THE FUTURE OF TRANSPORT

Heavy Vehicle Event Data Recorder

Update to the UN SG on EDR for M2, M3, N2 and N3 category vehicles on behalf of the European Commission

22 March 2022

Heavy Vehicle EDR

Overview

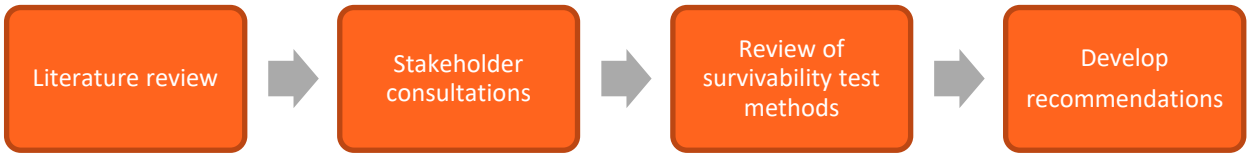
- Framework contract with European Commission - DG GROW
- Since 2014 involved in updating the General and Pedestrian Safety Regulations
- TRL's project phases:
  - GSR1 (2015): 50+ safety measures; indicative cost-benefit analyses and feasibility assessments; shortlist of candidate measures
  - GSR2 (2017): Evidence review and large-scale stakeholder consultation; suggested input values for cost-effectiveness analysis
  - GSR3/4 (2018): Cost-effectiveness analysis for Commission's impact assessment
  - GSR5 (2021): Support Commission in the development of secondary type approval legislation

Heavy Vehicle EDR

Overview

- Objectives
  - Understand status of heavy vehicle EDR (HV-EDR) development in EU and other regions
  - Recommend amendments to UN Reg No. 160 (light vehicle EDR)
    - Data elements for heavy vehicles
    - Triggering
    - Survivability
  - Highlight gaps in amended R.160 for further consideration by the SG
  - Recommendations on DSSAD for ALKS in heavy vehicles
    - Survivability

- Approach



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Findings – Literature review

- Introduction of stringent emission regulations has led to a progression to higher speed CAN-bus communication network
- Factory-equipped ECU, communications networks and sensors facilitate extensive data recording when triggered by a hard brake or other collision events
- Identified 3 types of heavy vehicle EDR triggering mechanisms (SAE J2728)
  - Safety system trigger
    - Originally airbag deployment
    - Latest SAE J2728 defines additional safety system triggers (ABS, ACC, AEB, ESC)
  - Hard braking trigger (vehicle deceleration)
  - Last stop trigger (recording triggered if the vehicle comes a stop for an extended period of time e.g. following an accident)
- Examination of 7 heavy vehicle EDR systems (North American market) concluded
  - Hard braking (deceleration) trigger was the most common
    - Thresholds ranged between 11.3 – 19.5 km/h per second
  - Less than half of the vehicles employed a last stop trigger
    - But becoming more common and more sophisticated

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Stakeholder Consultation – Method

- ‘Topic Guide’ sent to 27 stakeholders with request for interview
  - 8 stakeholders were interviewed over a 2-month period
  - 90 minutes scheduled for each interview
- Standard format to ensure consistency
  - Appendix A of report distributed recently

Category	A	B	C	D	E	F	G
N2					X		
N3		X			X	X	X
M2					X		
M3	Class 1		X	Class 1	X	X	
Independent	Independent expert on heavy vehicle EDR						

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Stakeholder Consultation – Market

- HV-EDR as a standalone device equivalent to light vehicle EDR is uncommon in the EU fleet
  - Market more developed in US
- Fitment of airbags tends to be uncommon across all categories and may be rarely fitted for some vehicle applications (except for M2/N2 vehicles based on N1 vehicle platforms)
  - Airbag control module, which provides the platform for light vehicle EDR, cannot be assumed to be present
- Advanced telematics systems are popular, facilitated by high-speed CAN bus network
  - Focused on fuel economy, driver hours and servicing
  - Much of this data is not relevant for EDR
  - Data typically sent via mobile telephone communication, and not always stored locally to the vehicle

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Stakeholder Consultation – Triggering

- Limited experience with triggering options for HV-EDR data capture
  - Due to lack of experience with HV-EDR generally
- The primary experience with this is from the US – SAE J2728 recommends multiple triggers
  - (Slide 4)
- Heavy vehicles in Europe often have active safety systems – could be used to trigger HV-EDR
  - May be particularly useful for triggering in collisions with vulnerable road users
  - Used in SAE J27828 – e.g. ABS, ACC, AEB or ESC may trigger HV-EDR
- Some stakeholders reported use of e.g. activation of AEBS or heavy braking to record some safety related data
  - However, the purpose of these systems is to avoid a collision and use of them as a trigger could lead to recording of non-collision events

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Stakeholder Consultation – Data elements

