

Proposal for EDR Performance Elements



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Overwriting

1. If an EDR non-volatile memory buffer void of previous-event data is not available, the previous event data that does not meet the trigger threshold of locking memory (GRSG-118-13 3.3.2) shall **be overwritten** by the current event data **chronologically**.

Justification:

- According to the view of judicial expertise institutions, usually in traffic accident analysis the more recent event data is, the more valuable it will be.

Remark: Recording the recent event data is better than it doesn't.

GRSG-118-13 3.3.4.1 Option #1 :If an EDR non-volatile memory buffer void of previous-event data is not available, the manufacturer **may choose to either** overwrite any previous event data that does not deploy an air bag with the current event data, or to **not record the current event data**.

- The previous event **could be reconstructed** by the subsequent events when multi-event occur in a short period.

2. If an EDR non-volatile memory buffer void of previous-event data is not available, as well as EDR has other triggering conditions except for 3.3.1, the manufacturers have the choice to overwrite any previous events according to the priority of the unlocked event.

Justification:

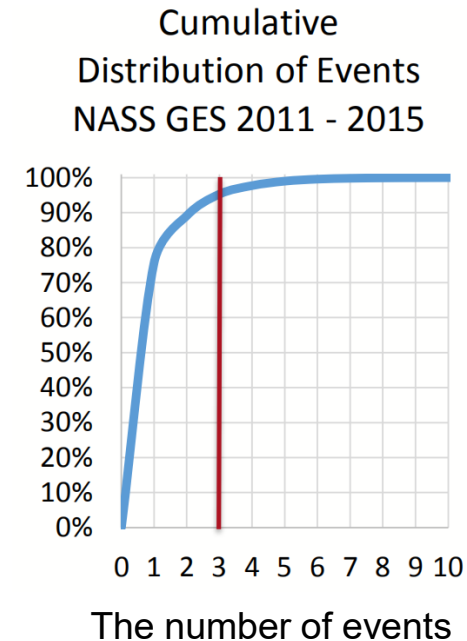
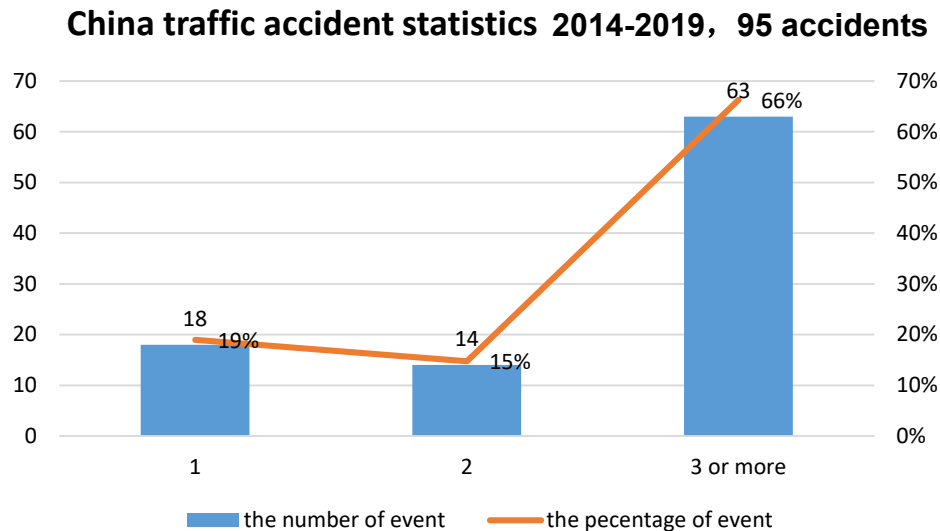
- The regulation shall allow OEM to set a special overwriting mechanism, e.g. overwriting priority between unlocked events and locked events, for those events which are more important than normal events and less important than non-reversible deployment events.

The number of events

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

Justification:

- Learning from relevant research, 94% of the accidents will be covered when EDR records 3 events, while about 88% when EDR records 2 events. (study based on NASS GES/CDS data, GIDAS study)



Due to the different situations of all the countries and regions, the specifications of the triggering condition and the locking condition related to VRU shall be discussed until the technologies are sufficiently developed.

Justification:

- The technologies of VRU protection system are under development. Different OEMs equip their products with very different VRU protection systems. The requirement of VRU protection systems are different.
- The VRU protection systems are not mandatory in some countries and regions.

