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Study on the benefits resulting from the installation of Event Data Recorders

Final Report

David Hynd and Mike McCarthy

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Quality approved:

Mike McCarthy
(Project Manager)



Iwan Parry
(Technical Referee)



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Executive Summary

Event Data Recorders (EDRs) record a range of vehicle data over a short timeframe before, during and after a triggering threshold and are typically used to record information about road traffic accidents.

This project - *Study on the benefits for road safety resulting from the installation of event data recorders* - is in response to a European Parliament resolution on the topic and the European Commission commitment to examine the benefit of installing Event Data Recorders (EDR) on improving road safety in Europe, in particular for professional vehicles. An EDR was defined by this project as:

"A system for recording vehicle data during unintended events with harmful outcomes (i.e. damage or injury), with no continuous monitoring of driver behaviour or performance"

The objective of this study was to assist the Commission in deciding whether the fitting of EDR in all vehicles or certain categories of vehicles could result in an improvement of road safety or have other possible consequences that would justify the costs associated with the adoption of EU legislative measures. The study aimed to quantify the costs and benefits for heavy goods vehicles, light goods vehicles, buses and coaches, and passenger cars (for private and commercial use).

The project was organised into three phases: information gathering, stakeholder consultation and cost-benefit analysis. The first two phases identified the potential benefits and disbenefits, technical specification, legal concerns, fitment and costs relating to EDR fitment, and allowed information required for the cost-benefit task to be located. Information gathering consisted of a literature review and direct discussions with stakeholders. Consultation comprised an online questionnaire, coupled with a stakeholder meeting and subsequent direct discussions. This information was used to carry out a cost-benefit analysis to identify and compare the costs and benefits in two scenarios: one reflecting the *status quo*, and one representing action to mandate an EDR specification over and above that prescribed by 49 CFR Part 563¹, with the capability to trigger in impacts with vulnerable road users and record the status of active safety systems. The parameters that could be monetised were compared, and the additional cost and benefits predicted in the action scenario used to compute benefit-to-cost ratios for each vehicle type.

The main findings of the project can be summarised as:

- EDRs are fitted to almost all new M1 vehicles in Europe and have been equipped for some years. Typically, the EDR is linked to the airbag control module. The data recorded is comparable to the mandatory specification demanded by 49 CFR Part 563, and in some cases, it is known that many more parameters than the minimum requirements of part 563 are recorded. The situation is similar for small

¹ United States Code of Federal Regulations on mandatory and "if fitted" EDR specifications (<http://www.nhtsa.gov/Laws+&+Regulations/Vehicles>). See also Appendix A.

commercial vehicles (N1). However, the fitment of EDRs to large commercial vehicles (N2/N3) and buses and coaches (M2/M3) is more variable in terms of how the system is organised and the types of data recorded.

- The available evidence suggests that many commercial fleets equip in-vehicle data recorders, primarily to measure and influence driving efficiency and behaviour, with the aim of reducing costs and improving safety. Insurers are also starting to offer reduced premiums in return for fitment of EDR and/or continuous driver monitoring systems. Some systems on heavy commercial vehicles include vehicle data recorders that can also record accident events. The use of these systems (and more extensive monitoring systems) in commercial fleets is governed by employment contracts.
- The benefits of EDRs are consistently documented in the literature in terms of the following areas:
 - **Road safety** – studies show a range of reductions in accidents when in-vehicle data recorders (including EDRs) are fitted because the presence of the system affects driver behaviour resulting in societal benefits of fewer accidents. However, these effects are smaller for EDRs in isolation and the evidence appears limited to commercial fleets; most ordinary car drivers are unaware that an EDR is fitted to their vehicle;
 - **Vehicle design** – manufacturers can obtain information on accident causation and use this to improve future vehicle designs and safety systems;
 - **Accidentology and accident reconstruction** – accurate information from before, during and after an accident provides robust information to help determine accident causation and allows accident researchers better information with which to assess the effectiveness of countermeasures, particularly those that help avoid accidents. This means that research and policy recommendations are focussed on the safety advances that have the greatest societal benefit;
 - **Legal proceedings** – information on the accident means that the liability for the accident can be more accurately and objectively determined, therefore reducing time and legal costs and providing road users and society with access to justice.
- The main concerns or disbenefits of EDR fitment relate to the legal and privacy issues of the data and who has access to the data under which circumstances. Furthermore, larger vehicles appear to have less standardisation with respect to EDR design and capability, meaning that standardising EDRs may therefore result in greater costs to manufacturers.
- The US EDR specification has minimum data frequency requirements that are exceeded by many current systems, thus demonstrating that the state of the art exceeds the current US EDR requirements stipulated by 49 CFR Part 563. Greater frequency data would provide a better and more complete understanding of accident events, thereby realising more of the benefit and this appears to be technically achievable by current systems.

- Limited information was forthcoming on system costs and these depend on the type of EDR system considered. For passenger cars and vans, EDRs seem to be largely fitted already, so additional costs may be negligible. We assumed the additional cost of an enhanced EDR specification would be comparable to the technical development and costs predicted in US prior to the introduction of Part 563. Other vehicle types are more variable in terms of the data recorded and the system architecture: costs may therefore be greater for these vehicles. We assumed a value of €20 per vehicle in acknowledgment of the technical challenge of providing an enhanced EDR specification and altered system architecture, and the smaller vehicle fleet.
- Legal advice on the application of European Directive 95/46/EC and the legal situation in six European countries found that:
 - Ownership of EDR data was not defined, although the vehicle owner would be likely to be considered the data owner: clarification of ownership would be beneficial to the access and management of EDR data.
 - Access to the EDR data was possible by any party able to access the EDR port. Further controls in this area would be technically possible and could be desirable to control access and prevent data modification or deletion. Stakeholders felt that this should be left to the manufacturer and should not impede access to the data for legitimate uses.
 - EDR data, by itself, does not constitute personal data. Thus, any party can use anonymised EDR data. Should the party accessing the data be in the possession of other data that renders the EDR data personal by linking it to an individual, the nationally enforced provisions of Directive 95/46/EC apply, which comprise adequate processes and controls to protect personal data.
 - All countries highlighted a degree of uncertainty surrounding the collection and use of EDR data and recommended that, although adequate legal frameworks exist once ownership and access are defined, specific conventions would be helpful to define these fundamental aspects.
- EDR data provides accurate and reliable information on the timing, chronology and actions taken in the pre-crash phase. This provides hard data where there are currently only estimates, and means that accident reconstructions and research can utilise this higher quality information to make better, more robust conclusions. These in turn could be used to support measures to improve road safety as well as enhancing the understanding of the causes of accidents. This is important for improvements to secondary safety, but also for the effective implementation of active safety technologies and protection of vulnerable road users. Use of data from active systems could also inform on positional relationships between road users in the pre-crash phase.
- There was evidence found on the effect of EDR fitment on driving behaviour for commercial fleets. If similar effects apply to private fleets, or if the effect on safety is greater than predicted by the estimates for commercial fleets, this would have very large benefits associated with monetised casualty savings.
- Behavioural change is strongly linked to information feedback; without mechanisms to raise awareness of EDR fitment, any effects on safety may reduce

over time. Mechanisms to improve driver awareness and engagement with EDRs are likely to result in greater safety benefits.

- Some important potential benefits could not be monetised: improved accident data leading to enhancements in safety and benefits relating to access to justice. These could represent very significant benefits, possibly at least double those monetised in this study, although benefits relating to accident data would be subject to a time lag. Retrospectively unlocking access to EDRs on vehicles already in the fleet (as some manufacturers have already done in some markets e.g. Toyota) would increase the potential benefits.
- Using the assumptions and values identified (with appropriate ranges) the following BCR values were identified. These do not include those benefits that could not be monetised; if these could also be realised, the benefits would be substantially increased towards or exceeding the upper estimates quoted:
 - BCR for M1 vehicles was estimated excluding potentially large components of benefit at between 0 to 5.7, central estimate 0.1;
 - BCR for N1 vehicles was estimated excluding potentially large components of benefit at between 0 to 6.6, central estimate 1.0;
 - BCR for M2/M3 vehicles was estimated excluding potentially large components of benefit at between 0 to 4.0, central estimate 2.0; and
 - BCR for N2/N3 vehicles was estimated excluding potentially large components of benefit at between 0 to 4.6, central estimate 2.3.
- If EDR data provides more robust evidence that leads to improvements in safety measures or regulation at the same level as predicted by Petersen and Ahlgrimm [2014] (i.e. 2%), then further benefits would be realised, although because of the lag between the data becoming available and subsequent action, these benefits would be largely realised outside the assessment period (unless retrospective access to EDR data is enabled by manufacturers). TRL considers substantial benefits are likely because evidence informing on the effectiveness of active safety systems requires robust information on the timing and chronology of events and actions in the pre-crash phase that can be provided by EDR data, especially if combined with sensor data (e.g. Time-to-Collision) from active safety systems. Furthermore, secondary safety systems and measures to address vulnerable road users could be improved.
- Bearing in mind that EDRs (or EDR-like data) is already being recorded in nearly all vehicles, a large proportion (in some cases all) of the cost may have already been spent. Therefore, measures to harmonise specifications in order to realise the potentially substantial benefits from EDR data would have long-term benefits for road safety and access to justice.
- Further information should be sought on the accuracy of costs associated with the implementation of an enhanced specification EDR.
- Costs associated with EDR download and analysis should be monitored and ongoing estimates collected on the benefits that the EDR can provide; small effects in this respect have a large influence on the overall cost-effectiveness.
- An enhanced EDR specification has the potential to deliver significant benefits, although the scale of these is not easily predicted with the available data because

much of the benefit is difficult to quantify. Central estimate BCRs appear greatest for large vehicles (despite the relatively high costs assumed), although the greatest absolute benefit accrues to M1 passenger cars because of the greater fleet size of this vehicle type.

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Abstract

The aim of this study was to investigate whether Event Data Recorders (EDRs) could deliver benefits that would justify the costs associated with EU legislative measures and considered: heavy/light goods vehicles, buses/coaches, and passenger cars.

A literature review and stakeholder consultation (direct discussions, an online questionnaire and a stakeholder meeting) identified the potential benefits and disbenefits, technical specification, legal issues, fitment and costs relating to EDRs. It was confirmed that most European vehicles are already equipped with EDRs or record EDR-like information, and the resulting data is not personal information unless it is linked to an individual, in which case appropriate controls already exist per Directive 95/46/EC.

EDR data was found to enable benefits in terms of: road safety (better evidence for safety measures), improved vehicle design, accidentology, and legal proceedings. Some of these potentially large benefits could not be monetised. A cost-benefit analysis considered the *status quo* and an EDR specification with the capability to record collisions with VRUs and data from active safety systems. An enhanced EDR specification was found to be more likely to be cost-beneficial for large vehicles, but bearing in mind the components not monetised, considered likely to be cost-beneficial for all vehicle types.

1 Introduction

Point 87 of the European Parliament resolution of 27 September 2011 on European road safety 2011-2020² called on the Commission:

to provide 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.

In addition, the European Commission has a published commitment to examine the added value of installing Event Data Recorders (EDR) on improving road safety in Europe, in particular for professional vehicles (EC, 2010). This is part of the steps that the Commission is taking to achieve the target to halve the overall number of road deaths in the European Union by 2020, compared with a 2010 baseline.

It is also understood that the EU framework requires the creation by Member States of independent technical investigation bodies for air, rail and maritime transport and that the Commission is evaluating to what extent the principals and methods, applied successfully in these modes of transport for technical investigations after accidents, could be applied to the field of road transport (EC, 2010).

Event Data Recorder (EDR)

For the purposes of this study, an EDR is defined as:

A system for recording vehicle data during unintended events with harmful outcomes (i.e. damage or injury), with no continuous monitoring of driver behaviour or performance

1.1 Objectives

The aim of this study is to assist the Commission in deciding whether the fitting of EDR in all vehicles or certain categories of vehicles could result in an improvement of road safety or have other possible consequences that would justify the costs associated with the adoption of EU legislative measures. The study will quantify the costs and benefits for heavy goods vehicles, light goods vehicles, buses and coaches, and passenger cars (for private and commercial use).

² 2010/2235(INI)

The specific objectives of the study are to:

- Analyse the benefits that could result from the installation of EDR, particularly for road safety but not excluding other benefits;
- Consult with Stakeholders; and
- Provide policy recommendations based on a cost-benefit analysis of the possible legislative or other measures.

The objectives of this interim report are to:

- Document progress with the evidence gathering phase of the project; and
- Identify gaps in the evidence base for discussion with stakeholders.

1.2 Background

An EDR is a device mounted in a vehicle that will record objective information about a collision that will enable the Police, accident investigators, manufacturers and researchers to understand better the causes of collisions and what may be done to mitigate them. An EDR records only information associated with an event that is, or is suspected to be, a collision. An EDR typically records information about vehicle systems immediately before during and after a collision; the total recording time is typically less than 30 seconds.

An EDR is thus explicitly different to other in-vehicle data recorders such as driver or journey monitoring devices. These latter systems typically record data about the vehicle and its location continuously, typically sending data to a central server via the mobile phone network. Many retrofit systems, particularly in the fleet and insurance markets, include both driver/journey monitoring and EDR functionality.

Historically, many of the major road safety advances have been achieved by improving secondary safety; for example by the improvement of vehicle structures and occupant restraint systems through the implementation of the EC frontal and side impact directives. In the future, however, the consensus view is that primary and active vehicle technologies will deliver significant safety improvements. These systems typically act before the accident to either mitigate or avoid the accident and make a decision to activate based on data collected from sensors that monitor the vehicle state as well as the road environment. One of the main issues is that it is difficult to find the effectiveness of these systems because the precise conditions of the pre-crash phase are not known and judgement is always required, which is inherently subject to error. As well as providing an accurate record of the vehicle state and the functions of the safety systems during an accident, EDR data also provides the prospect of significantly enhancing the accuracy of predicting the effectiveness of active systems. This will allow road safety policies and regulatory actions to be targeted at those systems most effective at realising casualty reductions on European roads. EDR data also provides the prospect of a large and detailed dataset that can be used for on-going monitoring of road safety systems and policies.

Previous European research on EDRs includes the SAMOVAR and VERONICA I & II projects. VERONICA I defined the following in relation to EDRs (Schmidt-Cotta *et al.*, 2006):

- Fundamental rights and freedoms
 - Exercise of public obligations
 - Collision causation investigation
 - Crime investigation
 - Fair and appropriate trials
 - Third Party's (Victim's) rights
 - Performance of a contract to which the person is party
 - Vital interests of the person itself (e.g. automatic rescue notification)
 - Product assurance
- Other legitimate purposes:
 - Casualty reduction
 - Real-life crash data for training and tuition
 - Prevention measures for young drivers
 - Statistical, scientific or historical accident research
 - Enhancements of vehicle and infrastructure design
 - Individual insurance tariffs

1.3 Potential Applications of EDR Data

VERONICA I further defined that the purposes of EDR should be:

- To provide reliable information
- On vehicle collision causation
- Available on-site or wireless
- For further processing by certified experts
- For dedicated road safety, legal, security and crime fighting applications

Table 1.1 shows some examples of the users of EDR data and the applications or benefits that may accrue for those users.

Table 1.1: Examples of users of EDR data and their applications/benefits

User	Application/benefit
Manufacturers	Improve the safety of motor vehicles
	Evaluate the correct operation of vehicle systems for development and litigation cover
Governments	Improve vehicle safety standards
	Improve infrastructure safety standards
	Reduce road fatalities, injuries and damage, and the societal costs associated with these
Vehicle owner/driver	Access to justice
Prospective vehicle buyer	Determine if a vehicle has previously been involved in an accident
Fleet operators	Reduced accident (injury and damage) claims
	Reduced fraud
Police	Impartial accident information
Courts	Objective data for civil and criminal legal proceedings
Solicitors and independent forensic road traffic accident investigators	Objective data to support expert witness statement and reduced reliance on (potentially unreliable) witness statements
Insurers	Faster and more accurate settlement of cases (with reduced costs)
Researchers	More accurate association of crash severity and injury outcome, to improve vehicle structures and restraint systems
	Improved understanding of driver involvement in collisions
Emergency responders	Improved triage (NB this benefit would probably require EDR data to be associated with eCall data)

The potential benefits resulting from the use of EDR data are numerous and relate to many different user groups. The three primary benefits relate to the following:

- Improvement of road safety by improving the data on the performance of current safety systems (which may include occupant restraints, active safety systems, road-side furniture and safety barriers, or road design)
- Access to justice using accurate and verifiable collision and pre-collision data
- Possible effects on driver behaviour

Most of the benefits listed in Table 1.1 relate to the provision by an EDR of more objective, reliable and cost-effective evidence of crash severity, pre-collision driver behaviour, vehicle system performance etc. than is currently available via e.g. accident reconstruction, witness statements or CCTV records. In order to deliver the potential benefits, it is therefore important that the measurements made by an EDR are relevant and reliable. This includes both the value of the measurement (e.g. left hand indicator on, accelerator position) and the timing of the measured parameters.

The potential benefits also vary by fleet type. No quantification of an accident reduction benefit (through improved driver behaviour) for private cars was identified in this review. Indeed, NHTSA's preliminary regulatory evaluation for FMVSS 405 [DOT, 2012c] notes that although NHTSA '*believes that the proposal will improve vehicle safety, the safety benefits are difficult to quantify. Therefore the benefits of this proposal are discussed qualitatively*'. Similarly, the EC VERONICA and VERONICA II projects [Schmidt-Cotta *et al.*, 2006; Schmidt-Cotta 2009] assessed benefits only in qualitative terms.

Nevertheless, collision reduction benefits have been demonstrated in a number of different professional fleet types. There is also a generic benefit for most of these users and applications that the time required to investigate an accident may be reduced, resulting in reduced costs. These potential benefits are explored in later sections of this report.

2 Experience with the Installation and Use of EDR

2.1 Introduction

The objective of an EDR is to record objective information about a collision that will enable the Police, accident investigators, manufacturers and researchers to understand better the causes of collisions and what may be done to mitigate them. This could be achieved in many ways and numerous examples are already available, e.g.:

- Fitment of proprietary EDRs by car manufacturers;
- Fitment of EDRs meeting CFR 49 Part 563 to cars sold in the US market;
- Inclusion of some EDR functionality in the engine management electronics of some US-market heavy goods vehicles;
- Fitment of aftermarket EDRs, often as a component of a more comprehensive driver (and possibly passenger, e.g. CCTV system on a bus) monitoring system, by insurers and fleet managers.

The application of EDR in modern vehicles is not solely about enhancing the data available about accidents – it is also about replacing traditional data sources that new technologies are eliminating. An example is tyre skid marks, which used to be used to help determine pre-event vehicle speed, but which are often not present for modern vehicles with ABS.

Many of the standard components of modern vehicles monitor and record information about the vehicle, e.g. for use in the maintenance of the vehicle. Indeed, some of this is already mandated in Europe and elsewhere to facilitate the monitoring of vehicle emissions performance. Other systems that may store information include electronic stability control systems (ESC), engine and transmission electronic control units (ECUs), cruise control module, and deployable restraint system control modules. Some of this information may be of use in accident investigations and there is an extensive literature on the access to, validity of and limitations of the data in these systems, with some companies specialising in the extraction and interpretation of this data for legal cases. For example, the ESC system may monitor the rotational speed of each wheel, vehicle yaw and lateral acceleration, brake and accelerator pedal positions, and steering input – any of which may be useful information in an accident investigation, particularly to help understand the pre-crash phase of a collision.

Even if useful data is stored in these systems, this sort of information is typically proprietary to a vehicle manufacturer and vehicle model. This means that the data may be difficult for a third party to access and interpret, and it can be very difficult to demonstrate the validity of the data for a court. Nevertheless, vehicle manufacturers can extract information at service or following a crash that helps them to maintain the vehicle, identify the cause of failures, and improve safety.

The following sections give an overview of current experience with the definition, installation and use of EDRs for a variety of vehicle and fleet types.

2.2 Legislation

2.2.1 Cars

US

The US has implemented technical requirements for EDRs if they are fitted to vehicles since 1 September 2010. The requirements are defined in Code of Federal Regulations (CFR) 49 Part 563, typically referred to simply as Part 563. The regulation is intended to standardise the data obtained through EDRs to ensure that the data can be put to the most effective future use. Part 563 applies to passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating (GVWR) of 3,855 kg or less and an unloaded vehicle weight of 2,495 kg or less (known as 'light vehicles') that are voluntarily equipped with an EDR. From 1 September 2014 the regulation will be mandatory for all light vehicles.

EDRs have been defined for light vehicles because these vehicles are required by FMVSS 208 to have frontal airbags, and the Airbag Control Module (ACM) which is implicitly required by this rule can be used as the basis of the EDR. This avoids some the cost and complexity that may be associated with mandating EDRs for heavier vehicles, which often do not have frontal airbags and therefore do not require crash sensors. It should be noted, however, that airbag deployment is not required in order for an EDR recording to be triggered.

Part 563 defines a set of data channels that must be recorded if an EDR is fitted, including a definition of the data format, accuracy, range and resolution of the recorded data. It also defines the data format etc. that must be used for a further set of data channels, if these parameters are recorded by the EDR.

It is important to realise that the EDR definition in Part 563 (including drafts prior to the first Final Rule issued in 2006) has changed substantively a number of times and that in some cases research findings about the validity etc. of EDRs fitted to use light vehicles may not be relevant for vehicles meeting a later version of Part 563. Care must therefore be taken when reviewing the results of studies using EDRs described as Part 563 compliant.

An overview of the development of the EDR requirements in Part 563, along with a summary of the current requirements, is presented in Appendix A.

NHTSA estimated the fitment rate of EDRs in new US-fleet light vehicles as 64% in 2006 [DOT, 2006] and 92% in 2013 [DOT, 2012b], and it is expected that this will be close to 100% by the end of 2014. (There are some exceptions to the rule, e.g. for 'walk-in' vans designed to be sold exclusively to the US Postal Service, so the rate will always be slightly less than 100%.)

Recently, NHTSA has issued a Notice of Proposed Rulemaking (NPRM) [DOT, 2012b] to place the EDR mandate in a Federal Motor Vehicle Safety Standard (FMVSS 405), instead of in Part 563. In the NPRM, NHTSA notes that '*placing the mandate in a FMVSS, instead of Part 563, would expand NHTSA's ability to avail itself of the enforcement authority of the Motor Vehicle Safety Act, making it possible to seek civil penalties for failure to provide an EDR or for failure to provide one that performs properly.*' NHTSA have also issued a preliminary regulatory evaluation for the proposed FMVSS 405 [DOT, 2012c]

The primary difference between the Part 563 regulation and the FMVSS 405 proposal is legal, rather than technical. The use of an FMVSS imposes a higher level of proof of compliance, and greater potential penalties for non-compliance (including prohibition of the sale of non-compliant vehicles), than an equivalent regulation [Alliance, 2013]. The NPRM requests comments on the possibilities for international co-operation regarding EDRs in light vehicles.

Japan

According to Ishikawa [2009], the Japanese Ministry of Land, Infrastructure, Transport and Tourism have also proposed technical requirements for the application of EDRs to light vehicles (3500 kg GVWR or less) [J-MLIT, 2008]. The proposal is apparently comparable to the US Part 563, except that two data elements have been added: the pre-crash warning and the pre-crash brake operating status.

Korea

The NPRM for FMVSS 405 [DOT, 2012c] notes that '*Korea has expressed an interest in the development of an EDR standard under the International Standards Organization*'.

Other Jurisdictions

No car EDR legislation was identified in other jurisdictions. In 2005, Transport Canada investigated whether a Memorandum of Understanding (MOU) with vehicle manufacturers would be a suitable way to deal with the safety of in-vehicle telematics devices, which included EDRs [Rudin-Brown, 2005]. No further information on the MOU or any alternatives was found.

The Australian Transport Council's National Road Safety Strategy 2011-2020 makes no mention of potential legislation on EDRs, although eCall is mentioned. The Australian Department of Infrastructure and Regional Development confirmed that Australia has no EDR legislation and no current plans for EDR legislation. Nevertheless, Holden (an Australian GM brand) specifically mention EDRs in their Privacy Policy [Holden, 2014], but no legislative activity was identified.

The Hong Kong Director of Audit reviewed accident investigation and law enforcement aspects of road safety [HKDA, 2006] and recommended that 'the Commissioner for Transport should, in consultation with the Secretary for the Environment, Transport and Works and the Commissioner of Police, monitor the development and application of vehicle EDR by car manufacturers.' It was noted that the recommendation was accepted by the administration.

2.2.2 Light Goods Vehicles

US

The US approach to EDRs (and other vehicle safety legislation) categorises all vehicles as either 'light' or 'heavy'. As noted in Section 2.2.1, Part 563 applies to passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating

(GVWR) of 3,855 kg or less and an unloaded vehicle weight of 2,495 kg or less. The US regulation will therefore cover many light goods vehicles and minibuses.

Japan

The proposed legislation in Japan would apply to vehicles with a GVWR of 3500 kg or less. This is slightly lighter than the definition used in the US, but would still cover many light goods vehicles and minibuses.

Other Jurisdictions

NHTSA noted that they had prioritised the definition of EDRs for light vehicles because these vehicles are required by FMVSS 208 to have frontal airbags, and the Airbag Control Module (ACM) which is implicitly required by this rule can be used as the basis of the EDR. In Europe, most LGVs have for many years been equipped with a driver's steering wheel airbag, and the associated airbag control module could similarly form the basis of an EDR.

2.2.3 Heavy Goods Vehicles, Buses and Coaches

Heavy goods vehicles and coaches in many jurisdictions are required to have tachographs that are used to record parameters such as vehicle speed and distance, and driver activity. The primary purpose of the tachograph is the monitoring and enforcement of regulations governing drivers' working hours, although they are also used to provide information in accident investigations.

Tachographs were originally analogue devices that used styli to trace lines on a paper disc that rotated throughout the day. The disk had to be replaced daily to ensure correct recording. Since August 2005, EU regulation 1360/2002 has required all applicable new vehicles to be fitted with a digital tachograph which record data at 1Hz, although some models provide 4Hz data for collision investigation. Data is linked to a specific driver via a digital driver card issued by a country's driving authority (e.g. the DVLA in the UK). Similar systems are used in many other jurisdictions.

Analogue and digital tachographs record very little information about a collision compared with the EDRs often fitted to cars. In the US, NHTSA started working on EDRs for heavy goods vehicles and buses at around the same time that it started work on EDRs for cars, via the NHTSA Truck and Bus EDR Working Group [DOT, 2002]. The Working Group identified road safety benefits that may result from the fitment of EDRs to trucks and buses, and identified data elements that were a priority for delivering these benefits.

Based on this, the Federal Highway Administration (FHWA), in collaboration with the Truck Manufacturers Association developed requirements and functional specifications for EDRs for heavy trucks (>4535 kg gross vehicle weight) [Pierowicz, 2004]. Included in the report are functional specifications for both complete crash reconstruction and less-detailed analyses of crashes. Requirements are defined for the various EDR components, hardware, software, sensors, and databases. This report also includes a cost-effectiveness analysis.

However, NHTSA have not moved forward with regulation for EDRs for heavy vehicles and buses, stating in the Final Rule of August 2006 [DOT, 2006] that EDR for heavy vehicles and buses would be considered '*separately, after consultation with the Federal Motor Carrier Safety Administration*' for the following reasons:

1. To provide NHTSA with time to build experience in terms of standardisation of EDR data in light vehicles. This experience could then be applied to its consideration of heavy trucks.
2. Because the relevant data to be gathered by EDRs installed in heavy trucks are not identical to that of light vehicles, so NHTSA considered that any such requirements should come in a separate regulation.
3. Because EDRs in light vehicles rely heavily upon sensors and diagnostic equipment associated with the vehicle's air bag system, NHTSA considered that it must carefully assess the costs, benefits, and lead time necessary for EDR requirements for heavy trucks, which may not have systems with all the necessary hardware.
4. To avoid delay in the application of EDRs to light vehicles.

