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Vehicle Event Data Recorders

Minimum set of user requirements

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 - Road Safety
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Vehicle Event Data Recorders

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Introduction

A vehicle Event Data Recorder or EDR is a device or function in a vehicle that records vehicle performance characteristics just prior to or during a crash. In the past tire skid marks were often used to reconstruct an accident. The mass introduction of devices like ABS on cars has made the analysis of road accidents more complicated and sometimes even impossible because tyre marks are no longer visible as physical evidence.

In the USA the NHTSA has promoted the installation of EDR's in cars for more than 10 years. In 2011 more than 85% of the cars sold in the US were already equipped with an EDR. Due to the high percentage of voluntary equipment, NHTSA has decided not to require the installation of an EDR, but if installed to require a minimum dataset of 15 elements and a specific format of the data. This requirement will be applicable to all passenger cars and vans sold after the 1st of September 2012. Next to the minimum data set, requirements are also given for an additional list of 30 elements if reported (more details in Annex 2)

In Europe the European Parliament has requested the European Commission to submit by the end of 2012 a proposal on EDR (more details in Annex 1).

In order to recommend the European Commission a specific European minimum dataset a questionnaire amongst TISPOL members has been organized for passenger cars and motorcycles. The questionnaire has been expanded to motorcycles in view of the proposed European requirement for the installation of ABS on motorcycles.

For the text of the questionnaires see Annex 3 and 4. An overview of the respondents is in Annex 5.

Results of the questionnaires

1. Passenger Cars

The questionnaire for passenger cars was circulated to 28 members. In total 22 members replied. From 19 members a completed form was received. Three members replied that due to legal or organizational reasons there is no experience with EDR's in their organization. The questionnaire that was circulated can be found in Annex 3. The respondents were asked to mark for each item if it essential, preferable or just nice to have. In the following tables for each item the scores are given and the highest score has been highlighted. For some items no answer was given, therefore the total number of replies is given as well. Respondents could give their own requirements. If that was the case, the answers are given after each table.

1.1. What kind of reading tool

<i>What kind of reading tool</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>One tool (not one brand) to image EDR data</i>	14	5	0	19
<i>Registration of the users</i>	10	6	3	19
<i>Central training of the users</i>	10	6	3	19
<i>Accredit certification numbers & names</i>	9	6	4	19
<i>Access by OBD/DLC</i>	11	7	0	18
<i>Access direct on ECU/module</i>	11	5	1	17
<i>Image / Extraction data forensic sealed</i>	14	5	0	19
<i>User friendly</i>	13	5	1	19
<i>European validation (NCAP)</i>	12	6	1	19

1.2. Value of triggering

<i>Value of triggering</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>Triggering by activating airbag (deployment)</i>	15	3	1	19
<i>Triggering by mayor activity (non deployment)</i>	15	1	3	19
<i>Triggering by broken electronic devices (lights etc.)</i>	13	3	3	19
<i>Triggering by censoring (pedestrians)</i>	14	2	3	19
<i>Triggering by button (driver, policemen first on scene)</i>	10	5	2	17

Comments: One respondent mentioned next to pedestrians, bicycles and skateboards are essential. For another respondent the last option (Triggering by button), was not clear. The capability to record multiple events (several collisions in accident) was also mentioned.

One respondent considered triggering due to longitudinal or transverse acceleration above a pre-set level as essential and added that it is essential that triggers caused by collisions are captured and retained in preference to triggers by broken electronic devices. If there were sufficient storage available, capturing triggers from broken electronic devices would be preferable, providing they do not overwrite collision data. It would be preferable if diagnostic trouble codes were recorded and retained.

1.3. Contents of the analysed data; display of

<i>Contents of the analysed data; display of</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to know</i>	<i>Replies</i>
<i>Name and certification number (accredited cert no:)</i>	14	4	1	19
<i>Investigation date</i>	17	1	1	19
<i>Accident date</i>	19	0	0	19
<i>Name of the software and version</i>	14	3	2	19
<i>Pre-crash data</i>	17	2	0	19
<i>Crash data</i>	16	0	0	16
<i>Complete HEX data dump for cross examination</i>	9	5	2	16

Comments received: “ The HEX data can be useful for checking the accuracy of the downloaded data”, and by another respondent: ” We need authorization by a certificate to take, read and use the data. Analysis can be done by an expert on accident investigation and reconstruction.”

