise Control States	The current state, or mode, of operation by the cruise control device.
Automatic Emergency Braking	Forward Collision Advanced Emergency Braking System state.
Time to Collision with Relevant Object [not required]	The time to collision is the duration after which the predicted travelling paths of host vehicle and relevant object lead to a distance of 0m between both.
Speed of Forward Vehicle [not required]	Absolute velocity of the preceding vehicle situated within 250 m in the same lane and moving in the same direction.
Distance to Forward Vehicle [not required]	Distance to the preceding vehicle situated within 250 m in the same lane and moving in the same direction.
Lane Departure Warning System State	Indicates the status of Lane Departure Warning system.
Steering wheel angle	Angle of the steering shaft connected to driver control.

<i>Data Element</i>	<i>Description</i>
Rollover Protection Engine Control	Stability control of engine retarder for rollover protection.
Stability Control Braking [only on foundation brake application/control]	Stability control of wheel brakes for Roll Over Protection or Yaw Control.
Yaw Control of Engine Retarder	Stability control of engine retarder for yaw control.
Yaw Control of Wheel Brakes	Stability control of wheel brakes for yaw control.
Vehicle Dynamic Control (VDC) System State	VDC Operational State. (Can this be combined into a single signal with stability control above?)
Blind Spot Warning System Status	Operating status of the blind spot warning system.
Crash [Impact Mitigation] System Activation Notification	Indicates detection and type of crash by installed crash mitigation system.
Seat Belt Status (Driver)	Shows if buckled or not.
Seat Belt Status (Passenger)	Shows if buckled or not.
Safety Restraint System Status	Operating status of safety restraint system(s).
[Delta-V, longitudinal]	The cumulative change in velocity, as recorded by the EDR of the vehicle, along the longitudinal axis.
[Maximum delta-V, longitudinal]	The maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the longitudinal axis.
[Time, maximum delta-V, longitudinal]	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.
[Maximum delta-V, lateral]	The maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the lateral axis.
[Time, maximum delta-V, lateral]	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.
[Maximum delta-V, resultant]	The maximum value of the cumulative change in velocity, as recorded by the EDR, of the vehicle along the lateral and longitudinal axis.
[Time, maximum delta-V, resultant]	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 and longitudinal axis.
[Roll angle]	
[Roll rate]	

<i>Data Element</i>	<i>Description</i>
[Pre-crash acceleration, longitudinal]	10 Hz
[Pre-crash acceleration, lateral]	10 Hz
Accident Emergency Call System Status	Operating status of emergency call system.
VRU System Status	Operating status of the VRU system.
Tyre Pressure Monitoring System Status	Operating status of the tire Pressure Monitoring System,