A recent NHTSA presentation [DOT, 2014] gave an overview of their progress and plans regarding a number of bus and coach related safety initiatives. The presentation included a section on heavy vehicle EDRs, which noted that:

- A draft report on heavy vehicle EDRs by Virginia Tech is under review at NHTSA;
- NHTSA is assessing appropriate performance measures, implementation issues, economic impacts and data collection needs for heavy vehicle EDRs;
- An 'Agency decision' on heavy vehicle EDRs is due 'early 2014'.

2.3 Standards

In addition to the few regulations regarding event data recorders, there are a number of relevant standards available. Indeed, Part 563 notes that SAE and IEEE standards in particular were considered in the development of the regulation.

SAE J1698

This series of standards defines recommended practices relating to EDRs in '*light-duty motor vehicle original equipment applications*'. The scope is EDR data relevant to crash and other vehicle events and only post-download data formats are defined (i.e. the format of the data as stored in the EDR is not defined).

J1698-1:2013 - Event Data Recorder - Output Data Definition. EDR element definitions and EDR record formats for those data elements that could be used for analysing vehicle events, including accidents.

J1698-2:2013 - Event Data Recorder - Retrieval Tool Protocol. Includes the definition of a common physical interface and the protocols necessary to retrieve data stored by an EDR. Covers access to the EDR via the SAE J1962 diagnostic connector (see below) and via direct connection to the EDR.

J1698-3:2013 - Event Data Recorder – Compliance Assessment. Procedures that may be used to validate that EDR output records from FMVSS 208 and 214 crash tests conform with the reporting requirements specified in Part 563 Table 1.

The SAE has an 'Event Data Recorder' Committee that is responsible for the development of J1698 and which continues to meet monthly [SAE, 2014]. Current and future work items are listed as: developing EDR record parameters related to pedestrian protection systems; provisions for multiple-impact events may be included in the next version; side-impact and rollover events may be addressed at a later time.

SAE J2728

SAE J2728:2010 - Heavy Vehicle Event Data Recorder (HVEDR) Standard - Tier 1. Recommended Practice for crash EDRs for heavy commercial vehicles, which are defined as heavy duty (> 4535 kg) wheeled vehicles intended to be compliant with current FMVSS or FMCSR (US regulations) and using SAE J1708/J1587 or SAE J1939 vehicle communication networks. The standard establishes 39 common data elements and data element definitions, event triggers, threshold levels, survivability requirements and recommended procedures for data extraction. Additional data elements that can be recorded if fitted are also defined. SAE J2728 recommends that the HVEDR should retain at least two acceleration trigger recordings, at least one SRS trigger recording, and a minimum of two last-stop trigger recordings.

SAE J1962

SAE J1962:2012 - Diagnostic Connector Equivalent to ISO/DIS 15031-3:2001. Defines the requirements of an On-Board Diagnostic (OBD) connector as required by US OBD regulations. The diagnostic connection specified in the standard consists of two mating connectors, the vehicle connector and the external test equipment connector. This document supersedes SAE J1962 200204, and is technically equivalent to ISO/DIS 15031-3:2001.

IEEE 1616

IEEE 1616:2004 - Motor Vehicle Event Data Recorders. This is a performance standard developed by the IEEE Motor Vehicle Event Data Recorder Brake and Electronic Control Working Group for EDR data collection, storage, and retrieval, including EDR output data capability and export protocols for data elements. The scope is EDRs for both light-duty and heavy-duty vehicles and the standard aims to ensure that comparable EDR parameters are generated by all vehicles.

IEEE 1616a

IEEE 1616a – Standard for Motor Vehicle Event Data Recorders (MVEDRs) – Amendment 1: Motor Vehicle Event Data Recorder Connector Lockout Apparatus (MVEDRCLA). This standard is an amendment to IEEE 1616 that defines a device to secure physically the OBD II connector used to access the EDR (and other vehicle systems) to prevent tampering and unauthorised download of EDR data. The standard does not define data security within the vehicle ECUs or intra-vehicle communication networks.

ISO 15031-3

ISO 15031-3:2004 - Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics - Part 3: Diagnostic connector and related electrical circuits, specification and use. This standard defines a minimum set of requirements for a diagnostic connector used for communication between a vehicle and external test equipment for emissions-related diagnostics. The scope is all types of road vehicles.

ISO/TR 12353-3

ISO/TR 12353-3:2013 - Road vehicles - Traffic accident analysis - Part 3: Guidelines for the interpretation of recorded crash pulse data to determine impact severity. This standard defines various methods for determining impact severity in road vehicle collisions based on acceleration, velocity and other data from EDRs.

ATA RP 1210

American Trucking Association Technology and Maintenance Council Recommended Practice 1210:2006. RP1210 is a recommended practice used for reprogramming and analysis of emission related (mainly) Electronic Control Units (ECUs) in heavy duty vehicles. The purpose of RP1210 is to create a standard programming interface for communication between vehicle ECUs and a PC via an on-board communication bus (i.e. CAN-bus).

ATA RP 1214

American Trucking Association Technology and Maintenance Council Recommended Practice 1214 - Guidelines for Event Data Collection, Storage, and Retrieval. This recommended practice defines eight event-related data elements, along with the storage method and data retrieval approach for EDRs on heavy vehicles. The minimum sampling rate is 1 Hz and the minimum recording time is from 30 seconds before to 15 seconds after an event trigger, which must be a deceleration between 0 and 10 mph/s. EDR data should also be stored in an ECU, not in the airbag control module.

2.4 EDR Data Retrieval Tools

2.4.1 Cars

Currently, there are three primary tools for the extraction of EDR data from Part 563-compliant EDRs:

- Bosch provides a 'crash data retrieval' (CDR) tool that covers almost all vehicles that have a Part 563 EDR, except Hyundai and Kia;
- Hyundai use a dedicated data retrieval tool provided by Global Information Technology (GIT);
- Kia use a dedicated data retrieval tool provided by Global Information Technology (GIT).

The Bosch CDR tool generally requires a VIN³ before it will download data, although this is not required by Part 563. This allows multiple downloads to be tracked and linked definitively with the vehicle. However, it is well established that entering a VIN from a different vehicle of the same make and model (or possibly the same vehicle platform) sometimes allows a download to be performed, although the accuracy of the data if this is done is not defined. The retail price for the basic Bosch CDR tool is \$2k without software and \$2.9k with a one-year software subscription⁴ (€1500 and €2175 respectively). This enables download from supported vehicles via the OBD II connector. In the event that the connection between the OBD II connector and the airbag control module (which contains the EDR functionality) is compromised (e.g. due to collision damage), then a direct connection to the ACM may be made using an appropriate interposer cable. Cables can be purchased separately (from \$150 each / €113) or a kit containing the basic Bosch CDR tool and all currently supported cables costs \$10,648 (€8k).

The GIT tools for Hyundai and Kia models appear to be virtually identical, but cannot be swapped between the makes. The GIT tool does not require a VIN before it will download data. However, the GIT tool does require that the model of the vehicle is input before download, and it is not known whether the data would be accurate if the wrong model is entered. Each GIT tool reportedly costs about \$5k (€3750) for the hardware⁵, plus an annual licence fee for the software.

The requirement for the VIN when using the Bosch tool has clear advantages:

- It ensures that the interpretation of the EDR data that is made by the download tool and its software should be correct for the specific vehicle being examined. In the absence of this specific link there is an increased possibility that the EDR data will be misrepresented in the resulting report.
- It ensures that downloads are easily and automatically linked to a specific vehicle, both in the electronic data file and any hardcopy. This helps to provide some level of traceability and to ensure that downloads from multiple vehicles are not easily mixed-up.
- It also means that downloaded data files can be reprocessed if there is an update to the interpretation software, and that updates can be flagged for particular VINs or groups of VINs.

Nevertheless, the use of the VIN is sometimes considered to have consequences for privacy, even though the VIN identifies the vehicle itself and does not provide name, address or other person identifying information about an individual. See Section 2.9 for further discussion of this issue.

³ Vehicle Identification Number

⁴ www.cdr-system.com/catalog/cdq3333-1.html

⁵ kiaspecialtools.com/SpecialToolsDetail.aspx?itemid=49761231

In addition to the above tools for downloading data from Part 563-compliant EDRs, Ishikawa *et al.* [2009] used the Denso DST-2 scan tool to download data from the ABS and engine ECUs in test vehicles used in J-NCAP and accident reconstruction tests.

2.4.2 Heavy Goods Vehicles and Buses

Bowman *et al.* [2013] report in some depth on the current status of EDR functionality in US-fleet heavy vehicles. They note that the data retrieval process and software are specific to each manufacturer (and sometimes to the supplier of a particular system installed by the manufacturer) and that in some cases data retrieval can only be conducted by third party companies who are approved by the manufacturer and who use manufacturer-supplied tools.

They also reported that industry feedback suggested that most systems record similar data elements, so standardisation should focus on the data bus format and the interface to external tools. Nevertheless, only 25% of the heavy vehicle data elements recommended by SAE J2728 have been widely adopted by the industry.

The stakeholders consulted during this study indicated that there was relatively little experience with downloading data from heavy vehicles in the European fleet, but that US-fleet vehicles were increasingly using RP 1210 (see Section 2.3) to enable a standard interface and tools were being developed to make use of this⁶. At the stakeholder meeting (see Section 5) it was noted that there is no significant technical obstacle to implementing EDR capability in heavy vehicles via a single download connector, provided that a standard set of data and a standard interface/connector is defined.

2.4.3 LCVs

No literature was identified demonstrating experience with downloading EDR data from European market light commercial vehicles (i.e. non-car derived vans and minibuses). LCVs have a similar electronic architecture to cars and current models almost all have a standard-fit driver's airbag and therefore crash sensors and an airbag control module (see Table 2.1). This means that the implementation of EDR should be very similar to that in cars, at least for frontal impact collisions (current LCVs typically do not have a standard fit side airbag, so may not have suitable sensors for triggering the EDR in a side impact, although these could be incorporated at low cost even without the airbag fitted). Indeed, some stakeholders indicated that there because there are relatively few ACM manufacturers with a lot of commonality between the products, it is possible that the EDR functionality is already included in some LCVs (although not necessarily enabled) due to part sharing with M1 vehicles. However, this could not be verified during the study period. In fact, Part 563 in the US applies to passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating of 3,855 kg or less and an unloaded vehicle weight of 2,495 kg, which if applied in Europe would include some of the vehicles listed in Table 2.1.

⁶ See for example www.synercontechologies.com/?page_id=73

Table 2.1: Standard/optional fitment of airbag control module (ACM), driver's and FSP's airbag in selected current European market LCVs

Make	Model	Model year	Standard ACM	Driver's Airbag	FSP's Airbag
Citroen	Dispatch/Jumpy	2007 On	Y	Y	Option
Citroen	Relay/Jumper	2006 on	Y	Y	Option
Fiat	Ducato	2006 on	Y	Y	Option
Ford	Ranger	2012 on	Y	Y	Y
Ford	Transit	2014 on	Y	Y	Option
Isuzu	D-Max	2012 on	Y	Y	Y
Iveco	Daily	2006-10	Y	Y	Option
LDV	Maxus	2005-09	Y	Y	Option
Mercedes-Benz	Sprinter 906	2007 on	Y	Y	Y
Mercedes-Benz	Vito 639	2003 on	Y	Y	Y
Mitsubishi	L200	2006 on	Y	Y	Y
Nissan	Cabstar F24	2007-on	Y	Y	Option
Nissan	Interstar X70	1998-2010	Y	Y	Option
Nissan	NV200	2009-on	Y	Y	Option
Nissan	NV400	2010 on	Y	Y	Option
Opel	Movano	2010-on	Y	Y	Option
Opel	Vivaro	2006 on	Y	Y	Option
Peugeot	Boxer III	2006 on	Y	Y	Y
Renault	Master III	2010 on	Y	Y	Option
Renault	Maxity	2007-12	Y	Y	Option
Renault	Trafic II	2000 on	Y	Y	Option
Toyota	Hiace	1999-2012	Y	Y	Option
VW	Amarok	2010 on	Y	Y	Y
VW	Crafter 2EX	2006 on	Y	Y	Option
VW	Transporter T5	2003 on	Y	Y	Y

2.5 Accident Investigation

EDR data has also been used to validate the delta-v estimates in accident research databases. The estimates have traditionally been made using computer programmes that calculate the delta-v from vehicle damage measurements and assumptions about the stiffness of the vehicles (or other objects) involved. For example, Johnson & Gabler validated NASS-CDS delta-v estimates for car-to-car and LTV-to-car side impact collisions.

As noted in Table 1.1, EDR data has been applied in accident research by manufacturers and research laboratories, and in accident investigations for criminal and civil cases. Much of the experience with these applications is based in the USA, because there has been greater access to EDR data for longer. Nevertheless, there is significant and growing experience with these applications in Europe.

2.6 Insurance

One particularly noteworthy early user of EDRs was Folksam insurance company in Sweden. Fildes *et al.* [2005] reported that over 180,000 crash pulse recorders had been installed in cars in Sweden by 2005, with data collected from over 700 accidents. Ydenius *et al.* [2013] report that 10 units per year are still being installed on various car models in Sweden. Folksam have used two types of EDR: the first a very basic mechanical device that recorded the movement of a ball bearing, which could be analysed to reconstruct the longitudinal collision pulse. The second device is a more modern electronic unit that records longitudinal and lateral accelerations at 1 kHz, for 500 ms, starting 30 ms before the collision starts. Ydenius *et al.* evaluated the accuracy of the EDR in sled tests and reported that the low-cost accelerometer used gave accuracy close to a laboratory standard accelerometer. Even in these idealised test conditions, the maximum error was 17.3% (EDR delta-v of 57.8 km/h cf. an actual delta-v of 69.9 km/h) in a lateral orientation.

2.7 Current EDR Capability

2.7.1 Cars

The minimum capability of EDRs in cars is essentially governed by Part 563 in US regulations. However, the implementation of EDR in cars originated with manufacturers and many manufacturers record – and make available via the download tool – many parameters that are either optional or not required by Part 563.

The functioning of a recent version of the General Motors EDR system was presented by German *et al.* [2007]:

'Many late model vehicles are equipped with an event data recorder (EDR) that records the time history of the forward or longitudinal delta-V during the crash pulse (NHTSA website). The recorded delta-V is available for most late model General Motors' vehicles and can be downloaded using the Crash Data Retrieval System (Vetronix, Santa Barbara, CA). The on-board EDR continuously monitors the vehicle's acceleration.

'Every 312 microseconds, the EDR samples the accelerometer and when two successive samples exceed about 2 g of deceleration, the airbag deployment algorithm is enabled (AE). Four acceleration samples are averaged over each

1.25 ms period. The resulting values are then integrated to determine the vehicle's cumulative delta-V. Values of the computed delta-V are stored by the EDR every 10 ms.'

In other words, the system samples the accelerometers at 3.2 kHz, delta-v is calculated from data averaged down to 800 Hz (NB: this is not the same as sampling at 800 Hz), and stored in the EDR memory at 100 Hz (presumably by storing every eighth value). The delta-v data presumably could be stored at a higher sampling rate (up to 800 Hz), provided that the storage memory and processor are fast enough to support this data rate.

To investigate the availability of optional EDR data further, 34 event data recorder reports available to the study team were reviewed. Of the 34, half of EDRs recorded and made available acceleration data, which is optional in Part 563, 10 of which included at least two axes (frontal and lateral) of measurement. Seven recordings were at the rather low sample rate of 100 Hz. The maximum sampling rate was 1250 Hz and a number recorded 250 ms of data from multiple axes at 1000 Hz. The 17 EDRs from which acceleration data were available are shown below (single axis unless otherwise noted):

- 2012 Volvo S60: 100 Hz, 250 ms of data (0 to 250 ms); triaxial acceleration data
- 2013 BMW X3: 100 Hz, 300 ms of data (0 to 300 ms); longitudinal and lateral acceleration
- 2008 Chrysler Sebring: 1000 Hz, 250 ms of data (-100 to +149 ms)
- 2009 Chrysler 300C: 1000 Hz, 250 ms of data (-100 to +149 ms); longitudinal and lateral acceleration
- 2009 Dodge Ram (Chrysler): 1000 Hz, 250 ms of data (-100 to +149 ms); longitudinal and lateral acceleration
- 2001 Ford Taurus: 500 Hz, 78 ms of data (0 to 78 ms)
- 2003 Crown Victoria (Ford): 1000 Hz pre-trigger, 1250 Hz post-trigger, 116 ms of data (-50 to +66.4 ms)
- 2003 Ford F350: 1000 Hz, 104 ms of data (0 to 104 ms)
- 2009 Lincoln MKX (Ford): 1000 Hz, 200 ms of data (-99 to +100 ms)
- 2005 Crown Victoria (Ford): 1250 Hz, 150 ms data (-73.6 to +79.2 ms)
- 2007 Ford Fusion: 500 Hz, 58 ms data (0 to 58 ms); 5 acceleration channels recorded (lateral, driver B-pillar, driver C-pillar, passenger B-pillar, passenger C-Pillar)
- Unknown GM model/year: 100 Hz, 750 ms data (-750 to 0 ms); triaxial acceleration data from two events, plus roll rate
- 2013 GMC Sierra: 100 Hz, 1000 ms (-700 to +290 ms); lateral acceleration and roll rate
- 2012 Honda Civic: 100 Hz, 250 ms (0 to 250 ms); longitudinal and lateral acceleration
- 2012 Mazda 3: 100 Hz, 250 ms (0 to 250 ms); longitudinal and lateral acceleration
- 2013 Mazda 3: 100 Hz, 250 ms (0 to 250 ms); longitudinal and lateral acceleration from two events

- 2013 Nissan Versa: 100 Hz, 250 ms (0 to 250 ms); longitudinal and lateral acceleration from two events

Kusano *et al.* [2013] noted that model year 2009 and newer Ford vehicles record steering wheel angle and vehicle yaw rate. Also, review of the EDR files above indicated that many of the optional parameters are usually recorded and that newer vehicles tend to record the status of driver assistance and active safety systems (e.g. whether the system has been turned off or on by the driver and whether it has been activated).

2.8 Accuracy of EDRs

The capability of EDRs, including some basic parameters like recording duration and recording frequency, has changed over time and some of the findings in older publications are not applicable to more recent EDR designs. For example Neihoff *et al.* [2005] showed that the recording duration in earlier EDRs was inadequate even in standard full-width rigid barrier laboratory tests (which are generally of short duration compared to some real world collisions) leading in some cases to very large underestimates of the delta- v . However, recording durations have improved in recent years and some of the gross errors shown in earlier reports are no longer relevant.

This part of the review therefore focuses on more recent publications concerning the performance of EDR systems and assumes that any EDR specified for Europe would be at least as capable as that defined in the most recent version of Part 563. It should be noted that some parts of the VERONICA II EDR specification may be desirable and may exceed the requirements in Part 563, which may address some of the issues raised here and in Section 3.

There are two main streams of literature regarding the accuracy of EDRs (or equivalent systems) in road vehicles: EDRs for cars and EDRs for heavy vehicles. Modern light goods vehicles usually contain airbag modules, at least for a steering wheel airbag, so it likely that they could be fitted with a similar EDR to cars and use similar triggering methods. Therefore, it is assumed that the review of recent car EDR performance will be relevant for light goods vehicles.

A detailed review of recent publications on the accuracy of EDR systems can be found in Appendix C and is discussed below.

2.8.1 Accuracy of EDRs for Cars

Where the recording time was adequate, the estimates of delta- v were generally good. In the J-NCAP tests analysed in Ishikawa *et al.* [2009], the 200 ms recording time of the EDRs was adequate and did not limit the accuracy of the delta- v estimate (although other factors did). However, much of the assessment of the accuracy of delta- v measurements made by EDRs has been based on data from full-width frontal impact crash tests with a rigid barrier. This crash configuration is likely to be a 'best case' for the accuracy of measurements and the recording duration. For example, Gabler *et al.* [2008] reported several offset frontal crash tests with a crash pulse duration exceeding 200 ms.

Indeed, the more recent publications evaluating EDRs in more complex loading conditions demonstrate a lower accuracy and a requirement for a longer recording duration cf. full-width rigid barrier crash tests. For example, car collisions with roadside

barriers (e.g. median barriers) may have a pulse duration of around 300 ms. The recording duration for delta-*v* specified in Part 563 has increased in recent versions and is now 250 ms for the delta-*v* with a window of 300 ms for the maximum delta-*v*.

Assuming that the recording duration is adequate for a particular collision, errors in the delta-*v* estimate may also result from limitations in the range and quality of the accelerometer used (e.g. Tsoi et al. [2013]). Furthermore, differences in the filtering applied to the acceleration data in the EDR and to laboratory accelerometers in standard crash tests will result in some differences in the delta-*v* estimates.

It may be that the current accuracy of delta-*v* reporting with Part 563 EDRs is as good as could be achieved without significant changes to the airbag control module, for instance changes to the accelerometer specification. This would impose additional manufacturing costs on industry but, perhaps more importantly, may force manufacturers to undertake comprehensive re-validation of their airbag deployment algorithms. This may be a complex and costly task, and may include a risk that an effective algorithm is replaced by a less effective algorithm until such time as sufficient real-world validation and tuning – such as manufacturers have performed with existing systems – can be repeated.

It can also be argued that the estimates of delta-*v* in EDRs built to the latest Part 563 specifications will be significantly more accurate on average than those estimated from vehicle crash damage using traditional accident reconstruction techniques, and therefore adequate for the application of EDR data.

Pre-crash speed estimates from EDRs were generally very good in laboratory crash tests, where there is no pre-crash braking or wheel slip. However, studies investigating pre-collision manoeuvres (braking, accelerating, severe cornering or loss of control) showed that the pre-crash speed estimates in these circumstances were far less reliable. This is not unexpected, because the vehicle speed estimate is generally derived from the speed of the transmission output which is not necessarily related to the vehicle speed if the vehicle spins its wheels or skids. A number of authors note that including vehicle yaw rate and ESC activity as standard EDR parameters would highlight that the pre-crash speed measurement may be inaccurate, and may allow the speed to be corrected.

In summary:

- EDR data download was accomplished in all laboratory crash tests that were reviewed, although in several cases incomplete data was flagged by the EDR.
- Pre-collision speed is usually reported to be very accurate when no pre-collision braking involved. This data has usually been derived from laboratory tests performed for legislative requirements or for consumer information such as the various NCAP programmes.
- Pre-collision braking can lead to significant error in the recorded pre-collision speed of the vehicle.
- Pre-collision manoeuvres, such as spins, can lead to significant error in the recorded pre-collision speed of the vehicle.
 - Registration of vehicle yaw rate would be of considerable help with identifying pre-crash vehicle manoeuvres that may have caused errors in the recorded vehicle speed. NB: some current EDR systems already record yaw rate (see Section 2.7). In addition, a yaw rate sensor is fitted to most

new European cars as part of the ESC system, so the recording of this parameter could be achieved with negligible additional cost.

- The estimate of delta- v is typically reasonably accurate in conventional laboratory tests performed for legislative requirements or for consumer information such as the various NCAP programmes, provided that the recording duration is sufficient to capture the whole collision event. This is the case for EDRs meeting the current Part 563 requirements. Nevertheless, errors of up to $19 \text{ km}\cdot\text{h}^{-1}$ (30%) have been reported even for EDRs in recent vehicles.
- The accuracy of delta- v estimates is much more variable in complex or severe (e.g. concentrated loading from a pole impact) loading conditions. This may be attributed to: the characteristics of the accelerometers used in the EDR; large vehicle deformations at the location of the EDR; large vehicle rotations during a collision; etc.
- Nevertheless, the delta- v estimates from EDR are considered to be much more reliable than estimates made using traditional crash reconstruction techniques.
- Seat-belt buckle status was correctly reported in laboratory crash tests by all EDRs that included this function.

Limitations:

Not all EDR parameters can be assessed in conventional crash tests. For example, the correct registration of brake application and engine RPM cannot be assessed, because the engine is usually not running and the brakes are not applied in crash tests.

Analyses of EDR performance in real-world collisions, typically performed as part of product liability litigation, have reported that EDRs do not always correctly record vehicle data, even where the equivalent data has been correctly recorded in conventional crash tests. This has been attributed to software errors, which can be difficult to identify. For this and other reasons, most sources note that an EDR is a key source of information regarding an accident, but that it should not be regarded as the sole source of data about the facts of an accident.

2.8.2 Accuracy of EDRs in Heavy Vehicles

In contrast to the literature on the accuracy of EDRs in light vehicles (principally cars), little information was found regarding the accuracy of crash-phase data for heavy vehicles. The literature for heavy vehicles focuses on: the accuracy of vehicle speed measurements during heavy braking and ABS braking events; on the effect of power loss on event data and the difficulties of data extraction; and on the synchronisation of event data recorded in different electronic control modules within the vehicle. All of the information identified was for US market vehicles and the level of experience with extracting event data from heavy vehicles in Europe seemed to be very limited, which was confirmed during discussions with stakeholders.

It is apparent from the literature that there are similar limitations to the accuracy of vehicle speed measurements as have been reported for cars, particularly on low-friction surfaces and under heavy braking. As for cars, a good understanding of the limitations of the recorded data is essential and implies that well-trained accident reconstruction experts will continue to be required for appropriate analysis of the data.

Furthermore, it is clear that the distributed nature of the recorded data within different vehicle sub-systems and the *ad hoc* data storage formats and interfaces present considerable difficulties compared with those for cars. In addition, raw data files can be tampered with and the tampering cannot be detected (e.g. Johnson *et al.* [2014]). These issues highlight the need for standardisation of the data that is recorded and the interface that is used to access the data, along similar lines to the standardisation that has already occurred for cars. At the stakeholder meeting (see Section 5.3) this standardisation was considered by stakeholders to be the key issue for the implementation of EDRs in European heavy vehicles.

The time synchronisation of data is also less well controlled than in Part 563 compliant EDRs. For example, Plant *et al.* [2013] reported lags between sensor status change and recording of the change in the heavy vehicle data recorder ranging between 0 and 2 seconds. It is likely that this would have to be improved as part of the implementation of EDR in European heavy vehicles in order to be able to realise the full benefits of heavy vehicle EDR, because reliable timing of information is important to many of the applications of EDR data.

2.8.3 Accuracy of the Sensors that are Recorded by the EDR

Directive 2014/45/EU of the European Parliament and of the Council of 3 April 2014 on periodic roadworthiness tests for motor vehicles and their trailers noted that:

'Malfunctioning technical systems and tampering have the potential to have a negative bearing on the safety designed in to the vehicle. A number of technical standards and requirements in respect of vehicle safety have been adopted in the Union. It is necessary to ensure, through a regime of periodic roadworthiness tests, that vehicles continue to meet safety standards.'

It is understood that consideration is being given to checks of components such as steering wheel angle sensors and roll sensors, the correct operation of which is important to systems such as stability control, and which may be recorded by an EDR. This verification of the functionality of electronic safety components would further increase the reliability of EDR recordings.

2.9 Legal Considerations

There is considerable discussion of the legal issues surrounding the application of EDRs, particularly regarding mandatory fitment. In the US, the 'Black Box Privacy Protection Act' [Capuano and Sensenbrenner, 2013] has been proposed with the objective of giving vehicle owners more control over the information collected in a light vehicle EDR. The proposed 'Black Box Privacy Protection Act' would give vehicle owners the option to disable the EDR and would make it illegal for anyone other than the vehicle owner to download or retrieve information without owner consent or a court order. The proposed legislation also requires manufacturers to notify consumers if an EDR is installed in their vehicle, to disclose its data collection capabilities, and provide information on how data collected may be used.

It should be noted, however, that CFR 49 Part 563 already states that the data is owned by the owner of the vehicle and that NHTSA will only access EDR data with consent. Part 563 also requires manufacturers to make a statement about the fitment of the EDR in the user's manual for the vehicle and most manufacturers give further information about

what is recorded, who owns the data and the purposes for which it is used in the user's manual and/or their Privacy Policies⁷. These also tend to state that the manufacturer will not access the EDR without consent.