1.4. Education and Certification

<i>Education and Certification</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>One accredited EU regulated education to read / analyse EDR</i>	9	10	0	19
<i>Different certification levels:</i>				
<i>1. To image the data</i>	12	5	1	18
<i>2. To image and operate on the vehicle networks and technology</i>	8	7	3	18
<i>3. To analyze the imaged data</i>	13	4	1	18

Comments: Especially 2 and 3 require thorough knowledge in vehicle engineering and accident reconstruction as background. If one accredited EU regulated education means one EU training standard, this would be preferable. For one respondent it is essential to have training for trainers who will then be able to deliver training and certification in their own countries.

1.5. Extra EDR function for Law Enforcement & Emergency Services

<i>Extra EDR function for Law Enforcement & Emergency Services</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to know</i>	<i>Replies</i>
<i>Optical signals</i>	10	7	2	19
<i>Acoustic signals</i>	6	10	3	19
<i>Using "stop" sign in front end/or back</i>	8	6	5	19

Comments: In Switzerland vehicles with blue lights / siren must carry data recording devices by law (UDS or RAG or similar devices)

1.6. Methods and systems

<i>Methods and systems</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>One protocol to readout EDR data within the EU.</i>				
<i>Extraction of EDR data by Police forces when vehicle is seized or is evidence in a criminal investigation</i>	13	6	0	19
<i>The public prosecutor or investigating judge decides if the data will be given to a public or private analysts</i>	10	8	1	19
<i>The owner of the car can decide if the data will be given to a public or private analysts (no criminal investigation)</i>	2	7	7	16

Comments: Next to the 16 answers to the last question, one respondent answered explicitly "NO". Another correspondent stated that the imaging of data must be treated similar to the collection of evidence whereas the analysis of data will require an order of a public prosecutor or court. For one respondent the last option is unclear. According to them "once the vehicle is equipped with EDR, no possibility for the vehicle owner to refuse to provide data". One respondent stated it is essential to be able to capture the data for police investigation purposes where appropriate.

1.7. Time of pre-crash data (now 5 seconds)

<i>Time of pre-crash data (now 5 seconds)</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>10 seconds of pre-crash data.</i>	8	4	0	12
<i>15 seconds of pre-crash data.</i>	5	6	0	11
<i>20 seconds of pre-crash data.</i>	2	3	6	11
<i>45 seconds of pre-crash data. (Veronica)</i>	4	4	8	16
<i>Seconds of pre-crash data; "number of seconds" that is applicable</i>				4

Comments: "When talking about accident investigation, 5 seconds is enough but if possible, it would be nice to get e.g. a failure list (cf. alarm information of the lane guard) of the behaviour from the past."

Data of additional movements up to 50 m were reported as nice to have by one respondent.

Another respondent stated "Pre-crash recording as long as possible; the longer the pre-crash recording time the more detailed the collision investigation can be."

The respondent from the UK stated: "An important consideration is the resolution of the data. I recommend that data should be collected for 20 seconds at 20hz, with 3 seconds either side of the trigger point being captured at 100hz. This is the resolution being used in the event data recorders being introduced into the Metropolitan Police as a replacement for our previous system."

Only a four respondents gave a clear figure for the number of seconds: One stated 15s as essential and 30s preferable, the other stated 60s as preferable, 20s as essential and 60s as essential

1.8. Future changes on request of

<i>Future changes on request of</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>OEM's, automotive industry</i>	5	8	0	13
<i>Users / Police</i>	9	5	0	14

Comments: some respondents reported difficulties understanding this question.

1.9. Validation (for using data in court)

<i>Validation (for using data in court)</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to have</i>	<i>Replies</i>
<i>European validation (NCAP) and registration</i>	12	4	1	17
<i>National validation (crash tests, SAE papers)</i>	8	4	3	15
<i>European case validation with European registration</i>	9	4	4	17

Comment: The best would be a worldwide validation (European, American and Asian similar to the overall vehicle licensing/registration)

1.10. Additional items

One respondent asked for the following additional items:

- A minimum time period for the storage of data; preferably as long as possible (important for the investigation of hit-and-run accidents);
- History of data extraction and (illegal) manipulation with EDR and its software;
- Regular verification of the functioning of the EDR (e.g. during periodical inspection of the car).