- Important to ensure data elements for HV-EDR are useful for collision investigation
  - Noting the differences in typical collision mechanics between heavy and light vehicle collisions
- Limited experience on data elements for HV-EDR in EU
- M3 stakeholders suggested (additional to typical light vehicle data elements)
  - Braking, steering, air pressure of the braking system, door status, ramp position, regenerative braking system, ISA status and GPS status
- N3 stakeholders suggested (additional to typical light vehicle data elements)
  - Angle of the turntable (towing) could be useful in jackknife type collisions, auxiliary braking systems, including handbrake, mass sensor for axles

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Stakeholder Consultation – Testing and survivability

- Regulatory crash tests – similar to those defined in UN Regulation 94, 95 and 137 for light vehicles – not defined for heavy vehicles
- Stakeholders did not support defining a crash test solely for the purpose of validating heavy vehicle EDR data recording
- Several alternatives were discussed by some stakeholders
  - ‘Bench tests’ using an artificial trigger signal and a sled test to assess the physical robustness of the EDR
    - Similar to Reg.144 Accident Emergency Call Systems / eCall tests
  - Ensuring that the EDR is mounted away from likely deformation zones
    - E.g. geometric criteria to minimise risk of direct damage to HV-EDR

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Recommendations – N3 vehicle configurations and triggering

- A wide variety of vehicle configurations exist, particularly for N3 collision mechanics may not be uniform across all types, such as:
  - 2, 3 & 4 axle rigid with maximum GVW 18 - 32 tonnes
  - 3, 4, 5 & 6 axle articulated with maximum GVW 26 - 44 tonnes
  - 4, 5 & 6 axles draw-bar trailer with maximum GVW 36 - 44 tonnes
- Separate triggering conditions could be necessary for each vehicle configuration
- Articulated vehicle is a tractor unit with a semi-trailer attached where part of the load is supported by the drawing unit
  - Development of a dynamic acceleration trigger threshold could be considered based on the load sensors of each axle
  - This may reduce the threshold when towing (laden) or reduce it when not towing (unladen)

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Recommendations – Approval M1 and N2 based on N1

- There are three main variants of M2 vehicle
  1. ‘Minibuses’ based on N1 category vehicles, produced and approved in a single stage by the OEM who builds the N1 platform
     - Some have similar occupant restraint systems, including airbag, as base N1
  2. Coach-built small ‘city-hopper’ and ‘transit’ buses based on N1 category vehicles, brought to market via multi-stage approval
     - Some have similar occupant restraint systems, including airbag, as base N1
  3. Small ‘city-hopper’ and ‘transfer’ buses based on a M2/M3 platform, which may therefore share structure and equipment with an M3 vehicle
- Similarly, some N2 based on N1 platform
- If base vehicle platform is an N1
  - May be more straightforward to offer manufacturer (single- or multi-stage) the option of complying with light vehicle EDR requirements for vehicles in the M2 and N2 categories

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Recommendations – Jerk-based trigger

- Jerk-based triggering has been proposed to identify and record collisions between a heavy vehicle and a car or vulnerable road user
  - Jerk is the rate of change of acceleration – may identify collisions with large mass ratios
  - None of the stakeholders had experience with using a jerk-based trigger
- Feasibility for HV-EDR unknown
  - Not demonstrated that jerk can detect collisions between vulnerable road users and heavier vehicles
  - Not demonstrated that jerk can reject non-collision events, such as pothole strikes
- Research efforts on jerk-based triggering for light and heavy vehicles could be combined
  - A two-phase approach to developing requirements was recommended (see report, Section 5)
    - Initial trials (CAE and physical tests) to evaluate collision detection
    - In-depth development to refine triggering, reject e.g. pot-hole strikes, demonstrate robustness

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Recommendations – Draft amendments to R.160 text

- Draft amendments to adapt Reg.160 to heavy vehicles (Appendix B)
  - Adapt to M2, M3, N2 and N3 category vehicles
  - Highlighting – no change / proposed amendment / remove text / further consideration by the SG
  - Scope, Definitions, Requirements
- Data elements (Appendix C1)
  - Additional data elements for heavy vehicles (Appendix C.2)
  - Based on stakeholder input, SAE J2728, regulated heavy vehicle safety systems, internal experts
- Survivability
  - Suggested via sled test in accordance with the test method for resistance to mechanical impact (Annex 9 of UN Regulation No. 144 – Accident Emergency Call Systems / eCall)
- Data capture, recording and formatting of the EDR data
  - Suggested via bench test such as the Appendix D of the Chinese Regulation on EDR

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Gaps / Considerations – Draft amendments to R.160 text

- Triggering
  - Effective/robust triggers capture (and then overwrite) mostly non-collision data
    - Is this acceptable?
  - Jerk-based triggering unproven
    - Needs considerable development effort
    - Development programme suggested
- Survivability
  - Geometric requirements for location of HV-EDR
  - AECS (R.144) sled test for robustness of HV-EDR to acceleration
    - Could use a more typical heavy vehicle crash pulse
- DSSAD Survivability
  - Same as HV-EDR

Thank you

David Hynd
Chief Scientist

dhynd@trl.co.uk
+44 1344 770 310
TRL | Crowthorne House | Nine Mile Ride | Wokingham
Berkshire | RG40 3GA | United Kingdom