The proposed legislation was referred to the Congressional Committee on Energy and Commerce and the Committee on the Judiciary for consideration in June 2013, which is the first stage in the process if a bill is to become law.

Green and McClafferty [2005] noted that *'evolving jurisprudence in both criminal and civil jurisdictions appears to significantly limit the owner to a reasonable expectation of privacy in allowing access to this data by many interested parties.'* They further reported that:

'In both Canada and USA, road safety government agencies appear to be very firmly supported in having access to EDR generated data to fulfil their role in improving vehicle and road safety. The long-established record by these government agencies in collecting crash and injury data and protecting the individuals involved from unwarranted intrusion into their personal privacy appears to have resulted in strong public support for data access to promote safety.'

They concluded that due to the long-established practice of collecting and coding extensive collision and injury data on reportable crashes subject to existing privacy legislation, EDR information collected by the Road Safety Directorate is unlikely to be considered 'personal information' as defined in the Privacy Act. They also considered that Canada's Personal Information and Protection and Electronic Document Act (PIPEDA) would be unlikely to apply to the collection of collision data from EDRs.

Interestingly, in discussing the expectation of privacy they give an example of how the balance of individual privacy and societal good has changed over time with e.g. breathalyser tests, where public order and safety have been considered to outweigh any possible invasion of privacy.

The International Working Group on Data Protection in Telecommunications was founded in 1983 in the framework of the International Conference of Data Protection and Privacy Commissioners and operates under the auspices of the European Commission. Membership of the Group includes representatives from Data Protection Authorities and other bodies of national public administrations, international organisations and scientists from all over the world.

The WG published a Working Paper on the privacy and data protection issues of EDRs in vehicles [IWGDPT, 2011]. They recommended that because EDR data reflects not just the technical status of the car (e.g. airbag deployment), but also (directly or indirectly) the behaviour of the driver (e.g. brake actuation, percentage throttle, use or not of seat-belts), then the data are therefore personal to the driver and potentially also to the passenger (e.g. passenger seat-belt usage).

However, they also noted that *'EDRs should only store personal data which are adequate, relevant and not excessive in relation to the purpose(s) for which they are*

⁷ See for example: www.volvocars.com/en-CA/footer/Pages/privacy-policy.aspx and www.mbusa.com/vcm/MB/DigitalAssets/pdfmb/ownersmanual/2014_C_Sedan.pdf page 27

*processed. **The use of anonymised data should be preferred wherever possible.***' (Emphasis added.)

The legal advice in Appendix D shows that the EDR data is not personal because it cannot be used to identify an individual; it only becomes personal if it is linked to an individual or is in the possession of someone who may be able to make such a link. The EDR data would therefore seem to be inherently anonymous unless a link to an individual is introduced. Discussion with the UK Information Commissioners Office indicated that they would also consider the EDR data to be non-personal in and of itself and that it would have to be linked to an individual, or be in the possession of someone who had access to other information that would enable them to establish a link, before the Data Protection Act would apply. The example was given that the data could be provided to an accident research team because it would be anonymous data. The possible inclusion of the VIN in the EDR data would not change this, because an accident researcher would not be able to establish a link between a VIN and a person. The EDR data with a VIN would be personal information if held by the Police, because they would be able to establish such a link.

Indeed, Section 9951 of the California Vehicle Code permits anonymously made examinations, including extraction and use of EDR data, for improvements to the vehicle's safety:

'For the purpose of improving motor vehicle safety, including for medical research of the human body's reaction to motor vehicle accidents, and the identity of the registered owner or driver is not disclosed in connection with that retrieved data.'

Section 9951 also notes that:

'The disclosure of the vehicle identification number (VIN) for the purpose of improving vehicle safety, including for medical research of the human body's reaction to motor vehicle accidents, does not constitute the disclosure of the identity of the registered owner or driver.'

Some authors have questioned directly whether typical EDR data can be considered personal. For example, O'Neill [2003] discusses that fact that much EDR data can be determined by other means [albeit in some cases less accurately]. For example, seat-belt wearing status can be inferred from marks on the seat-belt webbing, at least for higher-severity collision. Braking action is declared via the brake lights, which are a legal requirement on the car, and which are clearly visible to anyone who happens to be behind the lights. O'Neill puts forward the view that *'changing the method of collecting previously unprotected data will not alter the expectation of privacy of that data. In utilizing the EDR data, a privacy interest would not be created where none existed before'*.

This view hinges very much on the exact data that is recorded by an EDR. CFR 49 Part 563 specifies minimum requirements, but does not preclude the manufacturer recording additional, potentially personal, data – although, as noted above, manufacturers tend to state in their Privacy Policies that they will only access and use EDR data with the permission of the owner of the vehicle.

Some authors have concluded that the issue is less about the legal aspects than about public acceptance of EDRs. Indeed, this may change depending on the circumstances that an individual is faced with: for example, a driver may want access to their own or another road user's EDR data if they believe it will exculpate them, or may want to prevent access if the data may demonstrate that they have committed an offence. If the owner, driver and victims of the accident differ, then there may be a conflict of interest regarding access to EDR data.

Finally, there is the question of the admissibility of EDR data in court. Harris [2008] reviewed the situation in the US and found only two instances where EDR data were not admitted: in both cases this was because the data was found not to be associated with the case at hand, not because there was any deficiency in the data itself. In all other cases reviewed, EDR evidence was admitted. However, it is understood that EDR data has been rejected in the US where only a PDF of the EDR report was retained (i.e. not the raw data file). This is because the raw data can be re-inspected using up to date software before evidence is given, which allows an investigator to identify any differences in data interpretation provided by updated software.

For fleet applications, the legal issues are likely to be trivial. Many systems, often much more comprehensive than an EDR, are already fitted to fleet vehicles, whether cars, goods vehicles, buses or coaches. The fitment of internal and external cameras is common on buses and coaches in the UK and cameras are rapidly becoming more common even on goods vehicles. Many systems also use GPS to track the vehicle in real time over the mobile phone network, and this system is increasingly made available to customers. This includes individuals (e.g. bus and coach location relative to a bus stop or station, location of a delivery van) and companies (for tracking deliveries).

Many companies use driver and vehicle monitoring systems to identify driver training needs to reduce fuel consumption, aggressive driving or accident involvement. These fleet systems are less likely to include recording of vehicle accelerations at a sampling rate that is suitable for collision investigations than car EDR, but this is sometimes available as an option.

The application of these systems could be considered invasive if mandated for individuals, but are typically covered by contracts of employment for vehicles driven as part of a driver's job.

2.10 The Effect of EDRs on Driving Behaviour

2.10.1 Introduction

A range of studies have reported an effect on safety resulting from EDR fitment. This effect is brought about by the knowledge that the EDR is fitted to the vehicle positively influencing the driver's behaviour. The studies reviewed in this project reveal that the reported effects vary from little or no effect to substantial benefits.

One of the reasons for the large range of effects found in the literature appears to be the definition of "black box recorders", with some studies referring only to event data recording in the case of an accident and others meaning more comprehensive monitoring systems with driver feedback. Studies on monitoring systems report greater benefits in terms of accident reductions; this is to be expected because the driver knows that driving style is being monitored and that performance may directly affect employment

prospects, whereas recording of accident data that will only take place for rare accident event may not result in the same behavioural change.

Furthermore, the effect of EDRs on safety may also be related to whether the vehicle is being driven for commercial or private purposes in terms of whether the driver is motivated to modify driving style in response to the EDR. All the studies reviewed by TRL in this study related to commercial fleets and the mechanisms acting to bring about this effect may not apply in the same way to private driving.

2.10.2 Effect of EDR Fitment on Safety

In order to apply the evidence-based estimates for the effect of EDRs on accident reduction, TRL reviewed the following studies.

2.10.2.1 Studies on Commercial Fleets

The safety effect of EDRs fitment seems to be confirmed by research. For example, a VDO white paper on accident data recorders [VDO, 1998] lists numerous studies demonstrating a reduction in accidents and considerable reduction in vehicle damage costs in various fleets following the fitting of the VDO UDS EDR system. This included:

- Police fleets in Germany, Vietnam and Austria;
- A bus fleet in Germany;
- Security fleets in Germany; and
- A taxi fleet in Germany

The VDO EDR measured vehicle speed, direction and acceleration, as well as up to 10 status inputs, such as brake application, direction indicators and (for emergency vehicles) activation of blue lights. Storage of this data was triggered either by detection of a collision, pressing a button on the device, or activation of the vehicle's hazard warning system. Therefore, this system was more than recording only in accident events.

Overall, VDO assumed a total reduction in the number of accidents for these professional fleets of 15% and found that this would be cost-beneficial, based on a cost per EDR of approximately 250 DM (130 ECU). The accident reduction figure of 15% was the lowest figure of all the studies with numerical outputs and the cost information was based on data published by VDA in Germany [VDA, 1995].

Some of the studies showed that the accident reduction was maintained over a three-year period, after which the study ended. This included a security fleet and a taxi fleet.

SAMOVAR (2005) reported an effect of around 28% accident reduction (and approximately 40% reduction in repair costs) across a range of fleets. This study involved 850 cars and involved EDRs that monitored behaviour as well as triggering in the event of an accident.

In a study by Elvik (2007) it was calculated that accident data recorders can reduce casualties of all severities 7% in Norway and predicted a benefit-to-cost ratio of 2.15 (Elvik, 2007).

COWI (2006) predicted the following reductions in collision probability: Fatalities 10% (7%-15%), Severe injuries 10% (7%-15%), Slight injuries 10% (7%-15%). BCR

between 3.6-10.7 depending on high/low unit cost, effectiveness and market penetration estimates. This estimate made no distinction between private and commercial fleets.

Other studies from commercial fleets have shown significant effects. For example, Icelandic tests correspondingly showed a 56% accident reduction among equipped mail vans. Furthermore, field trials carried out by the Danish Road Safety and Transport Agency indicated a potential for a 20% (+/- 15%) reduction in accidents and costs. A range of eight fleets reported by Plihal (2007) showed accident reductions between 9% and 66% for a range of commercial fleets including police/security fleets, one taxi fleet and one bus company; the median accident reduction from these studies was 22.5%.

Initial reports from police forces equipping their fleets suggest that fitment of EDRs lead to improved driver behaviour changes in police drivers (Charlton 2005) resulting in reductions in police vehicle collisions of 20%-25% (Northamptonshire Police 2005; Hansard 8 March 2005 col. 1460). Similarly, a Dutch study noted a crash reduction in EDR-equipped fleets of 20%, and a German study showed that young drivers made aware of a black box fitted to a vehicle forced a change towards driving habits (SWOV 1997).

In addition, some general estimates have been made and these also vary in their predicted effect. For example, the VERONICA project stated that the behaviour change associated with EDRs reduces the risk and severity of accidents and repair costs by up to 25%. In contrast, the eSafety working group suggested that there would be no significant effect on accidents. The effect of EDRs on driving behaviour (and therefore safety) can be summarised as follows (see Table 2-2, below).

In addition to the safety benefits that may be brought about by positively influencing the driving behaviour, fitment of an EDR may also offer other safety benefits. For example, EDR data provides objective data for the vehicle state during the pre-crash phase and therefore provided higher quality accident data than is currently available, particularly in terms of understanding the causation of accidents and, for systems that monitor active safety systems, effectiveness of new safety technologies. This has the benefits of better understanding of what the vehicle was doing in the period up to the accident and provides better data for accident reconstructions (for example for police or other companies carrying out such activities) and accident research. With respect to research, EDR data may allow stronger evidence to be used to underpin road safety measures. For active systems it may allow better evidence for new technologies, especially if the EDR records information on the active system status and ideally locational data from any sensing systems.

The safety benefits of EDRs are discussed in Section 10.3.2 and a wider range of efficiency and cost benefits are also considered to be enabled by the use of EDR data are discussed in Section 10.3. The benefits of EDRs with respect to specific vehicle types are also highlighted within Sections 6 to 9, which deal with each vehicle type considered by this project.

Table 2-2: Summary of safety effects of EDR fitment in published literature

Study	EDR type	Fleet type	Effect on accidents
VDO (1999)	Accident data recorder (also with manual activation and activation with emergency lights)	Commercial	Average 15% reduction
SAMOVAR (2005)	Accident data recorder and monitoring systems	Commercial	28% accident reduction
Icelandic mail vans	Unknown	Commercial	56% reduction
Wouters and Bos (2000)	Accident data recorder and journey data recorder	Commercial	Approximately 20% reduction
Elvik (2007)	Accident data recorder	Unknown	Reduce casualties of all severities by 6%-7%
Plihal (2007)	Unknown	Commercial	Eight fleets: 9%-66% reduction (median: 22.5%)
Danish Road Safety and Transport Agency	Unknown	Unknown	20% (+/- 15%) reduction
eSafety working group (2005; page 40)	Accident data recorder	All	"No significant effect on accidents"
COWI (2006)	Accident data recorder	All	Reduce Fatalities, Serious injuries and slight injuries 10% (7%-15%)

3 Technical Issues Related to the Fitting of EDR

3.1 Introduction

The use of EDR data in cars has become commonplace in the USA and is becoming more common in Europe and elsewhere. The EDR acts as a central point for collating data from multiple vehicle systems so that the data that is available is to a common standard and is available via a single download. However, this sort of central EDR is not typically available on heavy vehicles. Instead, event data is also stored within discrete vehicle systems, such as the engine control system and the stability control system and may also be helpful for accident investigations. This distributed data is also often stored in cars for vehicle warranty, maintenance and liability reasons. Finally, aftermarket systems are also available, many of which focus on journey monitoring, but which may also provide useful information for collision investigations. The first part of this section examines whether these options are viable alternatives for delivering the benefits that may be expected of EDR.

The remainder of the section reviews the evidence for the data parameters that should be recorded in EDRs, as well as the reliability and integrity of the data.

3.2 Alternative Technical Solutions for EDR Functionality

3.2.1 Freeze-frame and Sensor Module Data

Freeze-frame data is recorded by some vehicle ECUs when a fault is detected. Essentially, the ECU will record a snapshot of the status of relevant vehicle operating parameters in order to facilitate diagnosis of the fault. Depending on the ECU and the fault that triggers the recording, different freeze-frame data may be available. For example, the ESC controller may detect a fault if a wheel speed sensor is damaged in a collision and record wheel speed, transmission speed, vehicle yaw or other parameters.

Sensor module data is similar, but typically refers to data that has been recorded as a result of a 'decision' by the sensor module, such as the decision to deploy and airbag.

However, Zeidler [2006] urged caution when using freeze-frame and sensor module data, because the correct interpretation of the data may depend on knowledge of the functioning of the electronic systems that may not available other than to the manufacturer.

Coyne *et al.* [2010] noted that freeze frame data may sometimes include information that is useful for a legal case, such as vehicle speed at the time of a collision, but that the extraction, validation and correct interpretation of this data is very specialised, time-consuming and costly. The process requires information that is design-specific and therefore proprietary to the manufacturer of the vehicle or the module. While reverse engineering may allow discovery of the data, this will not always be successful or yield reliable data; therefore, it is not unimaginable that manufacturers would be compelled by a court to take part in the investigation of specific accidents. Coyne *et al.* recommended that the introduction of a standard EDR in the EU would be more desirable.

Spek and Bot [2012] evaluated the accuracy of EDR and freeze-frame data in a series of crash tests. They reported that the EDR vehicle speed data was accurate and that

freeze-frame vehicle speed data was accurate as well, *'with the observation that the speeds may relate to the moment of the crash or to some later instance'*. Therefore, at best the freeze-frame vehicle speed sets a minimum possible speed for the vehicle around the time of the collision event. They also reported that linking of freeze-frame data to a specific accident is not straightforward and may require additional testing of the vehicle in order to establish a link between a specific fault code and the type of collision that occurred. This may not be possible or may be prohibitively expensive.

Although freeze-frame and sensor module data have been used in lieu of EDR data for the investigation of accidents, there are significant difficulties and uncertainties associated with this practice. The additional effort required to validate the data and to associate it definitively with a particular collision may not be justifiable in all cases.

3.2.2 Aftermarket Systems

The SARAC II EC project provided a good overview of the aftermarket systems available at the time [Fildes *et al.*, 2005], including EDRs from Independent Witness, Siemens-VDO UDS, MacBox, DriveCam. The MacBox system incorporated GPS tracking and automatic wireless transmission of location and other data, for eCall-like functionality. The DriveCam device focused on video and audio recording in the event of a severe acceleration (including hard braking), but could not sample acceleration data at sufficiently high rates to determine crash pulse reliably.

With the factory-fit rate of EDRs by manufacturers in the US market exceeding 90%, the market for aftermarket EDRs has shrunk considerably. In Europe there has been a considerable interest from fleet managers and insurers in driver monitoring systems and these are now widely fitted, especially in fleets. Manufacturers of aftermarket driver or journey monitoring systems are beginning to design basic EDR functionality into their systems, particularly relating to measuring the accelerations involved in a collision.

AxleTech International (a subsidiary of General Dynamics) market the Tacholink EDR. Standard data recorded by the EDR includes: vehicle speed, engine RPM, fast acceleration and heavy braking. Optional data may be recorded from the engine, transmission, lighting, safety equipment and so forth via the vehicle's OBD II port and from an optional tri-axial accelerometer. The system also has optional GPS and RF wireless data downloading, which may be relevant for fleet use.

SmartWitness market a two-camera vehicle CCTV system with on-board three-axis accelerometer for £260 + VAT. One camera is a standard camera with a 170° wide-angle, and the other is an infra-red night vision camera with a 10 m range and 120° field of view.

ISOtrack's vehicle tracking systems come with an optional CANBus/FMS that can monitor any data on the bus, including: monitor fuel economy, total fuel usage, total distance travelled, time driving, time idling, harsh braking, over revving, average speed, speeding, torque and time in cruise control.

Not many aftermarket EDR-only systems with comprehensive recording of vehicle system status were identified during the evidence gathering phase of the project.

3.2.3 Digital Tachograph

Reusch [2006] gave an overview of the functionality of the Siemens VDO digital tachograph (DCTO, now known as the Continental DCTO), including the functionality

required by EC 1360/2002 and additional functionality incorporated by Siemens. This included 4 Hz vehicle velocity data (cf. the standard 1 Hz data) recorded from 60 seconds before to 60 seconds after a trigger event, where triggers are defined as each transition from moving to stopping and each deceleration value larger than $3 \text{ m}\cdot\text{s}^{-2}$. This improved resolution for the vehicle velocity data may improve the fidelity of accident reconstructions by giving a better indication of the severity of a collision, the timing of a collision, or increased ability to determine locking or spinning of the drive wheels [Reusch, 2006].

However, Reusch also noted that there are only three buffers associated with each type of trigger; for example, this means that higher resolution data from one stopping event is over-written when a fourth stopping event occurs, and similarly for the deceleration trigger. Essentially, this means that any collision data that is recorded by the system is volatile. For example, it is quite possible that after a collision with a pedestrian or a cyclist the vehicle will be driven from the scene (e.g. for repair or to clear the road) before the data is downloaded and that the data will be lost if the vehicle movement includes three or more stopping events.

The lower frequency (1 Hz) data is stored for 24 hours of driving time (updated to 168 hours in 2008 [Kast, 2008]), so is less volatile, but may still be lost if a vehicle is not impounded following an accident. Reusch therefore recommends that data is downloaded before the vehicle is moved following a collision.

The large mass ratio in collisions between an HGV and a car or VRU typically results in a very low Δv for the HGV. This makes the identification and reconstruction of collisions from 1 Hz or 4 Hz data relatively coarse. Kast [2008] noted that a dedicated EDR, such as that proposed by the VERONICA project, would be a far better solution for the detection and analysis of accidents. Nevertheless, travelling speed at the time of occurrence of a collision remains a very useful parameter.

Furthermore, at the stakeholder meeting (see Section 5.3) it was strongly indicated that EDR functionality for heavy vehicles should be separate from the digital tachograph. This was considered to be technically more straightforward for manufacturers and suppliers, offered greater design freedom, and was a more secure solution.

3.2.4 Summary

Although freeze-frame data is used for accident reconstruction purposes, the effort required to interpret and validate the data is considerable. Much of the application of freeze-frame data found in the literature includes extensive testing, often including crash testing, with nominally identical vehicles in order to validate the accuracy and interpretation of the data. This has typically been performed for high-profile fatal accident cases where the cost of the approach has been justified; however, it is unlikely that this is a cost-effective approach in the majority of cases and is unlikely to deliver the potential benefits of EDR. It is clear from the current status of EDR development in cars and LCVs, and from consultation with stakeholders (see Section 5), that the availability of EDR data is highly preferred.

There are many after-market systems for all vehicle types that sometimes include elements of EDR functionality. However, to date these are primarily focussed on journey monitoring including vehicle location, driving efficiency and camera systems for fleet management and personal liability protection purposes. After-market systems typically do not have the recording resolution or accuracy of dedicated OEM EDR systems and so

offer relatively little information about the crash pulse, vehicle control status and so forth. There may also be considerable legal complications related to mandatory fitment of continuous journey monitoring equipment. It is therefore recommended that these systems are seen as complimentary to EDR, rather than an alternative technical solution.

Both the literature and consultation with stakeholders within this study indicated that EDR should not be integrated with the digital tachograph that is mandatory for heavy vehicles, and that separate technical solutions making use of existing vehicle systems should be prioritised.

3.3 Variables that should be Recorded

3.3.1 Cars

The two main definitions for EDRs are the Part 563 / FMVSS 405 NPRM in the US, and the VERONICA proposals in the UK. The VERONICA II report [Schmidt-Cotta, 2009] noted that:

'Where and when reasonable the project team accepted the NHTSA requirements also for the European EDR requirements; however in important cases, in particular for the pre- and post-crash acceleration parameters the requirement levels had to be raised to the state of the art of comprehensive accident analysis requirements.'

Nevertheless the Part 563 requirements have been updated a number of times (see Appendix A) and a comparison of the latest US requirements and those recommended by the VERONICA projects is shown in Appendix B. It can be observed that there are numerous differences between the two. Possibly the most important of these is the handling of acceleration measurements and the delta-v calculations:

- The FMVSS 405 NPRM focuses on the delta-v parameters in the longitudinal and lateral directions, and leaves it up to the manufacturer whether to record vehicle accelerations and – if so – the recording specification to use. This means that vehicle accelerations may have to be reconstructed from the delta-v data, which is only required to be recorded at 100 Hz. This limits some of the potential applications of the EDR data. Requirements to record vehicle acceleration data were removed to address issues with certifying EDRs due to accelerometer clipping, filtering and phase-shifting.
- The VERONICA recommendations focuses on the accelerations measured in the longitudinal and lateral directions and has no requirements to calculate delta-v parameters because these can be calculated by the investigator from the acceleration measurements. Together with the higher minimum sampling rate of 250 Hz, this means that accident investigators and researchers can derive their own delta-v estimates and don't have to rely on the (usually unspecified) algorithm used in the EDR.

Since the VERONICA projects, the proportion of the US new light-vehicle fleet that is equipped with a Part 563 compliant EDR has grown to over 90%. This means that there is considerable momentum behind the Part 563 specification.

Many of the optional VERONICA data elements ('if equipped' or 'if recorded') are related to airbag or pretensioner deployment, and occupant size classification. Although these systems are commonly fitted to European cars, they are not required (some are mandatory in the US) and are not required for other categories of vehicle.

A comparison between the Part 563 / FMVSS 405 NPRM data elements and the VERONICA-recommended data elements is shown below:

- VERONICA requires lateral and longitudinal acceleration to be recorded at a minimum of 250 Hz and defines a specification for normal acceleration if it is recorded by the EDR. Under Part 563 and the FMVSS 405 NPRM, all three parameters are at the option of the vehicle manufacturer – including whether to record the parameter and the specification if recorded.
 - As shown in Section 2.7, many current US-market light vehicles do record vehicle accelerations, including vehicles with biaxial measurements at up to 1250 Hz for 300 ms, and some with five-channel measurements at up to 500 Hz. It would appear, therefore, that there is no longer a strong technical or cost limitation to recording vehicle accelerations at high sampling rates.
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with changing these parameters from 'optional' to 'required' or 'if recorded'.
- Both Part 563 and VERONICA require a minimum recording interval for the crash phase of 0-250 ms.
 - Recommend increasing the minimum recording interval for longitudinal and lateral delta-v and accelerations from 0-250 ms to 0-300 ms or even 0-500 ms to ensure that the delta-v is adequately recorded for a wider range of collision types. (In Part 563, maximum and time-of-maximum delta-v parameters have to be identified over the 0-300 ms interval anyway).
- Many parameters that are required 'if equipped' in the VERONICA specification, such as vehicle roll rate and ABS activity, are specified as 'if recorded' in the US requirements. That is, the accuracy, resolution etc. are specified if the parameter is recorded, but there is no requirement to record that parameter even if the vehicle is equipped with it.
 - As shown in Section 2.7, many current US-market light vehicles record these parameters and, if fitted, they will be available over the internal vehicle communications buses.
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with changing these parameters from 'if recorded' to 'if equipped'.
- VERONICA requires all the activity of all active safety and driver assistance systems not otherwise defined (such as brake assist, distance control and future systems) to be flagged (if equipped), but defines only one data element. This means that the EDR would flag 'on' or 'active' if any one system showed activity, but that it would not be possible to tell which or how many systems had been active.

- Many current Part 563 compliant EDRs separately record the status of each active safety and driver assistance system. Typically this is a two- or three-state flag that requires minimal storage capacity.
- Recommend defining an open list of data elements such that the activity of each system is flagged and that any new systems are added to the EDR
- VERONICA had additional/more sensitive triggering requirements than the NHTSA triggering requirements.
 - A Part 563 must record data if the trigger threshold is met or any non-reversible deployable restraint is deployed, whichever occurs first.
 - Trigger threshold means a change in vehicle velocity, in the longitudinal direction, that equals or exceeds $8 \text{ km}\cdot\text{h}^{-1}$ within a 150 ms interval. For vehicles that record lateral delta- v , trigger threshold means a change in vehicle velocity, in either the longitudinal or lateral direction that equals or exceeds $8 \text{ km}\cdot\text{h}^{-1}$ within a 150 ms interval.
 - These are stated to be consistent with NHTSA's aim to focus on 'high delta- v crashes', including those that do and those that do not deploy airbags [DOT, 2012a].
 - VERONICA specified several trigger levels from 'corrected' delta- v that were considered to be more likely to capture car-to-pedestrian and HGV-to-car collisions (with low delta- v) without excessive numbers of unwanted triggers.
 - The VERONICA II report gives an example of a collision that was recorded between a large Chevrolet van-type ambulance in use in The Netherlands and a pedestrian. This event (delta- v of 2.53 km/h within 130 ms) triggered the EDR in the vehicle, even though an EDR meeting the Part 563 specification would not have been required to trigger. This was considered to demonstrate clearly the feasibility of triggering EDRs in so-called soft collisions.
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with adopting triggering requirements more closely aligned with those defined by the VERONICA projects.
- Trigger and download date and time were mandatory parameters in VERONICA and may be very important for accident reconstructions for criminal and civil litigations.
 - Recommend adding trigger and download date and time to the mandatory parameters in any EDR specification.
- VERONICA indicated that manual input to the system should not be possible in order to prevent the possibility of tampering.
 - The idea of preventing tampering is important, but this requirement may conflict with Part 563 requirements to lock certain types of data such that it cannot be overwritten, and the need to reset this memory if the car is repaired.

- Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with options for preventing, or as a minimum identifying, tampering.
- Steering wheel angle (steering input) defined in both if recorded
 - This is commonly recorded in current Part 563-compliant EDR and is typically available across the CANBus as an input to e.g. stability control systems.
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with changing these parameters from 'if recorded' to required or 'if equipped'. NB: most new European cars will be equipped with this parameter as part of an ESC system.
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with also recording the actual steering angle achieved if the vehicle uses a steer-by-wire or similar system.
- Part 563 requires 'engine throttle percent' or 'accelerator position percent'. These are not the same and, in fact, both may be very useful for collision investigations, e.g. comparing accelerator position (the demand from the driver) with the demand at the engine.
 - In addition, the engagement of cruise control should also be recorded (if fitted), because cruise control systems may adjust accelerator position with no input from the driver. These are sometimes recorded in current Part 563 compliant EDRs.
- VERONICA incorporates a number of parameters (e.g. siren, blue light) specifically related to emergency vehicles. These are only required if fitted, but would require the EDR for all cars to have capacity to record this data for the very small proportion that are modified to be emergency vehicles and would require a standard for the interface between these aftermarket devices and the EDR
- The occupant classification parameters defined as 'if recorded' in Part 563 and the FMVSS 405 NPRM would be enormously useful, e.g. for research into restraint systems that protect a wider range of occupants (age, sex, size).
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with changing these parameters from 'if recorded' to 'if equipped'. NB: if the vehicle is equipped with these systems it is because it is used within the triggering logic for the deployable restraint systems and therefore would be available to be recorded, although current US-spec EDRs may not be set-up to record them because it is not required.
 - Part 563 requires that the driver must be correctly reported as 5th female or larger. This is assessed in the standard FMVSS crash tests. However, some commenters have noted that if Part 563 is converted to an FMVSS, the correct function of the system will be required at all times. Given that approximately 2.5% of drivers will be smaller than 5th percentile female, there is a possibility that an EDR would correctly judge an occupant to be smaller than 5th percentile female and therefore not meet a strict interpretation of the standard. The commenters suggested that the

standard would only require occupant size to be correctly classified in the FMVSS crash tests.

- VERONICA sets requirements for satellite position information 'if recorded'. It should be noted that position information more sensitive and subject to greater information governance requirements than the other parameters recorded (see Appendix D.2.4).
 - It is recommended that the implications of regulations concerning processing of location data are checked before defining location data requirements for EDRs. This should include the implications for harmonisation of EDR specifications with other jurisdictions, which affects the costs of EDR provision.
- Neither set of data elements requires any recording of elements related to front centre seating positions.
- Replace 'right front passenger' with 'outboard front passenger' to allow for right hand driver cars.
- VERONICA recommended that faults should be flagged, e.g. to exonerate a manufacturer if a car had been driven with a warning light in effect. Gaasbeck [2013] noted in comments to the FMVSS 405 NPRM that fault codes should be included (along with documentation on how to interpret them), because these may fundamentally alter the interpretation of the EDR data.
 - Many current Part 563 compliant EDRs already record important fault codes.
 - Recommend discussion with vehicle manufacturers to identify any costs or limitations associated with requiring the recording of fault codes.

3.3.2 Heavy Vehicles

The VERONICA project [Schmidt-Cotta *et al.*, 2006] noted that EDR properties cannot be identical for passenger cars and heavy vehicles. Requirements for sampling rates, crash sensitivity, emergency power supply, standardised interfaces and so forth are likely to be different for light and heavy vehicles. This is partly due to the different driving and crash dynamics and partly due to the different existing vehicle electronic architectures for the two vehicle types. While VERONICA detailed the parameters that should be recorded, it would appear that the specification is intended to be applied to passenger cars and some of it would not be relevant to heavy vehicles (e.g. side airbag deployment). Consideration should be given to adjusting the parameter specifications for heavy vehicles and to harmonising where possible with existing standards such as SAE J2728 and ATA RP 1214 (see Section 2.3).

3.4 Accessibility and Integrity and Reliability of the data recorded by the EDR

3.4.1 Accessibility and Integrity

With current EDR systems for cars, e.g. those installed in the US, access to the interior of the vehicle is required in order to access a physical connector within the car and download data from the EDR. This provides a measure of security against a third-party tampering with the data. However, if the interior of the car is accessible then there is no further security against tampering. Tampering, in this context, may include deleting EDR data or modifying EDR data. Kowalick [2010] gives many examples of tools that claim to be able to delete or modify EDR data. SAE J1616a (Section 2.3) defines a connector that physically secures the OBD II port to prevent access to the vehicle's electronic systems, including the EDR. This may prevent casual download or tampering

The NHTSA EDR WG [DOT, 2001] reported that, '*There is a need for a system for authenticating and securing event data parameters*' from EDRs used in road vehicles, but this has not been implemented in Part 563.

VERONICA recommended that EDR data is only downloaded by an authorised expert or organisation, which digitally 'seals' the record such that any change to the record can be detected [Kast, 2008]. This approach is used with the Bosch CDR, which downloads and archives the raw data so that a) the veracity of presented data can be confirmed and b) data can be re-processed if an updated to the CDR software is release. However, this would not prevent vehicle drivers or owners tampering with EDR data prior to download by the authorised expert or organisation.

The issue of potential tampering was explored at the stakeholder meeting (see Section 5.3). There was a general view that no additional tampering controls are required for passenger cars because there is probably not the opportunity between the accident and being apprehended to erase or edit the data. Furthermore, in serious collisions downloads often have to be made directly from the airbag control module and the physical access to the airbag module is very difficult without specialist knowledge and bespoke equipment is required.

3.4.2 Reliability

If data from EDRs is to be used to improve vehicle safety and access to justice, then it is important that the data from the EDR can be relied upon, i.e. that the data recorded is an accurate representation of the physical parameters that have been measured. For example, if pre-collision velocity and braking effort are important for a driver to establish their innocence in a particular collision, then it is important that the values and timing of these parameters are accurate.

In the US, CFR Part 563 specifies the accuracy of EDR information. Compliance testing for Part 563 is defined in TP-563-00 [DOT 2012d]. However, comments to the NHTSA NPRM have indicated that the industry considers that the definition of the compliance tests could be improved and that the legislative text implies that the tests defined in TP-563-00 are insufficient to demonstrate compliance. For example:

1. The location of the accelerometer used as the datum in the test procedure may not be representative of that used by the EDR, leading to non-compliance of the

EDR even though both the test and EDR accelerometers correctly characterise the collision at their respective locations.

2. The filtering used in the EDR is different to that used in the tests, which may lead to a non-compliance. Different filtering is used in the EDR because it has been developed specifically to ensure appropriate deployment of the airbags and other deployable restraint systems; it would not be cost effective to change this in the EDR and any changes could be counterproductive, leading to inappropriate deployments.
3. Time-zero definitions are different and it is not clear how to align them. It should be noted that this alignment is routinely performed in research publications using EDR data, but there is not standardised process.
4. The text of Part 563 and FMVSS 405 states that the accuracy of delta-v measurements must be maintained over the range ± 100 km/h for both longitudinal and lateral collisions. This greatly exceeds the delta-v range in the TP-563-00 test procedures, which are based on standard legislative crash tests. Indeed, commenters have noted that this implies that the EDR delta-v accuracy must be demonstrated for lateral car-to-car impacts conducted with a bullet vehicle velocity of at least 200 km/h, which is not practicable. It would also be difficult (and probably not necessary) to protect the EDR in a crash of this severity.

If EDR are to be mandated in Europe, it would appear that definition of the test procedures and requirements for demonstrating the compliance and reliability of the EDR measurements would be an important part of the definition of any legislation.

4 Access to EDR Data, its Use and Confidentiality Issues

4.1 Introduction

One of the most important issues frequently cited with respect to EDRs and the data recorded by them is data protection requirements and how data can be accessed and used within the existing legal frameworks. Published literature on this subject is often inconclusive and sometimes conflicting, not least because the requirements of Directive 95/46/EC are implemented at the national level, meaning that there is the possibility of differing interpretations.

For this reason, this study aimed to analyse the issue of access to EDR data, its use and data protection issues by assessing the situation six European jurisdictions: United Kingdom, France, Germany, Italy, Spain, and Austria.

The research questions that the project addressed were as follows:

- Who owns the data recorded by the EDR system?
- Who has access to the data recorded by the EDR system?
- Under which circumstances will these data be accessible?
- What are the acceptable uses of the data?
- What are the data protection concerns and how can they be addressed?
- What is the adequate/feasible legal framework to address these issues?

Since the pertinent issues require specific legal expertise to produce an accurate response to the research questions, TRL sub-contracted a UK legal firm to provide responses to these questions. The full legal report for the situation in the six countries can be found in Appendix D; the key aspects from the legal review are summarised in the following sections.

4.2 Data Protection and EDR Data

In Europe, national laws in each country implement the requirements of European Directive 95/46/EC in terms of the processes and controls required for personal and sensitive data. This means that EDR data only becomes 'personal data' if it can be linked to an individual. Thus, anonymised EDR data is not personal data, but might become 'personal' or 'sensitive' data in conjunction with other data. This position held in each of the six European countries included in this review.

Therefore, if the person or organisation using the data has the ability to link the data recorded by the EDR with other data sets that allow identification of individuals (e.g. police or other enforcement authorities), they become a 'data controller' and must comply with national implementation of the Act to ensure the protection of personal and/or sensitive data. Whether or not EDR data becomes 'personal data' is therefore wholly dependent on the person or organisation storing and using the data, and whether

they have the capability to use other data to link EDR data to living individuals. The EDR data itself does not constitute personal information.

This advice appears to be at odds with the statement of the International Working Group on Data Protection in Telecommunications (see Section 2.9), but is supported by advice from the UK Information Commissioner's Office (see also Section 2.9).

4.3 EDR Data Ownership

The ownership of EDR data is not well defined in each of the European countries considered and there are a number of parties (e.g. vehicle owner, vehicle driver, vehicle manufacturer etc.) who could claim to be the owner. Legal advice was not conclusive on this point, but the most consistent opinion was that whoever owns the vehicle in which the EDR device is installed, also owns the EDR device and, by extension, any EDR data recorded on it. However, in Spain the owner was considered most likely to be the data subject (who is not necessarily the owner of the vehicle). It was also noted that the ownership of the EDR data is determined contractually in some circumstances or for some particular fleets of vehicles (e.g. by an employer or insurance provider).

Ownership of EDR data is therefore an area that would benefit from clarification. Currently, the issue of ownership is likely to have to be determined on a case-by-case basis, depending on the facts in any given situation, but was considered most likely to be the owner of the vehicle (EDR) in most European countries. This is in line with the position taken in the US, where the vehicle owner is defined as the owner of the EDR data.

4.4 EDR Data Access

Persons/entities/organisations (e.g. vehicle owners, vehicle drivers, employers, police or accident investigators) who have access to the OBD port in the vehicle may be able to retrieve and interpret EDR data, provided they have the correct equipment to read it. These may be those who own the data, but because this is not well defined in Europe, access is determined primarily by those physically able to access the OBD port in the vehicle (or directly access the EDR, which is generally a lot more difficult). At present, there is no standard approach to the security of EDR data and, if EDR data download is enabled by the vehicle manufacturer, it can be read by commercially available tool. This is an area that would benefit from more stringent controls to prevent EDR data being deleted or changed such that it is no longer an accurate record, although stakeholders considered it very unlikely that the average driver would have the opportunity, tools, or knowledge to manipulate EDR data.

4.5 Uses of EDR Data

EDR data has a range of potential value, from determining responsibility in a criminal investigation to providing accurate information for accident research to improve vehicle safety. If the data could identify any living person then the person or organisation storing and processing the data (the 'data controller' under the 1988 Data Protection Act) would need to comply with the necessary requirements for personal or sensitive data as specified by the Act and implemented in the national law of all European countries,

However, EDR data, in isolation, does not contain personal data and therefore could be used for accident research. In the US, some States have clarified this further. For example, Section 9951 of the California Vehicle Code permits anonymously made examinations, including extraction and use of EDR data, for improvements to the vehicle's safety:

'For the purpose of improving motor vehicle safety, including for medical research of the human body's reaction to motor vehicle accidents, and the identity of the registered owner or driver is not disclosed in connection with that retrieved data.'

Section 9951 also notes that:

'The disclosure of the vehicle identification number (VIN) for the purpose of improving vehicle safety, including for medical research of the human body's reaction to motor vehicle accidents, does not constitute the disclosure of the identity of the registered owner or driver.'

In general, the data protection concerns are considered to be dealt with adequately by the provisions of Directive 95/46/EC in terms of the responsibilities of data controllers and how the data should be used, processed and stored. In all cases, the data subject or owner has a right to know what personal data is being held and how it is being used, except in certain activities relating to criminal or justice proceedings. This appears consistent in the countries reviewed and also appropriate in terms of the use of EDR data.

4.6 Adequacy of the Legal Framework

The US has already defined specific legal requirements for EDRs. For example, 14 US States have specifically enacted legislation relating to EDR devices and prohibiting the download of data from EDR devices in vehicles, except in certain limited circumstances by certain third parties. References for this US legislation are presented in Table 4.1.

Furthermore, a draft bill was proposed to the US Senate in January 2014 to limit the retrieval of data from vehicle EDR devices, (the "S1925 - Driver Privacy Act"). This draft bill addresses, among other things, the ownership of data recorded by EDR devices installed in vehicles, the privacy of such data, the circumstances in which such data can be accessed and used by third parties other than the owner or lessee of the relevant vehicle and limitations on data retrieval regarding data that is recorded during an 'event' (as defined in section 563.5 of title 49, Code of Federal Regulations). The draft bill also makes provision for an EDR study to determine the length of time EDR devices installed in passenger motor vehicles should capture and record for retrieval vehicle related data in conjunction with an event in order to provide sufficient information to investigate the cause of motor vehicle crashes. It should be noted that the data recording duration necessary for different types of investigation is already established and has been considered in the development of Part 563.

Table 4.1: US legislation relating to EDRs

State	Reference to code
Arkansas	Code 23-112-107, 1 st September 2005
California	Code 9950-9953, 22 nd September 2003
Colorado	Statutes 12-6-4, 2 nd June 2006
Connecticut	Statutes 14-164aa, 1 st October 2007
Maine Statutes	Statutes 29A-1-17-3, 14 th July 2006
New Hampshire	Statutes 357-G, 1 st July 2006
New York	Laws 4A16 416-B, 16 th September 2005
Nevada	Revised Statutes 484D.485, 1 st January 2006
North Dakota	Code 51-07-28, 1 st August 1 2005
Oregon	Statutes 644, 1 st January 2008
Texas	Statutes 547.615, 1 st September 2005
Utah	Code 41-1a-1501, 14 th May 2013
Virginia	Code 46.2-1088.6, 1 st July 2006
Washington	Code 46.35, 1 st July 2010

In Europe, the main concerns relating to EDR data are those related to privacy. This review has confirmed that EDR data is only personal data when the data can be linked to an individual, and this is only the case if the entity in possession of the EDR data also has other information that can identify the person. In these circumstances, the entity accessing the data is likely to be an authority who has reason to access the data as part of investigative or legal remits and should other data (such as vehicle registration and access to licence information) enable identification of an individual, national law enforces the provisions of Directive 95/46/EC, which provide appropriate controls for personal data.

The ownership of EDR data requires clarification as this is not well defined, either at a European or national level, and is currently determined on a case-by-case basis, with the general opinion of legal experts that this is usually the vehicle owner. A definitive definition at a European level would be advantageous to clarify ownership status.

Access to EDR data is currently possible if the manufacturer enables access to the data and the user has the correct tools and knowledge to access the vehicle and interpret the data obtained. This is considered appropriate for authorities or persons requiring access to data for legitimate purposes; the manipulation of EDR data by the average driver is considered very unlikely. However, an IEEE standard exists for physically preventing unauthorised access to the connector should this become an issue that warrants preventative action. Previous EC Projects (VERONICA I and VERONICA II) recommended that the EU should introduce a Directive regarding the implementation of event-only EDRs (i.e. recording data associated with collisions and other similar events, without continuous driver or journey monitoring).

5 Stakeholder Consultation

5.1 Introduction

Consultation with stakeholders formed an important part of this project. TRL collected information in three main ways: by means of an online questionnaire, a stakeholder meeting/workshop, and direct communication.

The online questionnaire was developed to collect a wide range of current technical information on EDRs as well as the opinion and viewpoint of those consulted (see Appendix G for a list of the questions included in the online questionnaire). It should be noted that some of the questions were general questions for all and others were specific questions for certain stakeholder groups. When completing the questionnaire online, the respondent was guided through the questions relevant to their expertise.

A wide range of stakeholders were identified and these were categorised as follows:

- Vehicle manufacturers of each vehicle type and their associations
- Suppliers for each vehicle type and their associations
- Consumer associations
- Regulators and policy makers
- Road user groups
- Road safety groups and associations
- Fleet operators and associations
- Police forces and associations
- Periodic Technical Inspection
- Insurance companies and associations
- Accident investigators and accident research
- Solicitors and legal representatives

193 individual stakeholders from 106 companies or organisations were identified and invited to participate in the online questionnaire by email (see Appendix E for a list of affiliations for the stakeholders consulted and Appendix G for the content of the online questionnaire). Of these, 52 provided some level of response. The full stakeholder list was also invited to a face-to-face meeting to go over the results of the questionnaire, but also to review and gather information directly from stakeholders. The results from the questionnaire were used to develop a technical agenda for the face-to-face meeting and informed this phase of the information gathering. Throughout the project, but particularly after the stakeholder meeting, direct communication was made with a range of stakeholders to solicit or discuss specific information.

5.2 Questionnaire

The questionnaire provided an initial level of information and many respondents only partially completed the questionnaire and left many questions unanswered, presumably because of its necessarily extensive and detailed in content. In total 52 stakeholders provided some kind of meaningful response, although about twice this number started the questionnaire. Many of the questionnaire fields were deliberately designed as open text in order to provide information that could be used in the course of the project. This worked well although this approach made analysis of the questionnaire results difficult.

The stakeholders who provided a response to the online questionnaire were found to represent a broad cross-section of the stakeholder categories (see Figure 5-1).

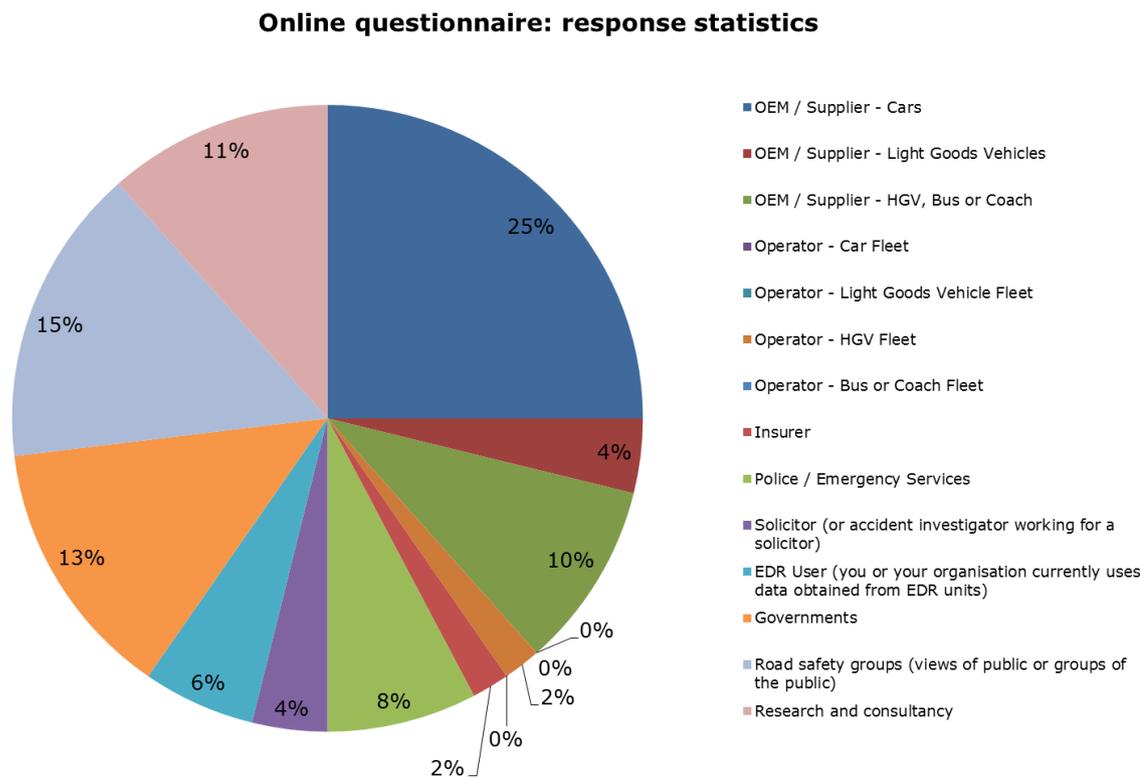


Figure 5-1: Distribution of stakeholder type providing response to online questionnaire

The main findings of the online questionnaire were used to define the technical approach and input to the stakeholder meeting and proved effective at forming the type and range of questions to be discussed with stakeholders. The meeting confirmed the findings of the online questionnaire in a more complete and detailed manner and for this reason the findings of the questionnaire are also covered by the main issues described in Section 5.3.

5.3 Face-to-Face Meeting

As part of the consultation for the project, a stakeholder meeting was held on 5th June 2014 to obtain the opinions of stakeholders on a range of technical questions on Event Data Recorders.

The meeting was very successful: 36 stakeholders from 25 organisations attended (see Appendix F for a list of those stakeholders that attended the meeting) and this provided a good level of information exchange. This section provides a high-level account of the main issues discussed at the meeting; this is not intended to reflect all representations made at the meeting, but to provide a summary of the key findings, areas of consensus, and points on which the views of the stakeholders varied.

5.3.1 EDR Fitment, Technical Aspects and Specifications

5.3.1.1 Passenger Cars

There was unanimous consensus that EDRs are equipped to “all or nearly all” new passenger cars sold in Europe and that these record data that is comparable to that required by Part 563. This is because either a Part 563 specification EDR unit is supplied with the airbag control module, or the one fitted has the capability to record the same types of data as the Part 563 specification. Numerous examples were given regarding first-hand experience of accessing EDR data using the Bosch tool (it was also noted that Kia and Hyundai also have specific EDR access tools).

Subsequent to the stakeholder meeting, ACEA clarified their position and stated that only a very small number of vehicles in Europe are fitted with an EDR certified to the Part 563 regulation (those vehicles that are also sold in the US) and that all others are not equipped with an EDR. This differs from information forthcoming from other stakeholders both at the meeting and subsequently (including suppliers and some manufacturers). Furthermore, accident investigation teams at TRL and elsewhere commonly use EDR information from European cars, including those not sold in the US. This evidence shows that most new production cars have EDR functionality, although the data is not accessible other than via the original manufacturer or supplier. The exceptions to this are Volvo, Toyota and Honda (Civic only), who have enabled access to the data via the Bosch CDR tool. It should be noted that Toyota has backdated the access to the data and in some cases data can be extracted for vehicles over 10 years old. Some manufacturers also declare the data recorded, and the uses that it may be put to, in the owner’s manual⁸.

There was agreement that the EDR system architecture should not be specified, and that this should be left to the manufacturer to decide how to integrate into the vehicle. However, the data recorded by the EDR and access to the data should be standardised as this promotes cost savings in manufacturing as well as making the exploitation of the data easier and more effective.

It was discussed that there was no reason why any European EDR specification should not improve on Part 563 in terms of sample rate, parameters recorded or the facility to trigger on accidents with vulnerable road users, although such changes would also result

⁸ E.g. http://www2.mercedes-benz.co.uk/content/unitedkingdom/mpc/mpc_unitedkingdom_website/en/home_mpc/passengercars/home/ownership/care/interactive_owners_manual.html

in increased costs. Suppliers indicated that it was feasible to use pedestrian detection systems to provide a signal to the EDR for triggering purposes. Such systems were not on the market when Part 563 was developed and the view was expressed from more than one stakeholder that all the available information from Advanced Driver Assistance Systems (ADAS) and active safety systems should be used where possible. There was agreement that there was no technical reason why the function, status and activity of active systems could not be recorded.

In line with future road safety targets, EDR information provides an improvement in understanding accident causation and therefore also the appropriate countermeasures. There was a consensus view that legislation was needed to realise the benefits of EDRs – especially for VRU accidents – and this requires a minimum specification for:

- The data (type, rate) recorded by an EDR;
- The interface/tool used to access the EDR;
- The triggering conditions for the EDR; and
- The number of events stored by the EDR.

However, one stakeholder expressed the opinion that making the EDR mandatory was not required because the EDR itself does not solve any safety issues and the broad solutions for road safety improvement are already known. Several stakeholders considered that it may not be necessary to mandate fitment, because most vehicles are fitted anyway and most of the potential benefits can be realised without 100% fitment.

It was suggested that the most important factor was the standardisation of the data, access, and triggering conditions; this could form the 'first step' with a decision as to whether or not to mandate EDR fitment as a 'secondary step'.

5.3.1.2 Light Commercial Vehicles

There was much less information forthcoming about light commercial vehicles. The consensus view was that M1-derived vehicles were probably all fitted with EDRs because they also have an airbag control unit and have a system architecture similar to M1 vehicles, but that other N1 vehicles might not be fitted (when not equipped with an airbag control module). There was no specific information from the OEMs and suppliers at the meeting.

5.3.1.3 Heavy Commercial Vehicles

Heavy vehicles have a different system architecture (compared to cars), with distributed information stored in various subsystems around the vehicle, e.g. the engine control unit and the AEBS control unit. EDR-type data is present on many or most of European heavy commercial vehicles, but no specific information was forthcoming.

An alternative approach to EDR triggering is required for these vehicles required because even if equipped, the airbag is not an appropriate trigger for the EDR on heavy vehicles.

In a similar way to passenger cars, a strong view was expressed that any legislation should specify the technical requirements of the system, but not how the system was organised within the vehicle. Furthermore, it was agreed that the EDR should not be integrated within the digital tachograph because there is not enough space within the

design package of the tachograph and the risk of tampering would be reduced if the EDR and digital tachograph functions were separated. One stakeholder indicated that the EDR data was more secure when distributed in the systems around the vehicle, although it was acknowledged that the way in which the data was accessed could be simplified and it would be beneficial if it could be accessed via a single download.

5.3.2 EDR Data Access and Use; Data Protection and Confidentiality Issues

In general drivers are unaware that their vehicle has an EDR, what data is recorded, and who has access to the data. It was highlighted that this is a general concern. At present, the OEM typically provides a statement in the driver's manual regarding the data that may be stored in the vehicle, but the feeling was that this was probably not detailed enough, and that most drivers are still unaware because they do not read the manual. Several stakeholders thought that general consumer awareness of EDRs should be increased.

Attendees agreed that the data protection situation in Europe was clear and well-defined: EDR data is not personal unless the person accessing/using the data is also in the possession of information that can link that data to an individual. The European Directive on data protection requirements are implemented at the national level and these form an effective framework.

Comments at the meeting reflected TRL's legal findings regarding ownership of the data and the situation in the US; the consensus view was that the owner of the vehicle also owns the data. However, there is a need for this arrangement to be formalised, as this is the first step in accessing the data. Specific fleets (commercial fleets for example) already include contractual requirements that specify the ownership of the EDR to the vehicle owner. Some insurance may also have clauses that allow the insurance company access to the data.

Stakeholders agreed that the owner of the data should have power over the data, unless a crime is suspected or is being investigated, in which case the authorities can access the EDR data as evidence. It was also agreed that the owner (or the driver if not the owner) should have transparency regarding who holds the data in question and what they are using it for.

Some views were that the driver that created the data, if they are not the vehicle owner, should also expect some say on access to the data. For example, in the case where they are different, the owner may be required to obtain the permission of the driver to provide a third party access to data, unless the police or the courts request the data.

OEM access to EDR data (for example during servicing) was discussed and a view expressed that this should not be allowed without the permission of the owner, although preventing access would in practice be difficult and outside the control of the vehicle owner. However, the OEM use information stored in the vehicle in order to maintain and service the vehicle appropriately and some vehicles have a variable service interval, which is only possible if the vehicle is monitoring how it is used. The benefits to the manufacturers in using the information to improve the safety of future vehicles can also only be achieved if the OEM has access to the data.

One stakeholder cited the situation of one manufacturer that stores vehicle data in 'cloud storage' off the vehicle. A view on the acceptability of this was not reached, but this

raises the issue of the vehicle owner not having access control over the data and should be considered for the future.