2. Motorcycles

The questionnaire for motorcycles was circulated to 28 members. In total 23 members replied. From 20 members a completed form was received. Three members replied that due to legal or organizational reasons there is no experience with EDR's in their organization. The questionnaire that was circulated can be found in the Annex 4. The respondents were asked to mark for each item if it essential, preferable or just nice to have. A number of respondents considered every item as essential, others were more selective.

2.1. Results of the motorcycle questionnaire

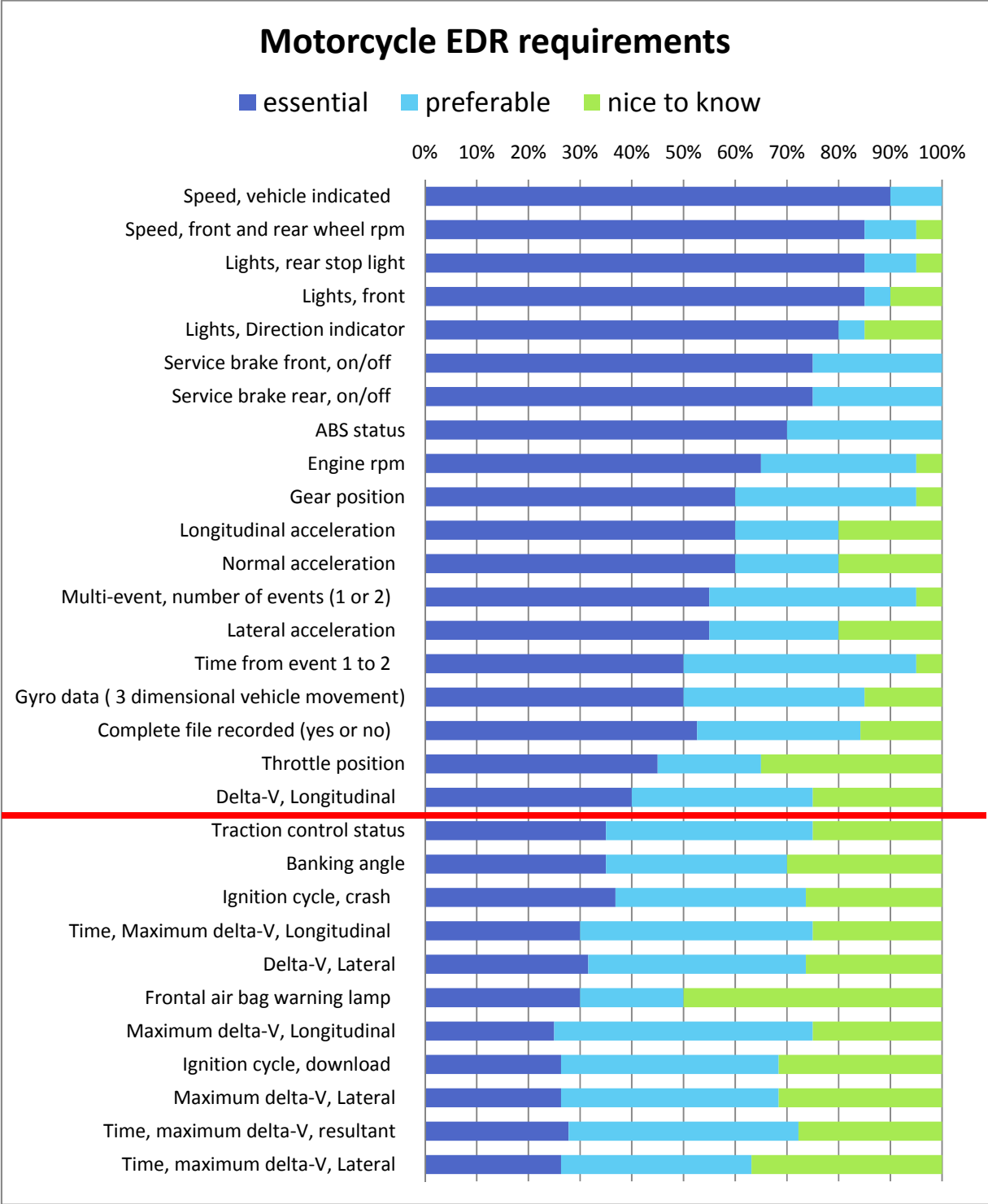
In the following table the scores are given for each item and the highest score has been highlighted. The items have been sorted to their score: the item with the highest score for essential on top. For some items no answer was given by some respondents, therefore the total number of replies is given as well.