The following data elements shall be deleted:

- **Multi-event, number of events** (1. It is unnecessary, and it can be identified by time from Event X to X-1. 2. It is very difficult to confirm the event interval.)
- **Normal acceleration**(It is very hard to reach consensus on the accuracy and necessity of this data element in the industry. For example the flexible structure, the complex components and so on may lead to inaccuracy of this data. It may not be suitable for the use in event reconstruction.)
- **Vehicle roll angle**(It is very hard to reach consensus on the accuracy and necessity of this data element in the industry.)
- **Frontal air bag deployment, nth stage disposal, driver, Y/N** (whether the nth stage deployment was for occupant restraint or propellant disposal purposes). **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). (It can be determined by the airbag deployment time.)

The following data elements shall be deleted:

- **Seat track position switch, foremost, status, driver. Seat track position switch, foremost, status, front passenger** (It's recording interval time is -1.0s to T_0 . At that moment, the accident has not happened yet. It doesn't mean much to the accident analysis. It is used for airbag control strategy.)
- **Occupant size classification, driver. Occupant size classification, front passenger** (It is easy to be obtained directly via site survey of accidents.)
- **Occupant position classification, driver. Occupant position classification, front passenger** (It's recording interval time is -1.0s to T_0 . At that moment, the accident has not happened yet. It doesn't mean much to the accident analysis. It is used for airbag control strategy.)

Test procedure

The EDR regulation shall provide some other test methods except for crash test.

Justification:

- The technical requirement shall be verified via test method. The driving operation data is used for investigation. Vehicle dynamic parameters acceleration and delta-V are important for accident reconstruction analysis, medical assistance, collision safety research, etc. which requires the accuracy of EDR data. (Sometimes EDR record was differ from reality. There are some reports about EDR's wrong record of the event data in some accidents.)

Case 1. Toyota's attorneys also noted that although both sides in the case agreed that one of the passengers in the vehicle **was belted** and the other **was not**, the data recorder said both seat belts were **unbuckled** at the time. "Everyone agrees that's wrong," the Toyota attorney said, according to a transcript **So clearly the veracity of the recorded data is questionable.**

The Present Limitations of Motor Vehicle Electronic Data Recording, Anderson, A.F., Kirk, B., Armstrong, K.: *The Present Limitations of Motor Vehicle Electronic Data Recording*, December 11, 2010. An Open Letter to the NAS team working on the project: Electronic Vehicle Controls and Unintended Acceleration (TRB-SASP-10-03)

<http://www.dbicorporation.com/anderson2.pdf>

Test procedure

Case 2. A new Toyota Tundra pickup struck an oak tree off a rural road in Washington state in 2007, killing the 29-year-old driver in what in many ways seemed like a common sort of tragedy. The data indicated that the truck had been going **177 mph** when it hit the tree, **much faster than what the pickup possibly could go**, safety experts said. Yet a separate reading from the recorder put the speed at **75 mph before impact**.

Crash data recorders in Toyota inquiry have history of problems. *Peter Whoriskey Sep 1, 2012 at 12:01 AM Sep 27, 2018 at 2:20 AM*

<https://www.statesman.com/article/20120901/NEWS/309003508>

Test procedure

Case 3. Actually, the driver safety belt was buckled, but the EDR record of safety belt status was SNA(Laboratory test, 2017.8).

Pre-Crash Data, 1 Sample (1st Prior Event, TRG 3)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	50
Safety Belt Status, Driver	SNA
Safety Belt Status, Front Passenger	SNA
Occupant Size Classification, Front Passenger	SNA
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA



Test procedure

The EDR regulation shall provide some other test methods except for crash test:

Justification:

- The crash test can not verify all the technical requirements of EDR.
- ① “Engine throttle, percent full”, “Accelerator pedal, percent full”, “ABS activity”, “Stability control”, “Steering input”, “Engine RPM”, “Service brake”, “Safety belt status”, etc. can’t be verified in the crash test set by UN Regulation No. 94, 95, 137.
- ② The EDR functional and performance requirements(eg. Overwriting mechanism, power failure record capability, data elements accuracy, etc.) can not be verified via crash test.

Bench test is important for verification of the EDR system's functional and performance requirement. Bench test is using a thruster to thrust the EDR controller with a controlled impact waveform. Bench test can conduct performance requirement test by using a controlled acceleration thrust and **can do functional requirement test** with much lower cost than impact test.

Thank you for your attention!