Data security was raised in relation to CANBUS data being accessible externally. One stakeholder indicated that part of the CAN network was accessible via mobile data, but that the EDR was not on this network. The airbag control module is protected and not open to hacking because by design it is crucial that the data cannot be manipulated. Data security is crucial for EDR data and for this reason the storage location should be on a secure CAN and not merged with any other systems (eCall on cars, digital tachograph on heavy commercial vehicles). One stakeholder commented that excessive controls on EDR data were not required over and above what is already implemented as part of good design.

It was agreed that EDR data can be erased or overwritten with dummy data and that tutorials exist on the internet showing how to do this. It was suggested that the data should be read only once written, but it was not clear if this would conflict with the way current EDRs record data.

There was a general view that no additional tampering controls are required for passenger cars because there is probably not the opportunity between the accident and being apprehended to erase or edit the data. Furthermore, the physical access to the airbag module is very difficult without specialist knowledge, and even then is still a significant job.

It was agreed that national law governed the access to data and the law of the country in which the accident occurred would prevail. It was highlighted that the national laws throughout Europe might not be at the same level and this might have implications for some citizens, although those aspects with European Directives (e.g. data protection) have minimum requirements that apply throughout the EU.

There was strong agreement around the table that access to the EDR data could be standardised, although because there are currently only three different access tools (for passenger cars) there is no requirement for further standardisation. For heavy vehicles, it would be preferable to be able to access the data from a single location. For all vehicle types protection on the access point (both physical and encryption of the data) would provide security to prevent tampering, but such measures were generally considered unnecessary by stakeholders.

5.3.3 EDR Safety Benefits and Costs

Monitoring systems have been shown to bring about reductions in accidents; however, there is no such evidence base for EDR. Benefits in the literature relate to commercial fleets and there is not the same evidence for private fleets. More research is required on the effect of EDRs on driving behaviour in private fleets.

One stakeholder had a strong opinion that the EDR does not provide a safety solution because the causes (and countermeasures) for accidents are already known: having EDR data on these accidents will not change the cause or provide a solution. Other stakeholders noted that EDR data from accidents would be important for research to establish the relative efficacy of different countermeasures, allowing manufacturers to focus on those that provide the greatest benefit. This would also assist regulators in having robust evidence on which to base action to encourage the systems that realise the greatest benefits.

There was consensus that an up to date specification for EDR should use all the information available and that the data provides an improved quality of evidence for accident causation and system effectiveness.

There was agreement that EDR data is not a 'silver bullet' in terms of accident reconstructions and that other data will always be required in conjunction with the EDR data. Several stakeholders highlighted that EDR data would reduce the cost and increase the accuracy of accident reconstructions significantly.

Many benefits (access to justice, better reconstructions) are very difficult to monetise. The difficulties of this were highlighted, but the overall impact depends on how close to break-even the quantifiable costs and benefits lie.

5.3.4 EDR Implementation Aspects

Differences were highlighted between the Part 563 and "Veronica" specifications in terms of recording delta-v or acceleration and "if recorded" specifications. It was agreed that without acceleration data, derivation of crash pulses would be possible, but that resulting pulse reconstruction would be relatively coarse because the recording rate for delta-v is low (100 Hz). It was highlighted that delta-v is the best measure of crash severity. Greater benefits would therefore be possible by following the Veronica specification, but a view on whether these outweigh the benefits of harmonising with Part 563 was not reached at the meeting, although it is known that some US systems also record acceleration in addition to delta-v even though they are not required to do so.

The group again agreed that all the data pertaining to ADAS and active safety should be recorded and there is the scope and to go further than that specified by Part 563. Since the vehicle already records these, there is no additional cost for these parameters.

CFR 49 Part 563 states that the "data must be available". The unanimous view was that the wording of any European specification could be tightened to prevent EDR being sent to manufacturers for decoding report. This is relevant for legal cases, where this process breaks the chain of evidence.

There was agreement that specific training is required in the downloading and interpretation of the EDR data, but the current arrangements within each country regarding people authorised to access the data are sufficient.

For heavy vehicles, the EDR data should be stored (or accessed from) a single location so that the download of EDR is easier.

Validation of the EDR system and the resulting data must be made in real crashes. This could be achieved for most parameters by recording in the legislative frontal and side impact crash tests. Euro NCAP tests would also provide an opportunity to test at higher impact speeds. It was noted that not all functionality of an EDR can be validated this way.

The use or integration of the VIN being linked to the EDR data would be a benefit for legal cases and circumstances where the chain of evidence is important. However, the VIN is not generally required for research purposes (although some make/model/fitment might be included) and the inclusion of the VIN may make the data personal in conjunction with some other information.

The consensus view was that a centralised European database would not be required and as long as the data specification was standard, data could be compared as required. Creation of a database of EDR validations was flagged as a useful tool to compare EDRs.

5.3.5 Conclusions

The main conclusions of the stakeholder meeting can be summarised as follows:

- All (or almost all) new passenger cars are fitted with EDRs that record data comparable to Part 563 and therefore the fitment costs (for these vehicles) have already been incurred. Light commercial vehicles (M1-derived) are also generally fitted with EDRs that meet or nearly meet Part 563 requirements. Those light commercial vehicles with optional airbags (that are not fitted) do not have EDRs. Large commercial vehicles are all (or nearly all) equipped with distributed systems that store EDR-type data.
- Some specific vehicles may not be equipped with EDRs and for these vehicles, there will be additional costs to meet any requirements for mandatory fitment.
- EDR data should be specified in terms of what is recorded, how it is recorded, how recordings are triggered and how recordings are stored. There is no reason why these data specifications should not be mandated; the fitment of EDRs could be mandated at a later step, as EDRs are already fitted to the vast majority of vehicles. Nothing in any European country (technical or legal) prevents EDRs being made mandatory. The benefits to research do not require 100% fitment; however, for some issues (such as access to justice) it may be expected that the same quality of information is available to prove innocence or secure a conviction.
- There is no reason why any European specification should not improve on Part 563 in terms of sample rate, parameters recorded (including active safety systems) or the facility to trigger on collisions with vulnerable road users. Suppliers indicated that it was feasible to use pedestrian detection systems to provide a signal to the EDR for triggering purposes. Such systems were not on the market when CFR 49 Part 563 was developed and the view was expressed from more than one stakeholder that all the available information from Advanced Driver Assistance Systems (ADAS) and active safety systems should be used where possible.
- Additional requirements for a European EDR specification will result in increased costs (as yet unspecified) for changes to triggering parameters and/or the integration of new signals (e.g. from active safety devices).
- The system architecture of the EDR should be left to the manufacturer and should not be integrated with other systems (eCall on cars and digital tachograph on heavy vehicles).
- The owner of the vehicle is considered to be the owner of the EDR data (as is the case in the US) although there were some differing views on this. Clarification of the ownership of EDR data would be welcomed and would improve the procedure to access the data.
- EDR data by itself does not constitute personal data. However, if any individual can be linked to the data then this becomes personal data and the European data

protection directive applies. This is implemented at the national level and compliance was considered appropriate and effective to ensure data protection.

- A range of safety benefits of EDRs have been identified relating to more accurate and cheaper accident reconstructions for research, information to assist manufacturers in improving design and safety systems and more effective access to justice. While there is evidence that a driver's behaviour in response to EDR fitment leads to a reduction in collisions in commercial fleets, the same level of evidence is not present for private fleets where the motivations for safer driving are different.
- There is scope for inclusion of active safety systems in the EDR data specification. This data is recorded by the vehicle already and would not result in any additional cost to include codes for: system function (switched on or switched off), system warning and system activation (if different).
- Availability of the EDR data should be via a harmonised tool (or small number of tools) and the data should be accessed via a single point, the security of which should be left to the manufacturer, but ought to be on a protected CAN and have appropriate security to prevent manipulation. The specification should exclude the manufacturer decoding the EDR and providing a report because this breaks the chain of evidence important for legal cases.
- Certification of download tools and specific training for the download and interpretation of EDR data are required to ensure accuracy of the data and to realise any legal benefits. The requirements for the individuals authorised to access the EDR data are covered adequately by existing arrangements.
- Tampering of EDR data is currently possible with expert knowledge and tools. However, the 'man on the street' is unlikely to have the knowhow and opportunity to tamper EDR data. Physical and/or data encryption security are possible; this should be left to the manufacturer and should not conflict with the requirements and ease of access to EDR data download for those approved to do so.
- Linking the EDR data with the VIN provides a benefit for legal cases and chain of evidence. VIN data may also provide some data for research (make/model/fitment) but also may make the data personal if the VIN could be linked to an individual using any other data held. The VIN should be recorded if possible and removed from any anonymised data where the VIN is not necessary to realise the potential benefits.
- A central European database of EDR data is not required and was considered to be an unnecessary cost. Provided the EDR data specification is harmonised, data can be compared between countries using similar exploitation models that exist for accident data and other European statistics. However, a central database of validation data may be useful.

6 Heavy Goods Vehicles

6.1 Current Practice

US

Engine control units (ECUs) and engine control modules (ECMs) on Large Goods Vehicles in the United States are capable of recording and storing a small range of data relating to the last stop and a 'hard stop', and have been capable of doing so for some years (Bayan *et al.*, 2009). This was implemented because emissions regulations meant that monitoring and measurement of engine parameters and the SAE J1939 standard was used by diesel engine manufacturers to deliver engine and emission efficiencies. Most US engines have some sort of short-term storage location and a time frame for capturing specific data elements that are kept after an event, should one occur [Bowman *et al.*, 2010].

Current US HVEDR systems have been developed as individual solutions by individual users and this has led to issues of incompatibility. For example, SAE J2728 provides voluntary guidance that 39 data elements should be recorded by HVEDRs, but only approximately 25% of these have been implemented in current systems so there is considerable scope for improvement in this respect. Furthermore, current HVEDRs collect vastly differing quantities of data elements, with some systems collecting less than 80 and others collecting over 450. Also general access to the data is problematical because there is no specific system architecture or standard tool that can be used. Instead, bespoke tools and software are required to access the HVEDR data depending on the HVEDR system.

However, despite these difficulties Bowman [2010] reports that the recording of EDR data has had a significant impact on vehicle safety by helping law enforcement, engineers, and researchers reconstruct events of a vehicle crash. This information is used by:

- Enforcement authorities to have an accurate understanding of the accident causation and liability;
- Automotive authorities to identify faults and to manage vehicle recalls
- Safety researchers to determine accident causation and to identify ways in which accidents can be mitigated or avoided;
- Insurance companies to determine accurate claims and reduce legal costs; and
- Fleet operators to monitor driver behaviour and develop effective training or corrective actions.

However, data recorded by the ECU/ECM is variable between manufacturers [van Nooten and Hrycay, 2005] and the data has been shown to under-record vehicle speed during braking because of longitudinal slip [Bayan *et al.*, 2009].

Bowman *et al.* (2010) indicate that EDRs have been incorporated into a range of safety systems, including crash mitigation systems, airbag control modules and driver monitoring systems, but also note that the adoption of EDR technologies has not been

consistent with respect to the type of goods vehicles or the systems in which they have been implemented.

Based on information from Industry collected by Bowan *et al.* [2010], the most frequent data used for triggering recordings in EDRs (or EDR-like ECU systems) are: airbag events, antilock brake system (ABS) events, or acceleration or speed changes.

The US standard SAE J2728 provides guidance about sampling rates for HVEDRs and requires a minimum sampling rate of 10 Hz for a duration of not less than 15 seconds either side of an event. Based on questionnaire and interview data collected by Bowan *et al.*, manufacturers are using ECUs rather than HVEDRs and are not necessarily complying with the requirements of this voluntary standard.

Bowman *et al.* [2010] identifies that the challenges related to HVEDRs are in their implementation; more specifically:

- Standardisation of the data elements recorded by the HVEDR;
- Standardisation of the data retrieval tools used to access the data from the vehicle; and
- Equipping HVEDRs on the full range of heavy vehicles in the fleet.

Improvements in the technology of HVEDRs in terms of the sampling frequency, data storage capabilities will lead to increased data resolution of events during and leading up to a crash. This will improve the accuracy and value of the data in terms of determining accident causation, liability and effective countermeasures.

The scope of the SAE J2728 standards development effort is to “establish common data elements and data element definitions for heavy commercial vehicle event data recording.” The committee is dealing specifically with crash event data recording rather than vehicle data logging and recording. The goal of the committee is to develop a standard that specifies event triggers, threshold levels, and survivability. The committee will also recommend procedures for data extraction.

Europe

It is understood that European Scania trucks that are fitted with an airbag have EDR functionality in the airbag module and have done so for the last ten years. The fitment rate is not high and an airbag module is not available on all cab variants. Furthermore, accident data is reportedly not available from the ECU [Personal Communication, 2014].

Despite searching literature for a European perspective on HVEDR fitment, no information was forthcoming. Since the original motivation for improved emissions control via engine data management is the same in Europe as it is the US, it seems reasonable to assume that European vehicles also have HVEDRs. In the stakeholder meeting (see Section 5.3) it was noted that there was not great technical obstacle to implementing EDR in heavy vehicles because various control units do record data in a similar way to that described above for the US. It was also indicated that the vehicle systems are very similar to those identified in the literature in the US market, with the same type of in-vehicle communications bus, engine control units and diagnostic interfaces – all driven by very similar environmental legislation. The primary issue identified by stakeholders was standardisation of the data parameters to be recorded

and the interface for accessing the data. Standards already exist (see Section 2.3), but are not widely or consistently implemented.

6.2 Technical Issues

In addition to the challenges identified in the preceding sections, there are a range of technical issues with heavy vehicle EDRs that can be identified from a review of the relevant literature.

6.2.1 Trigger Criteria

VERONICA recommended an additional 'standstill' trigger for heavy vehicles (i.e. initiating an EDR recording when the vehicle comes to a full stop) in order to maximise the chances of recording data from collisions between a heavy vehicle and a pedestrian, cyclist or motorcyclist. A buffer containing three such events is already typical for the engine-based EDRs found on many US-market heavy vehicles; the triggering criteria for storage of US heavy vehicle EDR data typically has three conditions:

1. When an acceleration above a specific threshold is detected. SAE J2728 specifies default of 11.3 km/h/s (approximately 0.3 g);
2. If an airbag or other active passenger restraint systems was activated;
3. For each 'last stop' – when vehicle speed falls below a minimum threshold for 15 seconds or more.

For these triggering criteria, the latter two are specific and do not vary between vehicle size, use etc. However the threshold for the detection of acceleration is likely to vary between vehicle types and should be carefully selected such that heavy vehicle EDR data is collected at appropriate acceleration events. The literature highlighted the difficulty in detecting acceleration events, especially in the cases of large goods vehicles which experience low levels of acceleration in impacts with lighter vehicles. Therefore, determining thresholds that are effective at discriminating accident events are likely to be difficult and the threshold should be adjusted according to vehicle mass and vehicle type.

In terms of additional triggering requirements, the activation of any active system (if fitted) should also start heavy vehicle EDR data recording. For example, the activation of Forward Collision Warning or (now mandatory) AEBS/LDWS should also trigger the heavy vehicle EDR because this would provide valuable information in the cases where the activation of the system was effective at avoiding the accident entirely, as well as the frequency of false alarms. It would also be advisable to ensure that the heavy vehicle EDR recorded the system status for active systems such that it would be possible to determine whether the system was active at the time of an accident. Consideration could also be given to modifying the AEBS sensor to detect possible conflicts with vulnerable road users and trigger an EDR recording. (The AEBS sensor is typically radar-based, which may not be the best solution for triggering VRU collision mitigation and may have too many false activations, but this would not be an issue for simply triggering EDR recording which is triggered far more often in heavy vehicles than cars or LCVs.)

6.2.2 Durability Requirements

Bowan *et al.* [2010] reported that the HVEDR units should protect against:

- Voltage loss;
- Thermal extremes (e.g., massive vehicle fires);
- Thermal cycling;
- Humidity; and
- Shock.

It is clearly important that the integrity of the HVEDR is such that the data is preserved in the case of an accident if the benefits are to be realised. The literature shows that because heavy goods vehicles do not typically experience significant acceleration or deformation in accidents (unless in collision with an object of similar mass) that no additional requirements for these factors are necessary. However, the robustness of the system should be considered and the appropriate design measures taken, especially on smaller goods vehicles.

Bowman *et al.* [2010] note that power loss to the engine control electronics in certain makes of heavy vehicle in the US market can result in data loss

6.2.3 Data Storage

Data collected from an ECU/ECM for current US systems are stored in the unit. The size of the data storage varies, but Bowman *et al.* [2010] reports that this can be large enough to record data from systems which record continuous data so it seems that the data storage available is not a barrier to record event data.

6.2.4 Data Access Tools

The literature reveals that in the US heavy vehicles, access to the data is dependent on the specific system. Some systems encrypt data and specialist software is then required to access the data. A survey of heavy vehicle manufacturers in the US found that most data retrieval tools are proprietary and although for most of the systems, data could be accessed with the appropriate tools, some could only be accessed by those specifically allowed by the manufacturer using proprietary tools [Bowman *et al.*, 2010].

The first step to develop and enable standard access tools is that the data is stored in the same location or safety system on the vehicle. This is not the case in the US system according to the information in the literature. Once this has been achieved, then the access interface and corresponding tool could be standardised.

6.2.5 Integration with Digital Tachograph

Stakeholders indicated that there was no benefit to integration with the digital tachograph currently fitted to heavy vehicles in Europe, and possibly some disbenefits relating to data integrity and security (see Section 5).

6.3 Legal Issues

Negligible legal issues are envisaged for fleet operators (see Section 2.9). For owner-drivers, the legal issues are likely to be very similar to those for private cars (see Section 2.9)

6.4 Benefits and Costs

Benefits from HVEDRs are strongly dependent on the types of data recorded by the system. In general terms these will accrue to three main groups: vehicle operators/fleets, vehicle manufacturers, and society. Benefits for vehicle operators relate to improved operational efficiency related to improved driving style because of awareness of the presence of an EDR. Benefits for OEMs relate to reducing liability by providing a means of collecting reliable data and improving vehicle designs and safety. Benefits for society include those for regulators, law enforcement and wider society in terms of improved safety, fewer accidents (and consequently injuries and fatalities) and access to justice.

Further consideration of the benefits and costs is presented in Section 10.

7 Light Commercial Vehicles

7.1 Current Practice

Light Commercial Vehicles (LCVs) in Europe typically now have driver frontal airbags, which implies some sort of collision detection sensor(s) and processing capability to make the fire/no-fire decision. The stakeholders consulted during this study indicated that car-derived vans were probably all fitted with EDRs because they have a system architecture and airbag control unit derived from the car (see Section 5.3.1.2). The stakeholders also considered that other N1 vehicles may not have an EDR if they do not have an airbag control module. However, as shown in Section 2.4.3, the majority current LCV models sold in Europe have at least a driver's airbag and airbag control module as standard equipment. Based on the comments at the stakeholder meeting (Section 5.3), this would imply that most current N1 vehicle models have EDR capability.

7.2 Technical Issues

Given the similarities in equipment and underlying electronic architecture, it is likely that the technical specifications for EDR for LCVs could be identical to that for passenger cars, with one exception: side impact delta- v and related parameters. LCVs have a much lower fitment rate for side airbags than passenger cars and are therefore unlikely to side impact sensors installed. This implies that triggering of EDR recording in a side impact would not be possible.

However, the airbag control module itself usually contains an accelerometer and it is possible that this is a multi-axis sensor in many cases. Even though this would not usually be adequate for side airbag deployment decisions, it may be sufficient to trigger EDR recordings in a side impact. This should be investigated further.

7.3 Legal Issues

Negligible legal issues are envisaged for fleet operators (see Section 2.9). For owner-drivers, the legal issues are likely to be very similar to those for private cars (see Section 2.9)

7.4 Benefits and Costs

The benefits for N1 vehicles are considered to be similar to those for passenger cars (M1). If the EDR is linked to the airbag control module as is the case in many cars, then the costs are likely to be similar (or identical) to M1 vehicles. See Section 10 for further consideration of costs and benefits for this fleet.

8 Buses and Coaches

8.1 Current Practice

US

In the United States, it is usual for companies to equip EDRs, although from the literature no fleet-wide estimates can be found on fitment and many sources use the term EDR to describe continuous data monitoring as well as event data monitoring.

The American Public Transportation Association (APTA) is specifically developing recommendations and standards for transit buses and has established a Vehicle Data Recorder (VDR) Working Group that is developing recommended practice for vehicle data recorders on transit buses [Sapper, 2009].

Europe

In the UK most bus and coach companies fit after-market journey data recorders, which will offer many of the benefits of an EDR, as well as additional benefits to the company. The journey data recorders typically record the actuation status of vehicle controls and multiple video feeds inside and outside the vehicle. These systems help monitor driving standards, reduce fuel use and protect the company against fraudulent claims. This market has been driven by the fact that many bus companies self-insure.

Transport for London (TfL) requires all buses operated under contract to TfL to include the following bus data to be recorded on the disc drive of the CCTV camera system: bus road speed taken from the GPS, foot brake application and traffic indicator activation 'left and right' recorded with date and time identification. Required camera views include the driver's cab and the forward view of the road.

National Express (a UK coach company) fit CCTV to most of their fleet and this appears to be an increasing trend in the market.

8.2 Technical Issues

Most buses in the UK and US have CCTV surveillance systems to protect occupants, drivers and operators, and these often incorporate some assessment of vehicle controls (either directly from the CAN bus or from video of the dash and driver's area). Some also include an accelerometer to record collision pulses.

Typically these systems record at a relatively low rate compared with typical car EDRs. This is because they are focussed more on obtaining efficient and safe driving, rather than investigating accidents where greater sampling rates would be desirable.

Although many bus and coach fleets fit journey data recorders, there are a large number of smaller coach operators who do not currently use these systems, presumably on cost grounds. Many of these operate older vehicles and would not benefit from mandatory fitment (at the time of vehicle production) until new production vehicles are sold on to second operators.

It is understood that the underlying architecture of large buses and coaches is similar to that of heavy goods vehicles, so similar technical solutions to the implementation would apply.

8.3 Legal Issues

Negligible legal issues are envisaged for fleet operators (see Section 2.9). For owner-drivers, the legal issues are likely to be very similar to those for private cars (see Section 2.9)

8.4 Benefits and Costs

The benefits for bus and coach EDRs are in general the same as those for other vehicle types. The motivation of bus and coach companies is that the journey data recorder provides a mechanism to improve safety for drivers and passengers, reduce liability and improve efficiency. Some of the systems also include event data recording in accidents although the sources reviewed did not specify the triggering criteria, the parameters that were recorded or the sampling rates.

Costs of event EDR recording is small compared with the cost of buying and installing a CCTV system for journey recording and although greater sampling rates would be desirable for crash data, it seems that the additional cost would be small compared with the overall cost of a driver monitoring system.

9 Cars for Commercial and Private Use

9.1 Current Practice

The current situation for EDRs in cars is dominated by CFR 49 Part 563 in US regulations since 2006 (and the proposal to implement this as an FMVSS standard). As noted in Section 2.2.1 Japan and Korea have made progress towards EDR legislation that is based heavily on Part 563. Furthermore, the evidence review and stakeholder consultation revealed that most European-market new cars are fitted with an EDR, although only Volvo and Toyota have thus far enabled data extraction using commercially available download tools.

Three download tools are available that cover most vehicles in the US market (single-make tools for Kia and Hyundai, with most other manufacturers using the Bosch system), and it is expected that the same tools would be used in other markets. There is considerable experience with downloading and using EDR data in the US, and growing experience in Europe. To date, this has included sending airbag control modules to OEMs and suppliers in order to get data extracted and data extraction from imported US-market vehicles, as well as validation of the extracted data against laboratory measurements from exemplar vehicles.

9.2 Technical Issues

There would be very little technical difficulty (or cost) if Europe wished to implement legislation similar to Part 563, because most European market vehicles already have an EDR that meets this requirement. However, there are several key limitations to the EDR defined in Part 563, including:

- The Part 563 specification is explicitly targeted at crash events only, including those that are of sufficiently low severity that the airbags do not trigger. However, the threshold for triggering recording very likely excludes most car-to-VRU collisions and definitely excludes 'near-miss' events (e.g. where an active safety feature actuated but a collision did not occur). The omission of VRU collisions is a serious limitation for European accident investigations and safety improvements, because these account for nearly 27% of fatalities (8000 pedestrians and cyclists were killed in EU-24 in 2010⁹). The VERONICA projects recommended a VRU triggering algorithm that could be used in addition to current triggers and if pedestrian/cyclist detection systems are fitted then these could also be used as an additional trigger.
- Many EDR parameters are defined as 'if recorded': that is, if the manufacturer chooses to record the parameter in the EDR then the minimum specification for the recording is defined by Part 563. However, VERONICA tended to define these channels as 'if equipped': that is, if the vehicle is equipped with a sensor that measures the parameter, then it must be recorded (and the minimum specification for the recording is defined). Consideration should be given to

⁹ Community database on Accidents on the Roads in Europe (CARE):

ec.europa.eu/transport/road_safety/specialist/statistics/index_en.htm

updating Part 563 requirements to ensure that if sensors are fitted to the vehicle then their outputs are recorded.

- Recording of the status of active safety systems only defined in Part 563 for ABS and stability control, and the recording of these parameters is not mandatory. Since Part 563 was first developed there have been numerous active safety and driver assistance systems deployed in the European fleet, such as active cruise control, lane departure warning, lane keep assist, automatic lighting, autonomous emergency braking, and pedestrian and cyclist detection systems. Previous European studies, such as the VERONICA projects recommended that the recording of the activation status of these systems was very important, and review of current EDR output files suggests that manufacturers typically already record them. Consideration should be given to requiring this if EDR fitment is mandated.
- There has been considerable comment on the compliance of EDRs, particularly with the proposal to convert Part 563 to a Federal Motor Vehicle Safety Standard, which imposes much tougher penalties for non-conformance. While compliance testing is defined in a draft document [DOT, 2014d], commenters to the FMVSS 405 NPRM have noted that the text implies that EDRs would have to be tested at up to 200 km/h impact speed in side impacts, which is clearly not practicable. If EDR fitment is to be mandated in Europe, consideration should be given to defining specific compliance testing that can be performed by manufacturers, possibly based on existing legislative crash tests.

It should be noted that considerable technical data about the vehicle is already stored in many cars for servicing and liability reasons. The EDR collates some of this data in one place and adds data specifically associated with a collision, such as airbag deployment and seat-belt use.

9.3 Legal Issues

As for larger commercial vehicles, negligible legal issues are envisaged because access to the EDR data would be controlled by contracts of employment or leasing/hire agreements. The legal issues relating to EDR fitment in private vehicles has been explored extensively in Section 4 and Appendix D. It is generally considered that EDR data as defined in Part 563 does not include any person identifying information other than the VIN, which is already clearly displayed on every car and which cannot be used to identify an individual other than by the police and other appropriate authorities in carrying out their mandated duties. EDR data would only become personal if it becomes associated with the owner or driver of the vehicle.

Ownership of the data has not been formally defined in Europe and does not appear to have been tested in court. However, it is generally considered that the ownership most likely resides with the owner of the vehicle, and most current applications of EDR data in Europe have used this ownership model. If EDR is mandated for private cars in Europe it may be helpful to define ownership in the legislation, although this is likely to be still subject to being tested in court in each country.

9.4 Benefits and Costs

An accident-reduction benefit for cars for commercial use has been demonstrated (see Section 2.10), similar to heavier commercial vehicles. However, it is less clear that an accident reduction effect will be realised in private vehicles. The other benefits relating to EDR fitment are difficult to monetise, but no less important for that. These include safety research leading to improved vehicles and safer roads, and access to justice in the event of a collision. These have the potential to be substantial societal benefits. Examples of discussions of this issue are given below.

NHTSA

'Benefits are discussed qualitatively because the final rule only requires EDRs to store certain event-related information (e.g., air bag deployment) before or during a crash. The stored data, although extremely valuable for safety research and emergency response, does not itself directly improve vehicle safety. It would also be difficult to estimate the portion of the benefits that could be credited to EDR data after a vehicle standard or a network of safety systems is implemented or a safety countermeasure is developed.'