A red line has been drawn to distinct the items considered essential from the others.

<i>Motorcycle EDR item</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to know</i>	<i>Replies</i>
Speed, vehicle indicated	18	2	0	20
Speed, front and rear wheel rpm	17	2	1	20
Lights, rear stop light	17	2	1	20
Lights, front	17	1	2	20
Lights, Direction indicator	16	1	3	20
Service brake front, on/off	15	5	0	20
Service brake rear, on/off	15	5	0	20
ABS status	14	6	0	20

<i>Motorcycle EDR item</i>	<i>Essential</i>	<i>Preferable</i>	<i>Nice to know</i>	<i>Replies</i>
Engine rpm	13	6	1	20
Gear position	12	7	1	20
Longitudinal acceleration	12	4	4	20
Normal acceleration	12	4	4	20
Multi-event, number of events (1 or 2)	11	8	1	20
Lateral acceleration	11	5	4	20
Time from event 1 to 2	10	9	1	20
Gyro data (3 dimensional vehicle movement)	10	7	3	20
Complete file recorded (yes or no)	10	6	3	19
Throttle position	9	4	7	20
Delta-V, Longitudinal	8	7	5	20
Traction control status	7	8	5	20
Banking angle	7	7	6	20
Ignition cycle, crash	7	7	5	19
Time, Maximum delta-V, Longitudinal	6	9	5	20
Delta-V, Lateral	6	8	5	19
Frontal air bag warning lamp	6	4	10	20
Maximum delta-V, Longitudinal	5	10	5	20
Ignition cycle, download	5	8	6	19
Maximum delta-V, Lateral	5	8	6	19
Time, maximum delta-V, resultant	5	8	5	18
Time, maximum delta-V, Lateral	5	7	7	19

The next figure shows the results in a graphical format:



2.2. Comparison with US legislation

The result of the motorcycle questionnaire has been compared with US regulation for cars. Two important remarks have to be made first: The US regulation has been written for cars, not for motorcycles and is intended for the US. Items like gear position are therefore missing because almost all US cars are equipped with an automatic gearbox. In the table below the results of the motorcycle EDR questionnaire is listed in the same order as under par 2.1 and behind each line is written if that item belongs to the required minimum set (see table 1 in the Annex) or to the additional items (see table 2 in the Annex)

<i>Result motorcycle EDR questionnaire</i>	<i>US Car regulation</i>
Speed, vehicle indicated	Required
Speed, front and rear wheel rpm	
Lights, rear stop light	
Lights, front	
Lights, Direction indicator	
Service brake front, on/off	Required
Service brake rear, on/off	Required
ABS status	Additional
Engine rpm	Additional
Gear position	
Longitudinal acceleration	Additional
Normal acceleration	Additional
Multi-event, number of events (1 or 2)	Required
Lateral acceleration	Additional
Time from event 1 to 2	Required
Gyro data (3 dimensional vehicle movement)	
Complete file recorded (yes or no)	Required
Throttle position	Required
Delta-V, Longitudinal	Required
Traction control status	
Banking angle	Additional
Ignition cycle, crash	Required
Time, Maximum delta-V, Longitudinal	Required
Delta-V, Lateral	Additional
Frontal air bag warning lamp	Required
Maximum delta-V, Longitudinal	Required
Ignition cycle, download	Required
Maximum delta-V, Lateral	Required
Time, maximum delta-V, resultant	Additional
Time, maximum delta-V, Lateral	Additional

Summary and Conclusion

The result of the questionnaire for **passenger cars** shows that all suggested items are considered as essential, with the following notes:

- Triggering of additional items are suggested like the detection of bicycles or the use of a pre-set acceleration level.
- One accredited EU regulated education is seen as preferable, not essential. One respondent suggested limiting the EU accreditation to the training of the trainers.
- An extra EDR function for law enforcement and emergency vehicles is considered as essential for the optical signals and preferable for the acoustic signal. The difference between the two signals might be caused by the differences in legal status of the acoustical signal in the different countries.
- The possibility that the car owner can decide to hand over the data or not is considered as not-essential by the majority. Several respondents are even opposed to the possibility that the car owner can decide to hand over the data or not.
- The desired time of Pre-Crash data showed some divergence in opinion, the majority sees a minimum of 10s as essential and anything more is preferable. For some 5 seconds is enough. One respondent added that next to the pre-crash time, a requirement to the resolution of the data should be given as well.
- One respondent asked for the following additional items: a minimum time period for the storage of the data, the history of data extraction and suggested verification of the functioning of the EDR during the periodical inspection.

For **motorcycles** 19 of the 30 suggested items are considered as essential to be included in a motorcycle EDR. The remaining 21 items are considered as nice to preferable.

Next steps

The following steps are suggested:

- The drafting of a set of requirements for passenger car and motorcycle EDR in the format of an EU regulation.
- Discussion of the draft set of requirements with invited outside parties e.g. industry.
- Discussion of the draft set of requirements with the European Commission.

ANNEX 1

The European Parliament has adopted the Koch report on Road Safety (A7-0264/2011) on September 27 2011. In this report the Commission is called upon to submit by the end 2012 a proposal on Event Data Recorders for Cars:

87. Calls on the Commission to submit a legislative proposal, including a timetable and a detailed approval procedure, by the end of 2012 providing for the phased introduction, initially in rented vehicles and subsequently also in commercial and private vehicles, of an integrated accident recorder system with a standardised readout which records relevant data before, during and after accidents ('Event Data Recording'); stresses, in that connection, the need to protect individuals' personal data and to use the data recorded exclusively for accident research;

The following text was prepared prior to the debate in Parliament.

To MEP Dr Koch

Recitals

Whereas on one side vulnerable road users still represent an unbearable high share of the accident victims,

whereas on the other side accident and prevention research sees itself confronted with insurmountable barriers because vehicle electronics do not leave brake marks on the road and the control devices in commercial vehicles do not allow retrieval of satisfying accident data,

whereas accident causation contribution by vehicle electronics (e.g. driver assistance systems) cannot be excluded because they are not accessible for accident analysts,

whereas there are neither technical nor legal nor economical obstacles for the mandatory implementation of standardized, accident related Event Data Recording functionalities

Amendment

the Parliament requests the Commission to pave the way for major enhancements in accident causation research by obliging the industry to implement standardized EDR functionalities in all new motor vehicles beginning with model year 2015.

Supplementary remarks for the deputies

1. Road transport is the only transport mode in Europe that does not have EDR. In air, rail and maritime transport it is mandatory since long.
2. The focus is on accidents with vulnerable road users involved and on the necessity to examine the impacts of electronic systems (e.g. driver assistance systems) on the causation of accidents.
3. The rapidly progressing use of electronic control and monitoring modules explains why we hardly find accident relevant accident marks (e.g. brake marks) any more on the road resulting in accident reconstructionists being confronted with remarkably worse conditions than in former times. They are faced with enormous problems to access the proprietary storage modules which are today very broadly in place in the vehicles. Traffic judges are heard with the same complaints.
4. In the field of commercial vehicles we see also an impairment because of the introduction of the digital tachograph in 2006. The reason for that is that in contrast to the former diagram sheet data are quickly

overwritten after an accident through vehicle movements and that accident reconstructionists do not get chip cards for downloading the data. Accident analyses by means of diagram sheets were wide-spread and state of the art. A public consultation conducted by the Commission in 2010 revealed that almost no one opted against but several of the consulted institutions (associations, ministries, trade-unions) in favor of supplementary EDR functions.¹ The manufacturers of the EU control devices (tachographs) also support the integration of EDR functions into the next generation of recording equipment. The European Road Victims Federation FEVR proclaimed its support for EDR in all vehicles already in 1997.

5. Because it gets more and more difficult to clear up accidents, prevention research and road safety policy get less and less impulses. As a red thread the request for real-life and in-depth data to be used for prevention research in automotive technology, infrastructure and driver training was spun through the ERSO conference in Rome in 2008.
6. With a mandatory EDR implementation the Commission would consequently continue on a way pursued since long. In 2004 the Commission came out with a call for proposals for a feasibility study expressively aiming at legislative actions for the introduction of accident event recording. The results were published in the final reports of the two VERONICA projects (2006 and 2009), co-financed by the Commission.
7. Neither technical nor legal problems were discovered as long as the legislator limited itself on the stipulation of functional and quality requirements and on the recording of short accident moments. This is indeed possible as the parallel EDR development in the USA shows with the European legislator only to commit itself to complete the requirements as far as possible also for the recording of collisions with vulnerable road users involved.
8. Data use for causation investigation and research is governed by national law which usually requires a court warrant. To this regard the situation is not different from traditional accident information, in particular as EDR data are of no value for others, need specific engineering know-how for interpretation and form only one part of an expert accident analysis.
9. American EDR requirements link the triggering of a recording to the airbag deployment which excludes the majority of accidents with vulnerable road users involved. The vehicle industry however already offers two-stage airbag modules which also record "soft" collisions without a prior airbag deployment.
10. In Germany the Traffic Court Conferences demand since long the implementation of EDR functions, the most recent conferences were those in 2003, 2004, 2007 and 2011.
11. With regard to the fact that most modern vehicles are already equipped with electronic storage modules, which are however not standardized in terms of quality and access, it will not be hard for industry to comply with implementation requirements without large extra costs.

Text jointly drafted by:

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¹ http://ec.europa.eu/transport/road/consultations/2010_03_01_tachographs_en.htm - see answers to question No. 2

ANNEX 2

In the US the EDR requirements are listed in the Code of Federal Regulations Title 49 Transportation Part 563: Event data recorders. Each vehicle equipped with an EDR must record all of the data elements listed in Table 1, during the interval/time and at the sample rate specified in that table. Data elements required for vehicles “if recorded” (the data is recorded in non-volatile memory for the purpose of subsequent downloading) are listed in Table 2.

Table I US Required Essential Data Elements and Formats

Item #	Data Elements	Recording Time*	Sampling Rate	Range	Accuracy	Resolution	Filter
1	Delta-V, Longitudinal	0 – 250 ms	100/s	-100 to 100 km/h	± 5%	1 km/h	N.A.
2	Maximum delta-V, Longitudinal	0 – 300 ms	N.A.	-100 to 100 km/h	± 5%	1 km/h	N.A.
3	Time, Maximum delta-V, Longitudinal	0 – 300 ms	N.A.	0 – 300 ms	± 3 ms	2.5 ms	N.A.
4	Speed, vehicle indicated	-5.0 to 0 s	2/s	-200 to 200 km/h	± 1 km/h	1 km/h	N.A.
5	Engine throttle, % full (accelerator pedal % full)	-5.0 to 0 s	2/s	0 – 100%	± 5%	1%	N.A.
6	Service brake, on/off	-5.0 to 0 s	2/s	On/off	N.A.	N.A.	N.A.
7	Ignition cycle, crash	-1.0 s	N.A.	0 – 60,000	± 1 cycle	1 cycle	N.A.
8	Ignition cycle, download	At time of download	N.A.	0 – 60,000	± 1 cycle	1 cycle	N.A.
9	Safety belt status, driver	-1.0 s	N.A.	On/off	N.A.	On/off	N.A.
10	Frontal air bag warning lamp	-1.0 s	N.A.	On/off	N.A.	On/off	N.A.
11	Frontal air bag deployment time, Driver (time to n th stage,) mandatory in case multi-stage air bags are equipped	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
12	Frontal air bag deployment time, RFP (time to n th stage,) mandatory in case multi-stage air bags are equipped	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
13	Multi-event, number of events (1 or 2)	Event	N.A.	1, 2	N.A.	1, 2	N.A.
14	Time from event 1 to 2	As needed	N.A.	0 - 5.0 s	0.1 s	0.1 s	N.A.
15	Complete file recorded (yes or no)	After Other Data	N.A.	Yes/no	N.A.	Yes/no	.A.