PACTS

'While the safety benefit of more comprehensive crash data cannot be quantified, data-led research is crucial for understanding the cause of collisions and for developing solutions to safety problems.'

Alliance of Automobile Manufacturers (submission to docket number 2012-0177-0926)

'The Alliance recognises that EDRs help to promote vehicle safety in a variety of ways. Among other things, they foster and increased understanding of vehicle and driver behaviour, which could lead to development of safer vehicle and roadway designs, and they allow a better understanding of crash events.'

If a definition of EDR very similar to Part 563 were to be implemented in Europe, it could be argued that the cost for mandatory fitment of EDR in European-market cars is zero because – as identified during the stakeholder consultation – the majority of the fleet is already fitted with an appropriate EDR. Some costs may accrue if an enhanced specification of EDR were mandated, e.g. as defined by the VERONICA projects. This is discussed further in Section 10.

10 Cost-Benefit Analysis

10.1 Introduction

The purpose of this cost-benefit analysis was to compare monetised information on the predicted benefits with the costs required to realise these benefits in order to judge the efficacy of the action scenario. In this case, the purpose of this project was to determine whether legislative or other measures on EDR specification or fitment could be justified.

Over recent years, there have been frequent calls for the fitment of EDRs (e.g. ETSC [2012]) and many benefits of EDRs have been quoted in the literature. In the US, the EDR has been used for many years in passenger cars and other vehicle types and technical requirements for EDRs (Part 563) have been developed so that a standard specification exists. From late 2014, all new cars in the US must be fitted with an EDR that complies with these Part 563 requirements.

As is often the case in real-world application of such analyses, some important components (either benefits or costs) cannot be monetised easily, meaning that the output of the cost-benefit study should not be considered in isolation to other benefits or costs. In the cases where direct monetisation was not possible in this analysis, TRL have indicated an opinion regarding the scale of the missing components so that this information can be considered in conjunction with the calculated benefit-to-cost ratios.

In this project, TRL used information gathered from literature and from stakeholder input (via a questionnaire, a stakeholder meeting and direct communication) and have been as transparent as possible regarding the information and assumptions made. It should be noted that the estimates used in this study represent what TRL consider the best available information; if or when more accurate, or improved, information becomes available, the analysis should be recomputed.

10.2 Costs

10.2.1 Introduction

Components of increased costs were identified relating to the following issues or technical requirements:

- Costs to meet an 'enhanced EDR specification' similar to that proposed by VERONICA project, and above that specified by Part 563.
- Costs for EDR readers throughout Europe, including EDR reader, software updates and licences.
- Costs to enable triggering on 'soft impacts', including pedestrians and other vulnerable road users.
- Costs to enable the status of active safety systems to be recorded in a crash (and near-miss) conditions.
- In the case of N2/N3 vehicles especially, costs to facilitate the download of EDR information stored in a range of sub-systems via a single download access point.
- Costs to access, download and store EDR data.

- Costs to analyse and interpret EDR data in accident reconstruction, insurance liability investigations and research.

10.2.2 Costs for the EDR Unit

In the US, costs for EDRs fitted to passenger cars (M1) that comply with Part 563 are reportedly as low as \$20 [DOT, 2012b]. The cost in Europe was considered comparable, especially since it is known that most M1 vehicles in Europe are already equipped with airbag modules that already contain an EDR that is capable of meeting the Part 563 specification. Petersen and Ahlgrimm [2014] used values of €25 for cars, €30 for trucks and buses. In this study, we based cost estimates on the NHTSA values for cars (€15), with upper and lower estimates of €20 and €10 respectively for cars and light vehicles. It is expected that the costs will reduce further over the assessment period and that the value assumed was a reasonable reflection of the cost bearing in mind current US values. We assumed current costs for trucks and buses to be greater than cars at €30 (€25-€35). Importantly, we assumed that there would be no additional cost in meeting a specification equivalent to Part 563 in Europe, but that additional requirements reflecting additional performance and/or data recording capabilities would result in additional costs. In terms of the comparison between the baseline and action scenarios and the benefit-to-cost ratios, it is the increases in costs that is important rather than the baseline cost.

Improving the specification of the EDR to the VERONICA requirements would be an advancement on those demanded by 49 CFR Part 563, and information gathered from stakeholders indicated that this would probably be a small additional cost to enable data recording of different parameters by the EDR. Indeed, it is noted that many of the current EDRs record a range of parameters comparable with the VERONICA specification and EDR downloads from US vehicles show that active system status is often already recorded. We assert that a manufacturer is extremely likely to voluntarily log information from an active safety system in order to monitor effectiveness, improve system performance and to protect against liability. In order to reliably trigger recording in the case of impacts with pedestrians or other vulnerable road users, output signals from a pedestrian detection system are the most reliable way to trigger the EDR, although the VERONICA project also defined requirements for more sensitive acceleration-based triggers [Schmidt-Cotta, 2009]. These would involve additional costs to code instructions for the monitoring of acceleration below that which triggers air bag 'wake-up' so that soft collisions could also be recorded by the EDR. Stakeholders indicated that triggering from a pedestrian detection system was feasible and relatively straightforward although it would entail additional costs to enable this functionality and to ensure that it worked correctly. Costs relating to lowering the threshold of triggering are not known although this approach seems feasible based on the available information. Similarly, enabling the EDR to report the status of active safety systems fitted to the vehicle at the time of the accident (or near miss) would require additional cost, but these would result in only a small memory demand and the changes required (if any) to pull the required information on active system status from the CAN bus.

Obtaining specific costs for these additions proved difficult and TRL made an estimate that an EDR capable of recording to an enhanced specification similar to VERONICA, with the detection of pedestrian impacts and status of active safety systems based on cost increases defined by DOT [2006] for changes required to meet Part 563. We assumed that the action scenario would involve no new sensors or filters, but might require

additional processing and memory requirements, and also adjustments to consider other data present on the vehicle CAN. Assuming these changes are of the same order as those predicted by NHTSA between meeting the mandatory and recommended Part 563 specifications, this implies cost increases per vehicle of €0.825 (€0.57-€1.08). If more accurate information on this topic becomes available, this could be used to recalculate the assessment. Costs for N1 vehicles were assumed to be comparable to M1 vehicles since most of these are car-derived in design and are equipped with an EDR in the airbag control module in a similar fashion to M1 vehicles

For M2/3 and N2/3 vehicles, additional costs would be required for the consolidation of the data stored in multiple subsystems to be downloaded via a single download point and additional costs for the content of the data to meet an enhanced specification. These vehicle types would be unable to trigger the EDR on vulnerable road user impacts (without a pedestrian detection system) although the current triggering criteria on each stop would enable such event to be captured. Again, specific costs for these modifications were found to be difficult to identify and it was assumed that a much larger increase in EDR cost might be required to meet the enhanced specification because the current data is not subject to a standard specification and is fragmented in many subsystems. We assumed a value of €20 per vehicle in recognition of the high costs that might result, although this could be an overestimate. Again, if more accurate information on any additional costs becomes available, this could be used to re-calculate the cost-benefit.

Table 10-1 shows the EDR unit costs that were assumed. These show the costs assumed for the baseline scenario and those for the action scenario, where the increased costs relate to enhancements in the EDR specification, detection of vulnerable road user impacts (for M1/N1) and recording of active system status.

Table 10-1: Costs assumed for EDR unit

Vehicle type	Baseline / Action scenario up to 2018			Action scenario 2018 onwards		
	Low	Central	High	Low	Central	High
M1	€10	€15	€20	€10.57	€21.08	€15.83
N1	€10	€15	€20	€10.57	€21.08	€15.83
M2/M3	€25	€30	€35	€45	€50	€55
N2/N3	€25	€30	€35	€45	€50	€55

10.2.3 Costs for Access, Download and Storage of EDR Data

EDR reader costs were estimated based on published prices by the US Crash Data Group¹⁰ which show the current price (October 2013) for a complete hardware CDR Tool with all cables, adapters, power supply and modules and software subscription to be \$10,648. The tool required to retrieve crash data from vehicle DLC port (including software) is \$2,898. We estimated low, central and high cost estimates based on these

¹⁰ <http://www.cdr-system.com/catalog/index.html>

numbers assuming that 25%, 50% and 75% of the readers purchased are the complete hardware tool respectively. This gave estimates (assuming a USD to Euro exchange rate of 0.75 and rounded to the nearest €100) for the lower, central and high estimates for EDR reader cost of €3,600, €5,100 and €6,500 respectively.

We did not assume any economies of scale resulting from a larger European market of EDR tools because the quality of the data is critical and this can only be provided by the car manufacturer. The current situation where the OEM provide the official requirements for the connector and any decoding to the EDR reader satisfies the requirement for EDR data to be made available. Although cheaper readers might be possible, we assumed that the price in this instance would not reduce because the quality and accuracy of the data can only be assured by a close technical partnership; breaking this link may reduce the credibility and hence any utility of the EDR data.

The number of EDR units required for Europe was estimated at 4,750 based on information from the US on the number of units sold since 2006. This estimate was adjusted to an estimate for Europe by calculating an 'EDR reader per person' value for the US¹¹, and using European population information¹² to scale a value for Europe. The costs associated with EDR readers were assumed to be divided evenly across the eight years of the action scenario. It is possible that the number of EDR readers required for Europe has been overestimated because there may be a greater number of private accident investigators in the US due to a generally more litigious culture. However, in the absence of other information, this value was considered the best estimate.

It was identified at the stakeholder meeting and by Petersen and Ahlgrimm [2014] that additional costs would be involved in the process of accessing and downloading EDR data. Petersen and Ahlgrimm [2014] estimated the costs for access and download of EDR data in Germany as €42 per fatal and €30 per serious accident. Stakeholder input was in agreement that there would be additional costs, but no cost estimates were forthcoming for this factor. With this in mind, we used the values estimated by Petersen and Ahlgrimm [2014], although the accuracy of wider general applicability of these costs to other European countries is untested.

Storage of the downloaded EDR data would also require additional costs, although the cost of digital storage has reduced so much over recent years that this may be considered a relatively small amount and perhaps within the capabilities of organisations who might be downloading and using EDR data. For example, EDR data from a current download is typically less than 10Kb in size. Bearing in mind that memory costs are now vastly reduced, and also expected to reduce further in the coming years, it was assumed that organisations collecting EDR data would be able to use existing IT infrastructure to store EDR data at no additional cost.

¹¹ US population = 315 million on Jan 1st 2013; <http://www.census.gov/popclock/>

¹² EU28 population = 507 million on Jan 1st 2013 - Eurostat data appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en

10.2.4 Analysis of EDR Data

Information from a police force in the UK highlighted that additional costs would also be incurred for analysis of EDR data. For example, in the case of a police accident reconstruction, additional time would be required to interpret the EDR data. No specific information was provided regarding the amount of additional time needed because this depends on the specific demands of each case. Furthermore, this is expected to reduce as proficiency in analysing the data increased.

The types of accident reconstructions carried out by the police are often very different in length, depending on the complexity of the situation and the precise accident circumstances. For example, a single vehicle loss of control accident might require less time than a multi-vehicle motorway accident. In some cases, the time required to analyse the EDR data might be additional to the other activities required (e.g. scene measurements etc.) and in others EDR analysis may replace current costs, for example, those to determine pre-crash speeds etc. It was also found that although the EDR data can provide information that cannot be obtained by scene investigation and inform on key aspects which are being eliminated by technology (e.g. ABS reducing braking evidence left at the scene), it is still necessary in most cases to validate the EDR data with the scene.

In this study, we acknowledge that additional costs might be possible, but that there is not sufficient information with which to make an estimate. Furthermore, from an objective analysis of the views collated from the stakeholder meeting and other discussions it seems reasonable to assume for the central estimate that the net change in cost is zero because the additional EDR data analysis costs replace the costs currently spent trying to estimate the same items of pre-crash information. The upper estimate assumes there is a reduced cost of reconstructions; this might be more easily realised over time as processes improve and general acceptance of EDR data increases.

10.3 EDR Benefits

10.3.1 Introduction

Components of benefits of EDRs were identified as relating to the following issues or technical requirements:

- Benefits relating to changes in driving behaviour as a result of EDR fitment which leads to fewer accidents and therefore fewer road casualties and vehicle damage.
- Benefits relating to higher quality accident data, particularly in terms of understanding the causation of accidents and, for systems which monitor active safety systems, effectiveness of new safety technologies.
- Benefits in terms of the quality of accident reconstructions and the certainty to which responsibility for the cause of an accident can be made, therefore providing better enforcement and the upholding of societal values.
- Reductions in insurance costs because of improved data quality.
- Better access to justice for the citizen; meaning that the ability to demonstrate innocence/compliance with the law, or the fault of another party for injury or other damages.

10.3.2 Safety Benefits

There is evidence in the literature that continuous monitoring equipment in commercial fleets has beneficial effects on safety (see Section 2.10). However, there is not the same level of information regarding EDRs. Although very similar – indeed, most continuous monitoring systems also have EDR functionality – there are fundamental differences between monitoring systems and EDRs which only record in the case of an accident.

Petersen and Ahlgrimm [2014] quote a 2012 study by AXA that found a reduction in accidents of 15% for drivers whose vehicles were equipped with an EDR. The authors correctly pointed out that this sample was almost certainly biased towards safer drivers (those who were willing to take up the EDR in the first place), and a benefit of 5% reduction in accidents was pragmatically estimated. TRL's opinion is that the basis for any improvement in safer driving behaviour in the private vehicle fleet as a result of EDR fitment is currently unproven and no evidence was found linking accident reductions in the general population to EDR fitment.

Monitoring of driving style and safety means that the driver is incentivised to drive more safely because of the knowledge about being monitored and the fear of losing employment. In private vehicles, there is not the same motivation, and in the context of EDRs which trigger in the event of an accident, drivers might tend to believe that an accident is unlikely to happen to them. It was therefore considered that, for private vehicles, the presence of an EDR alone, even if is known by the driver, may not influence driving behaviour, or may only do so for a small percentage of drivers. For this reason we assumed that for private fleets (M1 vehicles and 50% of N1 vehicles) the effect of EDR fitment of safety would be zero for the lower and central estimate. We set the upper estimate for private fleets at 2% because it is possible that some of the benefit seen in commercial fleets may also be realised by a proportion of private fleet drivers.

For commercial fleets (in this study considered to comprise 50% of N1 vehicles, N2/N3 and M2/M3 vehicles), the effect of EDR fitment and also continuous monitoring is better defined in the research. There is a range of evidence (see Section 2.10) that EDRs influence driving style, although the literature indicates that monitoring systems are more effective at influencing safety. We selected estimates for the safety effects of EDR fitment to commercial fleets as 0% to 10% with a central estimate of 5%. These are estimates at the low end of the studies reviewed because some of the studies involved systems with monitoring and at least some elements of driver feedback to reinforce changes in behaviour.

10.3.3 Accident Data for Research

Safety research and the development of safety solutions are have a fundamental application of accident data. This defines the problems that the safety countermeasures are designed to address. Particularly important is the cause of the accident and how frequently particular accident causes happen. Many of the newer systems and technologies that have the greatest predicted benefit act in the pre-crash phase and support the driver's action or provide autonomous actions to avoid or mitigate accidents and injury outcomes. Car manufacturers and suppliers have developed a range of ADAS (Advanced Driver Assistance Systems) and these may have varying effectiveness and safety benefits. At present, the effectiveness of these systems is typically estimated using predictive techniques because there is insufficient fleet penetration of systems to generate enough data for retrospective analysis. Even if there was sufficient

retrospective data, there are significant barriers to quality from lack of system fitment data because it is not known whether optional systems were equipped to the vehicle in question.

To be able to prioritise these systems so that ultimately the correct regulatory action and use of tax-payers money realises the maximum casualty benefit, more robust information on the pre-crash phase and the cause of the accident is required. Information on pre-crash speeds and the chronology and timings of driver inputs in these critical moments after the precipitating event and before the crash itself have the potential to provide some of the required information to assess system effectiveness or the effectiveness of prospective countermeasures.

The EDR itself will therefore not improve safety; accidents will still happen and people will still sustain injuries in these accidents. However, the EDR provides the possibility of providing reliable and accurate information from the pre-crash phase for active safety systems and also provide evidence that could improve existing or new secondary safety systems. This in turn allows the applicable countermeasures to be more robustly evidenced, meaning that there is a better quality of evidence available that regulators can use to support appropriate actions to improve road safety. It is considered that this will result in a reduction in accidents and casualties as the evidence collected by the EDRs is implemented to improve overall road safety.

The benefit for this component cannot be monetised but has the potential to be very significant. For example, if evidence from EDRs results in the quicker regulation of a promising safety system then many hundreds or thousands of casualties across the EU could be prevented. Taking into account the valuation of casualties (see Table 10-4) this has the potential to have a large monetised value, but the magnitude depends on the effectiveness of the safety system(s) implemented on the basis of EDR data, and the improvement in fleet penetration timing and rate of the system(s) compared to the case without EDR data. This can only be assessed in retrospect and even then, the difference in timescales and rate of implementation in the 'without EDR' case cannot be accurately estimated.

10.3.4 Accident Reconstruction

EDR data could also improve accident reconstructions carried out by the police or other authorities. At the stakeholder meeting, some participants were of the opinion that very significant reconstruction savings would be possible. This is certainly the case for research reconstructions, but for police reconstructions, other evidence suggests that monetised savings might not be achievable. All viewpoints agree that the provision of EDR data would improve the accuracy and quality of the reconstruction. In some cases, this might also translate into cost savings because, for example, determination of travel speeds or braking from scene evidence would be unnecessary. However, in other cases the examination of the scene for other aspects of the investigation would be required and any savings resulting from pre-crash information that might otherwise be obtained by scene measurements and calculation, might be offset completely by the additional cost involved in accessing and analysing the EDR data. Information supplied by one UK police force indicated that they expected, on the whole, no significant monetary benefit, but very much agreed that the quality and utility of the investigation outcome would be improved. This is in contrast to Petersen and Ahlgrimm [2014] who assumed EDR would

reduce the number of investigations by 20% *and* reduce the cost of the remainder by 5%.

On balance, therefore, we assigned a zero lower and central estimate for the benefit resulting from the availability of EDR data to police accident reconstructions, but a 2% reduction for the upper estimate. We assumed that there are 100,000 European reconstructions per annum (based on the fact that there are more than 40,000 “expert reconstructions” in Germany each year alone according to Petersen and Ahlgrimm) at an average cost is €3,000 (chosen for consistency with the cost for insurance investigations). The upper estimate assumed that EDR data could avoid 2% of reconstructions and reduce 2% of reconstructions by €300.

In addition to the effects on costs, there are significant benefits in terms of data quality that cannot be monetised. This is arguably more significant than the actual costs. For example, this might enable more successful convictions in the case of offences that have led to serious consequences (and the prevention of future occurrences by the same protagonist) or mean that the cause of fatal accidents is known with a greater certainty that might provide benefits to family members because the circumstances of the accident are known. Furthermore, there are also benefits relating to improved efficiency of legal processes which may result in reduced court time, therefore reducing costs. However, these benefits are difficult to quantify with the available information.

10.3.5 Insurance Claims

According to Petersen and Ahlgrimm [2014], about 10% of insurance claims require some sort of investigation to determine liability. At an average claim cost of approximately €3,000 [CEA, 2010], and bearing in mind the large number of insurance claims per year in Europe, this is a significant potential cost saving. Petersen and Ahlgrimm [2014] argued that EDR data may allow quick and accurate resolution of accident liability that can be relied upon by both sides. There may also be substantial benefits for insurance costs if claims relating to low-speed impacts can be reduced or fraud identified. The scale of this is uncertain, and to be able to realise any benefit, the EDR triggering be required to trigger at lower g levels. This would be expected to be the case if an enhanced specification for vulnerable road user impacts was introduced.

However, information supplied by the European Insurance Federation, (CEA) judged the percentage of cases for which EDR data could influence a liability investigation to be much smaller than proposed by Petersen and Ahlgrimm and provided some estimated for two European countries. In one country, about 100 of the 7.9 million annual claims were estimated that would benefit from EDR data as part of an in-depth liability investigation and in the other, the rate was estimated as “about 1 in a 1,000 cases”. According to CEA data, there are approximately 26 million insurance claims in Europe each year, so this puts the number of cases per year that might benefit from EDR data at between 330 and 26,000 per annum. It should also be noted that these values could be adjusted if further information on this issue is identified.

CEA’s members were also of the opinion that information from the EDR would be additional information that would make up a component of any report and would provide better data to identify liability and, in some circumstances, reduce insurance fraud. One member commented that the additional costs involved in using EDR data would likely balance out the benefits that would be derived from the use of the data.

It is clear that there are vastly divergent estimates for the number of insurance investigations and the effect on costs; this could have a large effect on the overall benefit to cost ratio. From a logical perspective, it is reasonable that EDR data would, in some cases, allow liability to be assigned more efficiently. However, the best evidence available to TRL indicates that the number of cases that this would apply to would be between 330 and 26,000 per year, and the most robust evidence available does not predict significant cost savings for these cases because the EDR data is only one component of the investigation. For example, it was highlighted that the EDR data, without a camera system, has no reference to identify the precipitating event (the event that started the chain of events that resulted in an impact), so when determining whether a driver had time to react or should have reacted to an event, an analysis of the scene and other traditional methods are required.

TRL assumed that EDR data might reduce costs by 20% (€600) for a percentage of the 26 million annual insurance cases in line with the two CEA estimates (between 100 in 7.9 million and 1 in 1,000). The central estimate was the average of these two frequencies. Should better information become available these values could be revised.

10.3.6 Access to Justice

The availability of EDR data means that the European citizen could use the data to prove innocence in the case that a charge (for example, exceeding the speed limit or being at fault for an accident) was made. For example, a blameless party in an accident would have access to information that might demonstrate this, thereby reducing stress and making the process of the insurance claim easier. This is a component that cannot be valued because the benefits are an intrinsic point of principle, rather than a benefit that has specific monetary value. However, better data would improve access to justice and this is an important consideration even though it cannot be compared in the same manner as other predicted benefits.

Furthermore, EDR data has the potential to improve the efficiency of the legal process by supplying data of greater quality so that overall legal costs are reduced. Again, these benefits are difficult to quantify, but the provision of better data is likely to make appropriate legal decisions more quickly and this has the potential to result in savings.

10.4 Vehicle Fleet

The European vehicle fleet was estimated based on figures contained within the EC Pocketbook [EC, 2013] which related to 2011 for registered vehicle stock and 2012 for new registrations (see Table 10-2). These values were assumed to remain constant over the assessment period. This assumption was deemed reasonable because vehicle stock totals remain reasonably constant over time, and new registrations, which can be subject to quite drastic variations driven by the prevailing health of the economy, follow a trend that cannot be accurately predicted for future years.

Table 10-2: EU 27 Vehicle stock and annual new registrations (EC, 2013)

Vehicle type	Vehicle description	EU 27 Vehicle stock (2011)	EU 27 New registrations (2012)
M1	Passenger cars	242,241,000	12,063,000
N1	Light goods vehicles	28,695,637	1,476,713
M2/M3	Buses and coaches	820,200	39,411
N2/N3	Heavy goods vehicles	5,284,863	271,966

For N-category vehicle stock data, the numbers for N1 and N2/N3 vehicles were estimated by taking the number for all goods vehicles in the EC pocketbook and applying the percentages of N1 and N2/3 vehicles assuming the vehicle stock is in the same ratio as new registrations. This was necessary because there was no sub-division of the N-category vehicle stock data.

For new registrations, numbers for N2/N3 vehicles were estimated by applying the same scaling factor as between N1 data for EU15 and EU27 to data for EU15 for N2/3 vehicles. This was necessary because there were no EU27 values for N category vehicles greater than 3.5 tonnes (i.e. N2 and N3 vehicles).

10.5 Cost-Benefit Analysis

10.5.1 Casualty Valuations

In order to monetise casualties resulting from an accident, it was necessary to assign a value to each severity class: fatal, serious and slight. Each country has a different casualty valuation depending on variations in the costs allocated to each component of cost and the valuation of 'willingness to pay' applied to each casualty level. There are also differing values used in European studies and no standard European value. In line with previous work carried out for the EC, TRL have used 'European monetary values' developed from recommended values for safety obtained from the European Commission Mobility and Transport website, which in turn used data from the HEATCO project. These values are shown in Table 10-3, below.

Table 10-3: Recommended monetary values for prevention of road accident casualty obtained from European Commission Mobility and Transport website

Country	Fatality	Severe injury	Slight injury	Fatality	Severe injury	Slight injury
	(€2002, factor prices)			(€2002 PPP, factor prices)		
Austria	1,760,000	40,300	19,000	1,685,000	230,100	18,200
Belgium	1,639,000	249,000	16,000	1,603,000	243,200	15,700
Cyprus	704,000	92,900	6,800	798,000	105,500	7,700
Czech Republic	495,000	67,100	4,800	932,000	125,200	9,100
Denmark	2,200,000	272,300	21,300	1,672,000	206,900	16,200
Estonia	352,000	46,500	3,400	630,000	84,400	6,100
Finland	1,738,000	230,600	17,300	1,548,000	205,900	15,400
France	1,617,000	225,800	17,000	1,548,000	216,300	16,200
Germany	1,661,000	229,400	18,600	1,493,000	206,500	16,700
Greece	836,000	109,500	8,400	1,069,000	139,700	10,700
Hungary	440,000	59,000	4,300	808,000	108,400	7,900
Ireland	2,134,000	270,100	20,700	1,836,000	232,600	17,800
Italy	1,430,000	183,700	14,100	1,493,000	191,900	14,700
Latvia	275,000	36,700	2,700	534,000	72,300	5,200
Luxembourg	2,332,000	363,700	21,900	2,055,000	320,200	19,300
Malta	1,001,000	127,800	9,500	1,445,000	183,500	13,700
Netherlands	1,782,000	236,600	19,000	1,672,000	221,500	17,900
Poland	341,000	46,500	3,300	630,000	84,500	6,100
Portugal	803,000	107,400	7,400	1,055,000	141,000	9,700
Slovakia	308,000	42,100	3,000	699,000	96,400	6,900
Slovenia	759,000	99,000	7,300	1,028,000	133,500	9,800
Spain	1,122,000	138,900	10,500	1,502,000	161,800	12,200
Sweden	1,870,000	273,300	19,700	1,576,000	231,300	16,600
United Kingdom	1,815,000	235,100	18,600	1,617,000	208,900	16,600

Table 10-4 shows two sets of values. The first set, denoted factor prices, is based on national currencies. The second set of values denoted PPP; factor prices are adjusted for differences in purchasing power and are therefore intended to be more directly

comparable across countries than the first set of values, since the PPP adjusted values account for differences in income and prices between countries.

Weighted averages using total road accident casualties in country of the PPP factor monetary values for the EU27 countries in Table 10-3 were calculated for prevention of fatal, severe (serious) and slight casualties. These weighted values were increased by 20% to account for inflation on the bias of an inflation rate of approximately 2% per year. This gave the European casualty valuations shown in Table 10-4, which were used in the analysis.

Table 10-4: EU Casualty values

Casualty severity	Casualty value
Fatal	€ 1,564,503
Serious	€ 231,278
Slight	€ 17,753

10.5.2 Assessment Timescale

The timescale of the assessment was chosen to be the years 2015-2025 inclusive. Other timeframes of assessment are of course possible, but as with all such assessments, estimates far into the future become subject to greater and greater uncertainty. However, the length of this assessment period was considered long enough to obtain a good representation of the costs and benefits and this timescale was considered appropriate.

10.5.3 CBA Assumptions

The general approach of the assessment was that the costs and benefits for the 'base scenario' would be compared to that estimated for an 'action scenario'.

The 'base scenario' is the situation in the event that no action is taken and the 'action scenario' is the situation assuming a defined action is taken. The difference between the costs and benefits of the two situations (over the assessment period) provide the information required to compute the benefit-to-cost ratios for the action scenario, which estimates how much monetised benefit one would receive for each Euro spent on the measure.