Table 2 US Required Additional Data Elements and Formats Under Specified Conditions

Item #	Data Elements	Recording Time*	Sampling Rate	Range	Accuracy	Resolution	Filter
1	Lateral acceleration	0 – 250 ms	500/s	(±) 50 g	±5%	0.01 g	SAE J211 Class 60
2	Longitudinal acceleration	0 – 250 ms	500/s	(±) 50 g	±5%	0.01 g	SAE J211 Class 60
3	Normal acceleration	0 – 250 ms	500/s	(±) 50 g	±5%	0.01 g	SAE J211 Class 60
4	Delta-V, Lateral	0 – 250 ms	100/s	(±) 100 km/h	±5%	1 km/h	N.A.
5	Maximum delta-V, Lateral	0 – 300 ms	N.A.	(±) 100 km/h	±5%	1 km/h	N.A.
6	Time, maximum delta-V, Lateral	0 – 300 ms	N.A.	0 – 300 ms	±3 ms	2.5 ms	N.A.
7	Time, maximum delta-V, resultant	0 – 300 ms	N.A.	0 – 300 ms	±3 ms	2.5 ms	N.A.
8	Engine RPM	-5.0 to 0 s	2/s	0 – 10,000 rpm	±100 rpm	100 rpm	N.A.
9	Vehicle roll angle (degree)	-1.0 to 5 s	10/s	(±) 1,080 ₀	±10 ⁰	10 ⁰	N.A.
10	ABS activity	-5.0 to 0 s	2/s	On/off	N.A.	On/off	N.A.
11	Stability control	-5.0 to 0 s	2/s.	On/off/engaged	N.A.	On/off/engaged	N.A.
12	Steering wheel angle	-5.0 to 0 s	2/s	+250 ⁰	+5 ⁰	5 ⁰	2/s
13	Safety belt status, RFP	-1.0 s	N.A.	On/off	N.A.	On/off	N.A.
14	Frontal air bag suppression switch status, RFP	-1.0 s	N.A.	On/off	N.A.	On/off	N.A.
15	Frontal air bag deployment, time to N th stage, Driver	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
16	Frontal air bag deployment, time to N th stage, RFP	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
17	Frontal air bag deployment, N th stage disposal, Driver	Event	N.A.	Yes/no	N.A.	Yes/no	N.A.
18	Frontal air bag deployment, N th stage disposal, RFP ₁	Event	N.A.	Yes/no	N.A.	Yes/no	N.A.
19	Side air bag deployment time, Driver	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
20	Side air bag deployment time, RFP	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
21	Curtain/tube air bag deployment time, Driver	Event	N.A.	0 – 250 ms	±2 ms	1 ms	N.A.
22	Curtain/tube air bag deployment	Event	N.A.	0 – 250	±2 ms	1 ms	N.A.

Item #	Data Elements	Recording Time*	Sampling Rate	Range	Accuracy	Resolution	Filter
	time, RFP			ms			
23	Pretensioner deployment time, Driver	Event	N.A.	0 – 250 ms	± 2 ms	1 ms	N.A.
24	Pretension deployment time, RFP	Event	N.A.	0 – 250 ms	± 2 ms	1 ms	N.A.
25	Seat position, Driver	-1.0 s	N.A.	Yes/no	N.A.	Yes/no	N.A.
26	Seat position, RFP	-1.0 s	N.A.	Yes/no	N.A.	Yes/no	N.A.
27	Occupant size classification, Driver	-1.0 s	N.A.	Yes/no	N.A.	Yes/no	N.A.
28	Occupant size classification, RFP	-1.0 s	N.A.	Yes/no	N.A.	Yes/no	N.A.
29	Occupant position classification, Driver	-1.0 s	N.A.	Yes/no	N.A.	Yes/no	N.A.
30	Occupant position classification, RFP	-1.0 s	N.A.	Yes/no	N.A.	Yes/no	N.A.

s: second; ms: millisecond; km/h: kilometer per hour; RFP: right front passenger; N.A.: not applicable

¹ List this element n-1 time, once for each stage of a multi-stage air bag system.

* Relative to time zero

ANNEX 3

EDR: passenger cars and commercial vehicles.

Questionnaire minimum set of user requirements.