General assumptions made that applied to both the 'base scenario' and the 'action scenario' were as follows:

- Vehicle stock and new registrations remain at the levels found in the latest EC statistical pocketbook data (2012/2012) over the course of the assessment period [EC, 2013].
- Inflation was assumed at 2% per annum and future benefits and costs were increased accordingly. Similarly, future costs and benefits were discounted by 3.5% per annum to reflect the fact that value of future costs and benefits is lower than their present value.
- The numbers of accidents and casualties for Europe were estimated using the latest EC data. To account for changing numbers of accidents and casualties over

time, CADAS data for the last five available years (2008 to 2012 inclusive) was used. This data was for the EU28 but excluded Bulgaria and Lithuania for fatal casualties, and in addition to these: Estonia, Finland and Italy for other casualty severities. There is a trend for an improvement in casualty statistics each year resulting from general improvements in safety. Predicting the number of casualties in the future is inherently uncertain because, although accident and casualty trends are generally downward for most vehicle types, there are exceptions to this, and over time it becomes increasingly difficult to attain the same magnitude of safety improvement. In order to model the expected future improvement in safety, it was assumed that future reductions in accidents and casualties would be attained at a rate about 50% of the general trend observed over the previous five years of CADAS¹³ data. This takes into account the fact that attaining the same level of safety gain becomes increasingly difficult. Therefore, an annual reduction of 2.5% accidents and casualties was predicted.

The 'base scenario' assumed:

- Fitment of EDRs (to a specification the same/similar to Part 563) is made on:
 - 96% of all vehicle new registrations in 2015
 - Existing EDR fitment will realise 6% of the benefits possible without harmonisation of data specification, access, fitment etc. because Toyota and Volvo vehicles from which EDR data can be downloaded accounted for 6% of new registrations in Europe in 2013¹⁴.
- 30% of the commercial fleets (assumed to be 50% of N1 and all N2/N3 and M2/M3) across Europe are already attaining the behavioural benefits from journey recorder or driver monitoring technology.

The 'action scenario' assumed:

- Fitment of EDRs (to a specification the same/similar to Part 563) is made on 96% of all vehicle new registrations in 2015, mandatory EDR specification by 2018.
- Mandatory EDR specification (on all vehicle types) that would record data to an 'enhanced specification' (compared with US Part 563) and record the status of active safety systems and capability to record vulnerable road user collisions where a pedestrian detection system is fitted.
- EDR data is downloaded from every accident from 2018 onwards (i.e. access and download costs are incurred for every accident). This may overestimate the costs for this element as data from some serious accidents may not be downloaded (information from one UK police force put this at 5% currently). However, without accessing the data, no benefits can be obtained from its application.

Costs for enhanced EDR specification for M1/N1 vehicles were assumed to result in a small increase in costs of a similar order to the difference between 2006 US estimates for compliance with mandatory and recommended Part 562 specifications. For N2/3 and M2/3 costs for this and for architectural changes to allow access from a single point were assumed to result in greater costs. These were uncertain and an annual increase of €20

¹³ CADAS = Common Accident Data Set based on CARE data

¹⁴ www.acea.be/statistics/tag/category/by-manufacturer-registrations

per vehicle was assumed because of the more significant changes required and the fact that these costs would be shared amongst a smaller vehicle fleet than cars.

10.5.4 BCR by Vehicle Type

If the values described above are computed using the assumptions stated, the following Benefit-to-Cost (BCR) ratios can be estimated for the action scenario over the assessment period 2015-2025. Note that the central estimate was not necessarily midway between the lower and upper estimates and depended on the input estimates used.

The main components that cannot be monetised and have not been included in the calculation of the BCRs can be summarised as:

- improved accident data
- access to justice

These aspects have the potential to substantially increase the BCRs quoted here such that the upper estimates in Table 10-5 would become central or even low estimates. TRL is of the opinion that EDR data would provide benefits in both of these areas but that identifying the 'most likely', or even the range, is subject to significant uncertainty. If conservative benefits could be achieved in these areas (or if the safety benefits observed for commercial fleets can be realised for private car fleets) the BCRs for each vehicle type would be comparable or above the upper BCR quoted in Table 10-5.

Table 10-5: Estimated BCR of action scenario (for components of cost and benefit that can be monetised) over the assessment period 2015-2025

Valuation type	Type of Estimate	Vehicle type and description			
		Passenger cars	Light goods <3.5t	Buses and Coaches	Heavy goods >3.5t
		M1	N1	M2/M3	N2/N3
Cost (€M)	Lower	153	36	6	42
	Upper	228	69	6	44
	Central	183	52	6	44
Benefit (€M)	Lower	0	0	0	0
	Upper	1,294	455	25	201
	Central	8	53	13	100
BCR	Lower*	0.0	0.0	0.0	0.0
	Upper*	5.7	6.6	4.0	4.6
	Central*	0.0*	1.0*	2.0*	2.3*

*These estimates do not include potentially large components of benefit which would substantially increase these BCRs which are based only on the components of additional costs and benefits that can be monetised.

10.6 BCR Discussion

The results and findings of this analysis depend on the assumptions and input values used. The upper and lower estimates for each parameter have been chosen so that an appropriate range has been considered in the analysis. These values were chosen based on the best evidence available, although in some cases more comprehensive and accurate data are required, particularly in relation to the costs of EDRs recording data to an enhanced specification and the costs to allow download of data from a single point for large vehicles.

Extensive parameter variations over and above that accounted for by the lower, central and high estimates for cost and benefit inputs were not carried out. This was because small variations in the benefit assumptions especially, have very large effects on the BCR values. Therefore, increasing the upper end of the benefit assumptions has the effect of stretching the upper estimate for the benefits, such that the conclusions are that the BCR is between zero and a very large number. With this in mind, it was deemed more appropriate to use ranges that could be supported by the available evidence, and to point out the effects on the BCR should greater benefits be realised.

Fitment levels of EDRs in current European vehicles appear to be high, and this has been assumed for all vehicle types. Information at the stakeholder meeting indicated that EDRs that have similar capability to that required by Part 563 are already equipped to "nearly all" current cars and are integrated into the airbag module. For N1 vehicles, car-derived versions may be considered as M1 vehicles in terms of EDR fitment. However, for other N1 vehicles the airbag (and therefore control unit with the EDR) is optional

equipment and may not be specified. A review of N1 fitment data for 46 models from 14 manufacturers showed that a driver's airbag is now standard fitment, although was optional on 26% of models reviewed (models that commenced in late 90s). For all models post 2000, all apart from one was equipped with a driver's airbag as standard equipment. For large vehicles, less information was available, but nearly all vehicles were considered to record EDR-like information in various control modules associated with the engine, braking system etc. that would equate to the same level of data as specified by Part 563, albeit not to any agreed EDR specification.

The information on EDR reader costs was based on US data and a range was determined based on the current US prices and what might be expected to be the case in Europe. Manufacturer costs were difficult to obtain because of the commercially sensitive nature of the data. It might be possible that because we based the European estimate on US data that the number of units required in Europe had been overestimated.

Costs associated with access and download of EDR data were estimated largely based on estimates made by Petersen and Ahlgrimm [2014]. It is recommended that future costs for these aspects be monitored so that the values used here can be confirmed. It would also be useful to monitor EDR analysis costs. Broadly speaking, we assumed that any additional costs spent analysing data would be offset by time savings elsewhere as a direct result of obtaining good quality EDR data.

There is some uncertainty regarding the cost of an enhanced EDR specification. For passenger cars, adding in functionality to detect vulnerable road users (if a detection system is fitted or for a reduced triggering threshold) appears feasible, but no costs were obtained for this functionality and that required to record a greater range of parameters. We assumed that the action scenario would involve no new sensors or filters, but might require additional processing and memory requirements and also adjustments to consider other data present on the vehicle CAN. Assuming these changes are of the same order as those predicted by NHTSA between meeting the mandatory and recommended Part 563 specifications, this implies cost increases per vehicle of €0.825 (€0.57-€1.08). If more accurate information on this topic becomes available, this could be used to recalculate the assessment. Costs for N1 vehicles were assumed to be comparable to M1 vehicles because most are equipped with an EDR in the airbag control module in a similar fashion to M1 vehicles.

For M2/3 and N2/3 vehicles, additional costs would be required for the consolidation of the data stored in multiple subsystems to be downloaded via a single download point and additional costs for the content of the data to meet an enhanced specification. Again, specific costs for these modifications were found to be difficult to identify and it was assumed that a much larger increase in EDR cost might be required to meet the enhanced specification because the current data is not subject to a standard specification and is fragmented in many subsystems. We assumed a value of €20 per vehicle in recognition of the high costs that might result, although this could be an overestimate. Again, if more accurate information on any additional costs becomes available, this could be used to re-calculate the cost-benefit.

A fundamental aspect regarding the benefit side of the equation is that there are key aspects that cannot be monetised. These, depending on the scale of any real-world effect, have the potential to have a very significant effect on the scale of the benefits and alter the overall results of the assessment. For example, issues of access to justice and improvements from EDR information being available to use as justification for

improvements in safety measures are areas that cannot be monetised. These aspects could have real benefits for society and have the potential to be very large in scale. It is recommended that if possible these aspects are monitored to highlight areas where EDR data has provided benefits. However, as noted earlier, in the case of road safety the number of casualties affected by more rapid, robustly-evidenced action will always be difficult to estimate because of the uncertainties involved with the baseline situation (i.e. the number of casualties had any action not occurred or been delayed because of insufficient data).

Furthermore, the effects on safer driving behaviour resulting from EDR fitment could have a large effect on the scale of the benefits; the BCR is very sensitive to the benefit assumed for this parameter. In this study, we assumed a central estimate for (private) M1 vehicles of no effect on driving behaviour resulting from EDR fitment because there was no evidence found to conclude otherwise. However, it is possible that with better knowledge and more frequent use of EDR data, that this may influence driving behaviour. Information campaigns or other mechanisms of improving driver engagement with EDRs may result in greater benefits. The upper estimate for this parameter was set at 2% to account for a small effect and this is the main reason for the large change in calculated BCRs, demonstrating how sensitive the assessment is to this input. Similarly, if the effects for commercial fleets of EDR fitment are greater than estimated this would confer significantly greater benefits. The values for commercial fleets were selected to be at the lower end of the effects noted in the literature because a proportion of the fleet are known to already be equipped with monitoring systems which have been shown to deliver the greatest change in driver behaviour. We also assumed that 30% of the benefit would be attained because these vehicles are already equipped with journey monitoring. It is possible that drivers may respond differently to the presence of an EDR compared with journey monitoring because the resolution and type of data recorded may be different.

This cost-benefit assessment considered the action scenario as the mandating of an enhanced EDR specification above and beyond that specified by Part 563 (similar to that identified by the VERONICA project), with the facility for improved triggers in vulnerable road user accidents. Stakeholders were largely in agreement that an improved specification would enable realisation of benefits in relation to vulnerable road user accidents and allow information on active safety systems to be collected. Without an improved specification, these areas of potential benefit cannot be realised.

Information collected at the stakeholder meeting showed that fitment of EDRs that record data to a similar level to Part 563 was already very high and we expect this to increase to approach 100% for cars by 2018. Mandatory fitment would therefore either not be required, or be an easily achievable goal depending on the viewpoint taken. However, TRL did not undertake comprehensive studies on all vehicle types and some stakeholders pointed out that additional cost and/or other technical difficulties might apply to some specific vehicles.

The baseline conditions assumed are also important because EDR data is increasingly being used in accident research and accident reconstruction. For example, vehicles with an airbag module are very likely to have EDR capability and increasingly manufacturers are enabling the Bosch download tool to be able to access the data. At the same time, police forces and accident investigators are increasingly using the EDR data for their own investigations. Therefore, one could take the position that for these vehicles, the costs and benefits are already available but cannot be achieved because of difficulties of

access and data harmonisation. In this instance, the case for mandating EDR fitment (or mandating a specification and access to the data) on these vehicles becomes a political one since, for most vehicles, the EDR capability exists and can be realised in some form with the correct tools and information provided from the manufacturer, despite the fact that the current data is not harmonised and access to some data is known to be problematical. To acknowledge this, TRL assumed that 6% of the possible benefit from EDRs is already possible without any further measures, based on the fact that Toyota and Volvo EDR data are expected to be downloadable using the Bosch tool from late 2014 and these vehicles account for 6% of new registrations in Europe. This is an estimate made on the basis that EDR information is already being used, but suffers from problems relating to access and data content.

Petersen and Ahlgrimm [2014] also identified possible benefits resulting from better accident data and proposed a 2% reduction in casualties. TRL did not monetise this potentially very significant benefit because although we agree that there is likely to be benefit of some sort, identifying the magnitude of the benefit is very difficult. However, it should be noted that if the scale of this effect is accurately predicted by a 2% reduction, this would result in substantially increased benefits – perhaps at least double those monetised here – although these might not all be realised within the assessment period because of the lag between obtaining sufficient data to support measures to improve safety.

10.7 BCR Conclusions

The aim of the analysis was to identify the costs and benefits in two scenarios: one reflecting the *status quo*, and one representing action to mandate an EDR specification over and above that prescribed by 49 CFR Part 563, with the capability to trigger in impacts with vulnerable road users and record the status of active safety systems. The parameters that could be monetised were compared, and the additional cost and benefits predicted in the action scenario used to compute benefit-to-cost ratios for each vehicle type.

Via consultation with stakeholders and a review of previous research, a range of potential benefits of the action scenario were identified:

- Benefits relating to changes in driving behaviour as a result of EDR fitment which lead to fewer accidents and therefore fewer road casualties. TRL assumed a range of 0% to 2% reduction, with a central estimate of 0% for M1 vehicles (private fleets). For M2/M3 and N2/N3 (commercial fleets) we assumed a range of 0% to 10% with a central estimate of 5%. For N1 vehicles, we assumed half the fleet was private vehicles and half commercial vehicles leading to a range of 0% to 6% with a best estimate of 2.5%. Benefits of EDRs for N2/N3 and M2/M3 may be overestimated because these fleets are already more engaged in monitoring and EDR technologies to support the driver, so it is possible that more than the 30% of the fleet assumed to be equipped are already realising the benefits.
- Benefits relating to higher quality accident data, particularly in terms of understanding the causation of accidents and, for systems which monitor active safety systems, effectiveness of new safety technologies. These potentially very large benefits could not be monetised.
- Benefits in terms of the quality of accident reconstructions and the certainty to which responsibility for the cause of an accident can be made. TRL assumed a

range of 0% to 2%, with a central estimate of 0% for reconstructions avoided and assumed for the upper estimate that 2% of the reconstructions could be reduced in cost by 10% (€300); see Section 10.3.4.

- Reductions in insurance costs because of improved data quality. For insurance reconstructions, we assumed that EDR data could save 20% (€600) for between 330 and 26,000 of annual claims, with a central estimate of 13,165 claims (see Section 10.3.5).
- Better access to justice for the citizen and enabling better enforcement and the upholding of societal values. EDR data is considered likely to improve the ability to demonstrate innocence/compliance with the law, or the fault of another party for injury or other damages. These benefits could not be monetised although it should be noted that these benefits would be attained immediately.

The main areas of costs associated with the action scenario were identified as:

- Costs to meet an 'enhanced EDR specification' similar to that proposed by VERONICA project, and above that specified by Part 563 and to enable triggering on 'soft impacts', including pedestrians and other vulnerable road users and to enable the status of active safety systems to be recorded in crash (and near miss) conditions. TRL assumed per vehicle increases ranging from €0.57 to €1.08 with a central estimate of €1.08, with these increases based on 2006 US estimates cost differences between mandatory and recommended Part 563 specifications.
- In the case of N2/N3 and M2/M3 vehicles, costs to allow the download of EDR information stored in a range of sub-systems via a single download access point. TRL assumed a much greater cost per vehicle for because the technical changes required were considered greater than for cars and the costs would be spread over a smaller fleet. Increases in per vehicle cost in the action scenario were assumed to be €20.
- Costs to access the EDR data. TRL assumed that 4,750 EDR readers would be required and the cost of the reader, software, licences and updates etc, would be between €3,600 and €6,500 with a central estimate of €5,100.
- Costs to download and store EDR data. TRL assumed values proposed by Petersen and Ahlgrimm [2014] and that data from every fatal, serious, and slight accident from 2018 is downloaded and stored.
- Costs to analyse and interpret EDR data in accident reconstruction, insurance liability investigations and research. TRL assumed that increased costs would be offset by benefits for police accident reconstructions for the lower and central estimates, but assumed in the upper estimate that 2% of 100,000 annual EU accident reconstruction cases would be avoided and 2% reduced in cost by 10% (€300).

The main findings of this cost benefit analysis were as follows:

- EDR data provides accurate and reliable information on the timing, chronology and actions taken in the pre-crash phase. This provides hard data where there

are currently only estimates, and means that accident reconstructions and research can utilise this higher quality information to make better, more robust conclusions. These in turn could be used to support measures to improve road safety as well as enhancing the understanding of the causes of accidents. This is important for improvements to secondary safety, but also for the effective implementation of active technologies and accidents involving vulnerable road users.

- There was evidence found on the effect of EDR fitment on driving behaviour, for commercial fleets. If similar effects apply to private fleets, or if the effect on safety is greater than predicted by the estimates for commercial fleets, this would have very large benefits associated with monetised casualty savings.
- Behavioural change is strongly linked to information feedback. Without mechanisms to raise awareness of EDR fitment, effects on safety may reduce over time. Mechanisms to improve driver awareness and engagement with EDRs are likely to result in greater safety benefits.
- Some other important potential benefits could not be monetised: improved accident data leading to enhancements in safety and benefits relating to access to justice. Depending on the effect of the action scenario, these could represent very significant benefits, possibly at least double those monetised in this study although benefits relating to accident data would be subject to a time lag. Retrospectively unlocking access to EDRs on vehicles already in the fleet (as some manufacturers have already done in some markets) would increase the potential benefits.
- Using the assumptions and values identified (with appropriate ranges) the following BCR values were identified. These do not include those benefits that could be monetised; if these could also be realised, the benefits would be substantially increased:
 - BCR for M1 vehicles was estimated excluding potentially large components of benefit at between 0 to 5.7, central estimate 0.1;
 - BCR for N1 vehicles was estimated excluding potentially large components of benefit at between 0 to 6.6, central estimate 1.0;
 - BCR for M2/M3 vehicles was estimated excluding potentially large components of benefit at between 0 to 4.0, central estimate 2.0; and
 - BCR for N2/N3 vehicles was estimated excluding potentially large components of benefit at between 0 to 4.6, central estimate 2.3.
- If EDR data provides more robust evidence leading to improvements in safety measures or regulation at the same level as predicted by Petersen and Ahlgrimm (i.e. 2%), then further benefits would be realised, although because of the lag between the data becoming available and subsequent action, these benefits would be largely realised outside the assessment period. TRL considers substantial benefits are likely because evidence informing on the effectiveness of active safety systems requires robust information on the timing and chronology of events and actions in the pre-crash phase that can be provided by EDR data. Furthermore, secondary safety systems and measures to address vulnerable road users could be improved.

- Further information should be sought on the accuracy of costs associated with the implementation of an enhanced EDR specification.
- Costs associated with EDR download and analysis should be monitored and ongoing estimates collected on the benefits that the EDR can provide; small effects in this respect have a large influence on overall cost-effectiveness.
- An enhanced EDR specification has the potential to deliver significant benefits, although the scale of these is not easily predicted with the available data; much of the benefit is difficult to quantify. Central estimate BCRs appear greatest for large vehicles (despite the relatively high costs assumed), although the greatest absolute benefit accrues to M1 passenger cars because of the greater fleet size of this vehicle type.

11 Conclusions

This project has examined the benefit of installing Event Data Recorders (EDR) on improving road safety in Europe. The main conclusions of this study can be summarised as follows:

- EDRs are fitted to almost all new M1 vehicles in Europe and may have been equipped for some years. Typically, the EDR is part of the airbag control module. The data recorded is currently comparable to the mandatory specification demanded by Part 563 in the USA, and in some cases it is known that many more parameters are recorded. The situation is similar for small commercial vehicles (N1). However, the fitment of EDRs to large commercial vehicles (N2/N3) and buses and coaches (M2/M3) is more variable in terms of how the system is organised and the types of data recorded.
- The available evidence suggests that many commercial fleets equip in-vehicle data recorders, primarily to measure and influence driving efficiency and behaviour, with the aim of reducing costs and improving safety. Insurers are also starting to offer reduced premiums in return for fitment of EDR and/or continuous driver monitoring systems. Some systems on heavy commercial vehicles include vehicle data recorders that can also record accident events.
- The benefits of EDRs are consistently documented in the literature in terms of the following areas:
 - **Road safety** – studies show a range of reductions in accidents when in-vehicle data recorders (including EDRs) are fitted because the presence of the system affects driver behaviour resulting in societal benefits of fewer accidents. However, these effects are smaller for EDRs and the evidence appears limited to commercial fleets; most ordinary car drivers are unaware that an EDR is fitted to their vehicle.
 - **Vehicle design** – manufacturers can obtain information on accident causation and use this to improve future vehicle designs and safety systems.
 - **Accidentology and accident reconstruction** – accurate information from before, during and after an accident provides robust information to help determine accident causation and allows accident researchers to accurately assess the effectiveness of countermeasures, particularly those that help avoid accidents. This means that research and policy recommendations are focussed on the safety advances that have the greatest societal benefit.
 - **Legal proceedings** – information on the accident means that the liability for the accident can be more accurately and objectively determined, therefore reducing time and legal costs and providing road users and society with access to justice.
- The main concerns or disbenefits of EDR fitment relate to the legal and privacy issues of the data and who has access to the data under which circumstances. Furthermore, larger vehicles appear to have less standardisation with respect to

EDR design and capability, meaning that the cost of standardising EDRs would have to be added to the cost of implementation.

- The US EDR specification has minimum data frequency requirements that are exceeded by many current systems, thus demonstrating that the state of the art exceeds the current US EDR requirements stipulated by 49 CFR Part 563. Higher frequency data would provide a better and more complete understanding of accident events, thereby realising more of the benefit and this appears to be technically achievable by current systems.
- Limited information was forthcoming on system costs and these depend on the type of EDR system considered. For passenger cars and vans, EDRs seem to be largely fitted already so additional costs may be negligible. We assumed the additional cost of an enhanced EDR specification would be comparable to the technical development and costs predicted in US prior to the introduction of Part 563. Other vehicle types are more variable in what is recorded and in terms of system architecture; costs may therefore be greater for these vehicles. We assumed a value of €20 per vehicle in acknowledgment of the technical challenges of providing an enhanced EDR specification and altered system architecture and the smaller vehicle fleet.
- Legal advice from six European countries on the national application of European Directive 95/46/EC found that:
 - Ownership of EDR data was not well defined and would benefit from clarification; at present, the car owner would be most likely to be considered the owner, but ownership would need to be defined on a case-by-case basis.
 - Access to the EDR data was possible by any party able to access the EDR port who was in possession of the correct tools and information. Further controls in this area would be technically possible and could be desirable to control access and prevent data modification or deletion.
 - EDR data, by itself, does not constitute personal data. Thus, any party can use anonymised EDR data. Should the party accessing the data be in the possession of other data that renders the EDR data personal, the nationally enforced provisions of Directive 95/46/EC apply which contain adequate processes and controls to protect personal data.
 - All six countries that were reviewed (Austria, France, Germany, Italy, Spain and UK) highlighted a degree of uncertainty surrounding the collection and use of EDR data and recommended that, although adequate legal frameworks exist once ownership and access are defined, specific conventions would be helpful for these fundamental aspects.
- A cost-benefit analysis was carried out to compare the costs and benefits in two scenarios: one reflecting the status quo, and one representing action to mandate an EDR specification over and above that prescribed by Part 563, with the capability to trigger in impacts with vulnerable road users and record the status of active safety systems. The parameters that could be monetised were compared, and the additional cost and benefits predicted in the action scenario used to compute benefit-to-cost ratios for each vehicle type.

- Via consultation with stakeholders and a review of previous research, a range of potential benefits of the action scenario were identified:
 - Benefits relating to changes in driving behaviour as a result of EDR fitment which lead to fewer collisions and therefore fewer road casualties. TRL assumed a range of 0% to 2% reduction in collisions, with a central estimate of 0% for M1 vehicles (private fleets). For M2/M3 and N2/N3 (commercial fleets) we assumed a range of 0% to 10% with a central estimate of 5%. For N1 vehicles, we assumed half the fleet was private vehicles and half commercial vehicles leading to a range of 0% to 6% with a best estimate of 2.5%. Benefits of EDRs for N2/N3 and M2/M3 may be overestimated because these fleets are already more engaged in monitoring and EDR technologies to support fleet management, so it is possible that more than the 30% of the fleet assumed to be equipped are already realising the benefits.
 - Benefits relating to higher quality accident data, particularly in terms of understanding the causation of accidents and, for systems which monitor active safety systems, effectiveness of new safety technologies. These potentially very large benefits could not be monetised.
 - Benefits in terms of the quality of accident reconstructions and the certainty to which responsibility for the cause of an accident can be made. TRL assumed a range of 0% to 2%, with a central estimate of 0% for reconstructions avoided and assumed for the upper estimate that 2% of the reconstructions could be reduced in cost by 10% (€300).
 - Reductions in insurance costs because of EDR data. For insurance reconstructions, we assumed that EDR data would only provide cost savings in some cases, and would save 20% (€600) for between 330 and 26,000 of annual claims, with a central estimate of 13,165 claims. There would also be benefits in many cases in terms of the quality of the data available.
 - Better access to justice for the citizen and enabling better enforcement and the upholding of societal values. EDR data is considered likely to improve the ability to demonstrate innocence/compliance with the law, or the fault of another party for injury or other damages. These benefits could not be monetised although it should be noted that these benefits would be attained immediately.
- The main areas of costs associated with the action scenario were identified as:
 - Costs to meet an 'enhanced EDR specification' similar to that proposed by VERONICA project, and above that specified by Part 563 and to enable triggering on 'soft impacts', including pedestrians and other vulnerable road users and to enable the status of active safety systems to be recorded in crash (and near miss) conditions. TRL assumed per vehicle increases ranging from €0.57 to €1.08 with a central estimate of €1.08, with these increases based on 2006 US estimates cost differences between mandatory and recommended Part 563 specifications.
 - In the case of N2/N3 and M2/M3 vehicles, costs to allow the download of EDR information stored in a range of sub-systems via a single download access point. TRL assumed a much greater cost per vehicle for because the

technical changes required were considered more extensive than for cars and the costs would be spread over a smaller fleet. Increases in per vehicle cost in the action scenario were assumed to be €20.