Filled in by: (name)

country:

department:

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to have
What kind of reading tool:			
<i>One tool (not one brand) to image EDR data</i>			
<i>Registration of the users</i>			
<i>Central training of the users</i>			
<i>Accredit certification numbers & names</i>			
<i>Access by OBD/DLC</i>			
<i>Access direct on ECU/module</i>			
<i>Image / Extraction data forensic sealed</i>			
<i>User friendly</i>			
<i>European validation (NCAP)</i>			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to have
Value of triggering			
<i>Triggering by activating airbag (deployment)</i>			
<i>Triggering by mayor activity (non deployment)</i>			
<i>Triggering by broken electronic devices (lights etc.)</i>			
<i>Triggering by censoring (pedestrians)</i>			
<i>Triggering by button (driver, policemen first on scene)</i>			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to know
Contents of the analyzed data; display of			
<i>Name and certification number (accredited cert no:)</i>			
<i>Investigation date</i>			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to know
Accident date			
Name of the software and version			
Pre-crash data			
Crash data			
Complete HEX data dump for cross examination			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to have
Education and Certification			
One accredited EU regulated education to read / analyze EDR			
Different certification levels:			
1. To image the data			
2. To image and operate on the vehicle networks and technology			
3. To analyze the imaged data			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to know
Extra EDR function for Law Enforcement & Emergency Services			
Optical signals			
Acoustic signals			
Using "stop" sign in front end/or back			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to have
Methods and systems			
One protocol to readout EDR data within the EU. Extraction of EDR data by Police forces when vehicle is seized or is evidence in a criminal investigation			
The public prosecutor or investigating judge decides if the data will be given to a public or private analysts			
The owner of the car can decide if the data will be given to a public or private analysts (no criminal investigation)			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to have
Time of pre-crash data (now had 5 seconds)			
10 seconds of pre-crash data.			
15 seconds of pre-crash data.			
20 seconds of pre-crash data.			
45 seconds of pre-crash data. (Veronica)			
Seconds of pre-crash data; put a "number of seconds" in the column that is applicable			
Future changes on request of			
OEM's, automotive industry			
Users / Police			
Your own requirements			

<i>For each line: put a "X" in the column that is applicable</i>	Essential	Preferable	Nice to have
Validation (for using data in court)			
European validation (NCAP) and registration			
National validation (crash tests, SAE papers)			
European case validation with European registration			
Your own requirements			

ANNEX 4

Motorcycle EDR - Questionnaire minimum set of requirements

Filled in by: (name)

country:

department:

<i>For each line: put a "X" in the column that is applicable</i>	essential	preferable	nice to know
Throttle position			
Engine rpm			
Gear position			
Speed, front and rear wheel rpm			
Gyro data (3 dimensional vehicle movement)			
Lights, rear stop light			
Lights, front			
Lights, Direction indicator			
ABS status			
Traction control status			
Banking angle			
Delta-V, Longitudinal			
Maximum delta-V, Longitudinal			
Time, Maximum delta-V, Longitudinal			
Speed, vehicle indicated			
Service brake front, on/off			
Service brake rear, on/off			
Ignition cycle, crash			
Ignition cycle, download			
Frontal air bag warning lamp			
Multi-event, number of events (1 or 2)			
Time from event 1 to 2			
Complete file recorded (yes or no)			
Lateral acceleration			
Longitudinal acceleration			
Normal acceleration			
Delta-V, Lateral			
Maximum delta-V, Lateral			
Time, maximum delta-V, Lateral			
Time, maximum delta-V, resultant			
Lateral acceleration			

Other items (specify in the following lines)

ANNEX 5

Overview respondents to the questionnaires on EDR

<i>country</i>	<i>MC</i>	<i>Car</i>	<i>Remark</i>
Austria	(x)	(x)	No jurisdiction
Belgium	X	X	
Bulgaria	X	X	
Cyprus	X	X	
Czech Republic	X	X	
Denmark	X	X	
Estonia	X	X	
Finland	X	X	
France	X		
Germany	X	X	
Greece	X	X	
Hungary	X	X	
Ireland			
Italy	(x)	(x)	Referred to Min. of Infra
Latvia			
Lithuania			
Luxembourg	(x)	(x)	No EDR team
Netherlands	X	X	
Norway	X	X	
Poland	X	X	
Portugal			
Romania	X	X	
Slovakia	X	X	
Slovenia	X	X	
Spain	X	X	
Sweden			
Switzerland	X	X	
UK	X	X	