- Costs to access the EDR data. TRL assumed that 4,750 EDR readers would be required and the cost of the reader, software, licences and updates etc, would be between €3,600 and €6,500 with a central estimate of €5,100.
- Costs to download and store EDR data. TRL assumed values proposed by Petersen and Ahlgrimm [2014] and that data from every fatal, serious, and slight accident from 2018 is downloaded and stored.
- Costs to analyse and interpret EDR data in accident reconstruction, insurance liability investigations and research. TRL assumed that increased costs would be offset by benefits for police accident reconstructions for the lower and central estimates, but assumed in the upper estimate that 2% of 100,000 annual EU accident reconstruction cases would be avoided and 2% reduced in cost by 10% (€300).
- EDR data provides accurate and reliable information on the timing, chronology and actions taken in the pre-crash phase. This provides hard data where there are currently only estimates, and means that accident reconstructions and research can utilise this higher quality information to make better, more robust conclusions. These in turn could be used to support measures to improve road safety as well as enhancing the understanding of the causes of accidents. This is important for improvements to secondary safety, but also for the effective implementation of active technologies and accidents involving vulnerable road users.
- There was evidence found on the effect of EDR fitment on driving behaviour for commercial fleets. If similar effects apply to private fleets, or if the effect on safety is greater than predicted by the estimates for commercial fleets, this would have very large benefits associated with monetised casualty savings.
- The literature indicates that behavioural change is strongly linked to information feedback. Without mechanisms to raise awareness of EDR fitment, effects on safety may reduce over time. Mechanisms to improve driver awareness and engagement with EDRs are likely to result in greater safety benefits.
- Some other important potential benefits could not be monetised: improved accident data leading to enhancements in safety and benefits relating to access to justice. Depending on the effect of the action scenario, these could represent very significant benefits, possibly at least double those monetised in this study although benefits relating to accident data would be subject to a time lag. Retrospectively providing EDR access to vehicles already in the fleet (as some manufacturers have already done in some markets) would increase the potential benefits.
- Using the assumptions and values identified (with appropriate ranges) the following BCR values were identified. These do not include those benefits that could not be monetised; if these could also be realised, the benefits would be substantially increased:

- BCR for M1 vehicles was estimated, excluding potentially large components of benefit, at between 0 to 5.7, with a central estimate of 0.1;
 - BCR for N1 vehicles was estimated, excluding potentially large components of benefit, at between 0 to 6.6, with a central estimate of 1.0;
 - BCR for M2/M3 vehicles was estimated, excluding potentially large components of benefit, at between 0 to 4.0, with a central estimate of 2.0; and
 - BCR for N2/N3 vehicles was estimated, excluding potentially large components of benefit, at between 0 to 4.6, with a central estimate of 2.3.
- If EDR data enables more robust evidence which leads to improvements in safety measures or regulation at the same level as predicted by Petersen and Ahlgrimm (i.e. 2%), then further benefits would be realised, although because of the lag between the data becoming available and subsequent action, these benefits would be likely to be largely realised outside the assessment period. TRL considers substantial benefits are likely because evidence informing on the effectiveness of active safety systems requires robust information on the timing and chronology of events and actions in the pre-crash phase that can be provided by EDR data. Furthermore, secondary safety systems and measures to address vulnerable road users could be improved.
 - Further information should be sought on the accuracy of costs associated with the implementation of an enhanced specification EDR.
 - Costs associated with EDR download and analysis should be monitored and ongoing estimates collected on the benefits that the EDR can provide; small effects in this respect have a large influence on the overall cost-effectiveness.
 - An enhanced EDR specification has the potential to deliver significant benefits, although the scale of these is not easily predicted with the available data as much of the benefit is difficult to quantify. Central estimate BCRs appear greatest for large vehicles (despite the relatively high costs assumed), although the greatest absolute benefit accrues to M1 passenger cars because of the greater fleet size of this vehicle type.

12 Recommendations

Cars

Although the central estimate of the benefit-cost ratio was less than 1, there are key benefits for road safety that were identified during the project that could not be monetised; if these benefits are attainable, the benefit-cost ratio is estimated to be significantly greater than 1. Furthermore, it would appear that EDRs for cars can be enabled at minimal cost if a specification equivalent to CFR 49 Part 563 / FMVSS 405 is implemented. It is recommended that this is considered as a minimum.

Many M1 EDRs already exceed the minimum specification defined in Part 563 and additionally record acceleration in multiple axes, record data at up to 1000 Hz, and record the status of active safety systems. This latter could have particularly important benefits for identifying the effectiveness of different active safety systems. It is recommended that consideration is given to enhancing the EDR specification compared with Part 563, in particular to record the status of all active safety systems fitted to the vehicle if the full benefits from EDR data are to be realised.

The Part 563 EDR specification is not considered adequate for triggering on 'soft impacts', including collisions with pedestrians and other vulnerable road users. It is recommended that consideration be given to defining adequate triggering requirements for pedestrian and cyclist collisions. At minimum, this could require that any pedestrian and/or cyclist detection system (e.g. camera-based or bumper trigger) be used to trigger an EDR record; in addition, the improved acceleration-based triggering proposed by the VERONICA project could be considered.

Light Commercial Vehicles (LCVs)

If fitment of EDRs is mandated for M1 vehicles, it is recommended that EDRs to the same specification are required for LCVs. Note that many channels in 49 CFR Part 563 are defined as 'if fitted'; for example, side airbag activation status would only be recorded if a side airbag was fitted to the vehicle. Therefore, there would be no requirement to enhance the specification of the vehicle and therefore no associated vehicle costs.

Heavy Goods Vehicles (HGVs)

It is recommended that standards are developed with heavy vehicle manufacturers and that these define the data that is recorded (channel, duration, sampling rate), the location of stored data with respect to system architecture, and the interface via which data can be downloaded (preferably a single interface or multiple interfaces of a single design per vehicle). EDR data should be stored separately to digital tachograph data.

General

It is recommended that ownership of EDR data is formally clarified within any legislation that is considered.

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Appendix A History of CFR 49 Part 563

The following section summarises the regulatory history of the establishment of Part 563 given in the most recent NPRM [DOT, 2012b] and previous versions of Part 563.

Final Rule August 2006

In August 2006, NHTSA issued a final rule amending 49 CFR Part 563 to establish uniform performance requirements for the accuracy, collection, storage, survivability, and retrievability of on-board motor vehicle crash EDRs voluntarily installed in light passenger vehicles. The regulation applied to passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating of 3,855 kg or less and an unloaded vehicle weight of 2,495 kg or less that are voluntarily equipped with an EDR.

The 2006 final rule was intended to standardise the data obtained through EDRs so that the data would provide information to enhance NHTSA's '*understanding of crash events and safety system performance, thereby potentially contributing to safer vehicle designs and more effective safety regulations*'. The final rule was intended to be technology-neutral, so as to permit compliance with any available EDR technology that meets the specified performance requirements. The rule was also intended to ensure that EDR infrastructure '*develops in such a way as to speed medical assistance through providing a foundation for automatic crash notification (ACN)*'.

The regulation:

- Requires that the EDRs installed in light vehicles record a minimum set of specified data elements;
- Standardises the format in which those data are recorded;
- Helps to ensure the crash survivability of an EDR and its data by requiring that the EDR function during and after the front and side vehicle crash tests specified in two Federal motor vehicle safety standards; and
- Requires vehicle manufacturers to ensure the commercial availability of the tools necessary to enable crash investigators to retrieve data from the EDR; and
- Ensures public awareness of EDRs, by requiring vehicle manufacturers to include a standardised statement in the owner's manual indicating that the vehicle is equipped with an EDR and describing the functions and capabilities of EDRs.

Final Rule January 2008

On 14 January, 2008, the agency responded to petitions for reconsideration on the August 2006 final rule, and made the following amendments to Part 563:

- Clarified the event storage definitions to alleviate any uncertainties in multiple event crashes;
- Revised certain sensor ranges and accuracies to reflect current state-of-the-art technologies;
- Clarified the recorded data reporting format;
- Specified vehicle storage conditions during compliance testing;

- Clarified the required data elements and scope of covered sensors; and
- Revised the effective date to provide sufficient time for manufacturers and suppliers to comply with the rule.

NHTSA stated that they made these changes *'to encourage a broad application of EDR technologies in motor vehicles and maximize the usefulness of EDR data for vehicle designers, researchers, and the medical community, without imposing improvements to EDRs that have been voluntarily installed'*. The 2008 final rule also provided two additional years of lead time to provide manufacturers more time to implement the necessary changes to EDR architectures within their normal product development cycles.

Final Rule August 2011

On 5 August, 2011, the agency published a final rule responding to three petitions for reconsideration and made the following clarifications and amendments to Part 563:

- Removed the required standardisation of the reporting requirements for all acceleration data requirements to address certification issues with data clipping, filtering and phase-shifting;
- Clarified the application of sensor tolerances to within the range of the applicable sensor;
- Clarified the NHTSA position regarding exclusion of peripheral sensors from the reporting requirements for EDRs;
- Clarified the event storage definition to alleviate uncertainties in multiple event crashes;
- Revised requirements for the capture of event data in crashes that:
 - Involve side or side curtain/tube air bags such that EDR data would only need to be locked if the vehicle also captures lateral delta-V data, and
 - Involve non-reversible deployable restraints other than frontal, side or side/curtain tube air bags such that EDR data would not need to be locked at the option of the manufacturer,
- Clarified that any non-reversible deployable restraint may serve as an event trigger;
- Revised the minimum range requirement for the 'steering input' data element from an angular basis to a percentage basis; and
- Made other minor technical and editorial corrections.

Final Rule August 2012

On 9 August 2012, NHTSA published a final rule responding to further petitions for reconsideration and made the following clarifications and amendments to Part 563:

- Revised the steering input data element;
- Delayed the introduction of the data clipping flag requirement by one year;

- Clarified the interpretation of the locking of side impact events;
- Clarified that NHTSA is working with the SAE EDR committee to ensure that any compliance test procedure that may be introduced considers SAE J1698.

NPRM FMVSS 405 2012

On 13 December 2012, NHTSA published a Notice of Proposed Rulemaking to convert Part 563 into a Federal Motor Vehicle Safety Standard under CFR 49 Part 571. The rule would also make the fitment of EDR mandatory from 1 September 2014.

Appendix B Comparison of Part 563 / FMVSS 405 NPRM and VERONICA Data Elements

The EDR data requirements in Part 563 / FMVSS 405 NPRM are compared with those from VERONICA in the table below.

Data element	FMVSS 405 NPRM						VERONICA					
	Required?	Sample rate (Hz)	Recording interval ^A	Min range	Accuracy ^B	Resolution	Required?	Sample rate (Hz)	Recording interval ^A	Min range	Accuracy ^B	Resolution
Speed, vehicle indicated	Y	2	-5.0 to 0 s	0-200 km/h	±1 km/h	1 km/h	Y	10		0-250 km/h	± (3% + 1 km/h)	1 km/h
Engine throttle, percent full (accelerator pedal percent full)	Y	2	-5.0 to 0 s	0-100%	±5%	1%	Y	2		0-100%	± 5%	0.01
Service brake	Y	2	-5.0 to 0 s	On or Off	N/A	On or Off	Y	10-25		On or Off		On or Off
Ignition cycle, crash	Y	-	-1.0 s	0-60,000	±1 cycle	1 cycle	Y				±1 cycle	1 cycle
Frontal air bag warning lamp	Y	-	-1.0 s	On or Off	N/A	On or Off	Y			On or Off		On or Off
Frontal air bag deployment, time to deploy/first stage, driver	Y	-	Event	0-250 ms ^C	±2 ms	1 ms	Y			0-250 ms ^C	±2 ms	1 ms
Lateral acceleration	IR	-	N/A	OEM ^D	OEM ^D	OEM ^D	Y	250		50 g	±5%	0.1 g
Longitudinal acceleration	IR	-	N/A	OEM ^D	OEM ^D	OEM ^D	Y	250		50 g	±5%	0.1 g
Ignition cycle, download	IR	-	At time of download	0 to 60,000	±1 cycle	1 cycle	Y				±1 cycle	1 cycle
Safety belt status, driver	IR	-	-1.0 sec	On or Off	N/A	On or Off	Y			On or Off		On or Off
Frontal air bag deployment, time to deploy/first stage, right front passenger	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	Y			0-250 ms ^C	±2 ms	1 ms
Multi-event, number of event	IR	-	Event	1 or 2	N/A	1 or 2	Y			0-500 ms ^C		1, 2 or 3
Time from event 1 to 2	IR	-	As needed	0-5.0 sec	0.1 sec	0.1 sec	Y			0-5.0 sec	0.????	0.1 s
Longitudinal delta-v	Y	100	0-250 ms	±100 km/h	±10%	1 km/h	N					
Maximum delta-v, longitudinal	Y	-	0-300 ms	±100 km/h	±10%	1 km/h	N					
Time, maximum delta-v, longitudinal	Y	-	0-300 ms	0-300 ms ^C	±3 ms	2.5 ms	N					
Trigger date time	N						Y					
Download date time	N						Y				±60 s	1 s
Horn	N						Y	10-25		On or Off		
Main beam	N						Y	10-25		On or Off		
Dip beam	N						Y	10-25		On or Off		



Data element	FMVSS 405 NPRM						VERONICA					
	Required?	Sample rate (Hz)	Recording interval ^A	Min range	Accuracy ^B	Resolution	Required?	Sample rate (Hz)	Recording interval ^A	Min range	Accuracy ^B	Resolution
Parking lights	N						Y	10-25		On or Off		
Indicator	N						Y	10-25		On or Off		
Yaw rate	N						Y	10-25		±180°/s	5%	1°/s
Frontal air bag deployment, time to nth stage, driver	IE	-	Event	0-250 ms ^C	±2 ms	1 ms	IE			0-250 ms ^C	±2 ms	1 ms
Vehicle Roll Angle	IR	10	-1.0 up to 5.0 s	±1080°	±10%	10 deg	IE	10		±1080°	±10%	10°
Engine rpm	IR	2	-5.0 to 0 s	0-10,000 rpm	±100 rpm	100 rpm	IE	2		0-10,000 rpm	±100 rpm	100 rpm
ABS activity	IR	2	-5.0 to 0 s	On or Off	N/A	On or Off	IE	2-10		On or Off		On or Off
Stability control	IR	2	-5.0 to 0 s	On, Off, or Engaged	N/A	On, Off, or Engaged	IE	2-10		On, Off, or Engaged		On, Off, or Engaged
Safety belt status, right front passenger	IR	-	-1.0 s	On or Off	N/A	On or Off	IE			On or Off		On or Off
Frontal air bag deployment, time to nth stage, right front passenger	IE	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms
Monitoring active safety devices	N						IE			On, off or active		
cis-gis Horn (emergency vehicles)	N						IE	10-25				
Blue light	N						IE	10-25				
Normal Acceleration	IR	-	N/A	OEM ^D	OEM ^D	OEM ^D	IR	250		50 g	±5%	0.1 g
Steering input	IR	2	-5.0 to 0 s	±250°	±5%	± 1%	IR	2-10		±250°	±5%	± 1%
Frontal air bag suppression switch status, right front passenger	IR	-	-1.0 s	On, Off, or Auto	N/A	On, Off, or Auto	IR			On, Off, or Auto		On, Off, or Auto
Frontal air bag deployment, nth stage disposal, driver	IR	-	Event	Yes or No	N/A	Yes or No	IR			Yes or No		Yes or No
Frontal air bag deployment, nth stage disposal, right front passenger	IR	-	Event	Yes or No	N/A	Yes or No	IR			Yes or No		Yes or No
Side air bag deployment, time to deploy, driver	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms
Side air bag deployment, time to deploy, right front passenger	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms
Side curtain/tube air bag deployment, time to deploy, driver side	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms
Side curtain/tube air bag deployment, time to deploy, right side	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms
Pretensioner deployment, time to fire, driver	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms



Data element	FMVSS 405 NPRM						VERONICA					
	Required?	Sample rate (Hz)	Recording interval ^A	Min range	Accuracy ^B	Resolution	Required?	Sample rate (Hz)	Recording interval ^A	Min range	Accuracy ^B	Resolution
Pretensioner deployment, time to fire, right front passenger	IR	-	Event	0-250 ms ^C	±2 ms	1 ms	IR			0-250 ms ^C	±2 ms	1 ms
Complete file recorded	IR	-	Following other data	Yes or No	N/A	Yes or No	IR			Yes or No		Yes or No
Satellite position information	N						IR	1				Full NMEA dataset
Lateral delta-V	IR	100	0-250 ms	±100 km/h	± 10%	1 km/h	N					
Maximum delta-V, lateral	IR	-	0-300 ms	±100 km/h	± 10%	1 km/h	N					
Time, maximum delta-V, lateral	IR	-	0-300 ms	0-300 ms ^C	±3 ms	2.5 ms	N					
Time, maximum delta-V, resultant	IR	-	0-300 ms	0-300 ms ^C	±3 ms	2.5 ms	N					
Seat track position switch, foremost, status, driver	IR	-	-1.0 s	Yes or No	N/A	Yes or No	N					
Seat track position switch, foremost, status, right front passenger	IR	-	-1.0 s	Yes or No	N/A	Yes or No	N					
Occupant size classification, driver	IR	-	-1.0 s	≥5th female or larger	N/A	Yes or No	N					
Occupant size classification, right front passenger	IR	-	-1.0 s	Child	N/A	Yes or No	N					
Occupant position classification, driver	IR	-	-1.0 s	Out of position	N/A	Yes or No	N					
Occupant position classification, right front passenger	IR	-	-1.0 s	Out of position	N/A	Yes or No	N					

Key	Key	Key
Essentially identical requirement	Y	Y
Primary difference is Y / IR / IE	IE	IE
Some difference in requirement	IR	IR
Substantially different requirement	N	N

^A Relative to time zero

^B Accuracy requirement only applies within the range of the physical sensor. For vehicles manufactured after September 1, 2014, if measurements captured by a sensor exceed the design range of the sensor, the reported element must indicate when the measurement first exceeded the design range of the sensor.

^C Or 0 to End of Event Time plus 30 ms, whichever is shorter

^D At the option of the manufacturer

Appendix C Literature on the Accuracy of EDRs

C.1 Accuracy EDRs in Cars

Lawrence *et al.* [2002] performed 260 front-to-rear impact tests to evaluate SDM delta- v accuracy in low-speed collisions (delta- v up to 10 km·h⁻¹). In all cases the SDM underestimated the actual delta- v , by as much as 4 km·h⁻¹ at low speed and 2.6 km·h⁻¹ at 10 km·h⁻¹. However, despite the large number of tests only two bullet vehicles and one target vehicle were used, so the results may not be representative of the fleet.

Comeau *et al.* [2004] assessed GM EDRs in a series of laboratory crash tests, including two frontal impacts with a rear under-run guard at 48 and 65 km·h⁻¹. The laboratory instrumentation showed that the maximum delta- v occurred at 300 ms in the 48 km·h⁻¹ test and that the GM EDR in the vehicle used had an adequate recording duration (although other vehicles from the same manufacturer in the same test series had much shorter recording durations).

Because the number of car models in Japan equipped with EDR has increased in recent years, the National Police Agency¹⁵ [Ishikawa *et al.*, 2009] evaluated the accuracy of EDR data (and freeze-frame data from the vehicle ECUs) in 14 J-NCAP crash tests (full-width rigid wall and offset deformable barrier) and eight accident reconstructions with more complex conditions than the J-NCAP tests (e.g. multiple-vehicle rear impacts, car-to-car side impacts, and front and side pole impacts). For all test, the pre-crash vehicle velocity and crash-phase change of velocity (delta- v) were compared with the estimates derived from the laboratory instrumentation used in the tests. All seven J-NCAP car models had EDRs installed as standard.

The pre-crash vehicle velocity estimated from the EDR data was reported as having a maximum error of 0.7 m·s⁻¹ (2.5 km·h⁻¹), or 3.9%. In all cases except one (which had no error), the EDR underestimated the pre-crash vehicle velocity.

The maximum error in the delta- v estimate was reported to be up to 14% (2.4 m·s⁻¹, or 8.6 km·h⁻¹), with a mean error of 7.3%. In all cases except one, the EDR underestimated the delta- v from the laboratory instrumentation. It should be noted that this result varied depending on whether the laboratory delta- v was calculated from high-speed video data, an accelerometer mounted on the central floor of the vehicle, or the left and right sills. This implies that there is some uncertainty in the estimate of delta- v even with laboratory-grade instrumentation, possibly due to variations in the local deformation and rotation of the vehicle.

The pre-impact vehicle velocity in the accident reconstruction tests was also reasonably accurate, with a maximum reported error of 2.6 m·s⁻¹ (9.4 km·h⁻¹). However, the maximum error occurred in a moderate-speed front-rear collision (31 km·h⁻¹) and so

¹⁵ Research into EDR (Event Data Recorder) for Traffic Accident Reconstruction [http://www.npa.go.jp/english/kokusai/2013POJ\(38-39\).pdf](http://www.npa.go.jp/english/kokusai/2013POJ(38-39).pdf)

represented an error of 31%. An error of similar magnitude in a low-speed rear impact that may be associated with a whiplash claim (e.g. 8-20 km·h⁻¹) would introduce a very significant uncertainty regarding the likelihood of injury. According to the paper, full braking of the vehicle was activated prior to impact, which may have affected the accuracy of the EDR measurement, although the error was an overestimate and full braking would normally be associated with an underestimate of the vehicle velocity.

The delta-*v* estimates in the more varied collision configurations of the accident reconstructions were markedly less accurate than in the J-NCAP test conditions. The maximum errors were -30% to +40%, depending on how the laboratory delta-*v* was calculated. With the exception of pole impacts, larger percentage errors were associated with relatively low-speed collisions and the error was generally less than 10 km·h⁻¹. All cars used in the accident reconstructions were Toyota models fitted with EDR (model year 2007-2008 was specified for most vehicles).

It was noted that some of the errors were most likely due to large deformation of the vehicle at the location of the EDR, which distorted the cover of the EDR. This may have distorted the accelerometer, which is bonded to the EDR cover, potentially affecting the internal strain gauge sensor.

Freeze-frame data was accessed in most tests, but only yielded useful information in one case where damage to one of the ABS sensors during the collision led the ABS ECU to record the vehicle velocity (identical to the EDR vehicle velocity) and the speed of each wheel.

Ruth *et al.* [2010] assessed the accuracy of EDR vehicle speed estimates in situations involving significant vehicle rotation, such as may occur during a loss of control event. A single US-market 2009 Ford vehicle model was used, with factory fitted EDR and Powertrain Control Module. Loss of control events led to very large differences between the vehicle speed reported by the systems fitted to the car and external instrumentation. This is because the vehicle speed data is derived from wheel or transmission speed and if the vehicle is sliding sideways, the wheels are partially or completely locked (skidding), or the wheels are spinning (loss of traction), then the estimated vehicle speed can be very inaccurate. For example, in their tests Ruth *et al.* reported estimated vehicle speeds under or overestimated the actual vehicle speed by as much as 60 km·h⁻¹ for actual vehicle speeds of about 60-80 km·h⁻¹.

Comeau and Dalmotas [2011] assessed Toyota EDRs in 14 full-width rigid barrier crash tests from 40 to 56 km·h⁻¹. They reported an average pre-crash speed error of -4.1%, with all but one measurement underestimating the true value, and a maximum error of just -5.6%, which was within the tolerance specified by Toyota. The EDR correctly reported belt status for front seat occupants in every test, and correctly reported the position of the driver's seat. Where occupant size (5th female or 50th male) was reported, this was reported correctly. However, in four tests the EDR reported the occupant as 'Adult', when the correct designation would have been 50th male in one test and 5th female in three tests. It was noted that these errors may have been due to data retrieval tool, not the EDR itself.

The difference between the laboratory delta- v and that estimated by the EDR ranged between +0.9% and -14%, with an average error of -4%. In all cases the recording duration was adequate for the collision event.

Tsoi *et al.* [2013] evaluated EDR data from 41 US NCAP crash tests involving model year 2012 GM, Chrysler, Ford, Honda, Mazda, Toyota and Volvo vehicles. All tests were full-width rigid barrier tests conducted at 56 km·h⁻¹ and in all vehicles delta- v was recorded at either 100 or 500 Hz. The maximum error in pre-crash speed was 2.7 km·h⁻¹, with a mean of 0.6 km·h⁻¹. The maximum error in delta- v was 19 km·h⁻¹ (approximately 30%). In all cases the delta- v recording duration was sufficient to capture the main collision event, but in several cases only 150 ms of data was recorded which was sufficient for a crash pulse lasting 60-120 ms depending on the vehicle model. However, a full-width rigid barrier impact has a very short duration compared with many real-world collision types and a longer recording duration would be required in many cases. The 300 ms recording duration for delta- v in the latest version of Part 563 should be adequate for most single collision events.

Tsoi *et al.* reported that one reason for the underestimate in the EDR delta- v values could be that 50 g accelerometers are commonly used for airbag deployment decisions, as noted by the Alliance of Automobile Manufacturers (AAM) in a petition to NHTSA [Alliance, 2008], and approximately half of the laboratory accelerations exceeded 50 g . Furthermore, the AAM noted that accelerometer data is filtered at 400 Hz in the vehicle, compared with the crash test standard of 60 Hz. Both of these will affect the delta- v estimate.

Further, Tsoi *et al.* reported that all EDRs tested correctly reported the belt buckle status for the front seat occupants (when configured to report this) and front airbag deployments.

Won *et al.* [2013] evaluated the vehicle speed measured by the vehicle transmission ECU [which would be recorded by the EDR] with measurements based on a GPS system. Comparisons were made for several different manoeuvres for vehicles with and without ABS. Under maximum braking, the error in the vehicle speed measured by the vehicle was equal to the speed of the vehicle for the vehicle without ABS, i.e. the vehicle recorded zero speed once the wheel was locked. With ABS the error was reduced, but could still result in an error in estimated collision speed of up to 30 km·h⁻¹ if the collision occurred at the time of maximum error. Aggressive turning and spinning manoeuvres also resulted in marked errors because of the disconnect between vehicle speed and transmission output speed due to wheel slippage or wheel locking during the manoeuvres.

C.2 Accuracy of EDRs in Heavy Vehicles

In contrast to the literature on the accuracy of EDRs in light vehicles (principally cars), little information was found regarding the accuracy of crash-phase data for heavy vehicles. The literature for heavy vehicles focuses on: the accuracy of vehicle speed measurements during heavy braking and ABS braking events; on the effect of power loss on event data and the difficulties of data extraction; and on the synchronisation of event

data recorded in different electronic control modules within the vehicle. An overview of typical papers is given below. All of the information identified was for US market vehicles and the level of experience with extracting event data from heavy vehicles in Europe seemed to be very limited, which was confirmed during discussions with stakeholders.

Bayan *et al.* (2009) evaluated the accuracy of vehicle deceleration data in full-braking events for various combinations of initial speed, load and surface friction, and for braking on curves with simulated brake faults. They reported that pre-braking vehicle speed measurements were accurate to within 3.7 km/h on both dry and wet surfaces, for all speeds, loads and cornering radii that were tested. Under ABS braking without continuous wheel lock-up vehicle speed could be underestimated by up to 16 km/h, and with lock-up (which could occur even with correct ABS operation) the error was greater. They concluded that knowledge other than the vehicle-recorded wheel speed was required in order to estimate vehicle speed during braking. For the vehicle tested, they found that the ECU speed did not reach zero until several seconds after the vehicle became stationary. They hypothesised that this was due to vibration of the transmission output shaft being incorrectly identified as shaft rotation by the magnetic sensor. Similar findings were reported by e.g. Steiner *et al.* [2009] for other makes and models of heavy vehicle.

Reust *et al.* (2010) evaluated the accuracy of vehicle deceleration rate data and the accuracy with which the time of first application of the brakes could be established – which is often an important parameter in accident reconstructions for determining fault. They reported that vehicle deceleration (based on wheel-speed measurements) was under-reported during hard braking due to the ABS brake function, and that the degree of error was related to the speed of the vehicle. In the vehicle studied, the brake application was sampled at 1 Hz, which potentially leads to a large error in the estimate of the position of the vehicle at initial brake application. They proposed a method to reduce the error for rapid brake application events based on the vehicle deceleration data.

Messerschmidt *et al.* (2010) found that virtually all US-market heavy vehicle engine control module require uninterrupted electrical power from the vehicle battery in order to store EDR data in non-volatile memory. None of the 14 models reviewed contained a capacitor for back-up power supply when a catastrophic power loss occurs, such as may happen during a severe collision. They found that many systems require additional triggers beyond wheel speed in order to initiate recording. For example, before recording EDR data one system required the reported engine speed to be zero for 15 seconds, one required an 'elegant shutdown', one required power for 5-7 seconds after an elegant shutdown and application of the parking brake, and one required power for up to 25 seconds after a braking event. Bowman *et al.* [2010] also noted that power loss to the engine control electronics in certain makes of heavy vehicle in the US market can result in data loss.

Johnson *et al.* (2014) presented methods for the forensically-sound extraction of data from current US market heavy vehicles. Great care was reportedly required in order to ensure the correct extraction of the raw hexadecimal data and to interpret this data into meaningful information about the vehicle and event. They reported a process for altering a raw data file from one vehicle, and that the tampering could not be detected.

Plant *et al.* [2013] investigated that time lag between the state change of various heavy vehicle sensors, broadcast of the change on the vehicle's CAN bus, and the time reported by the EDR. For the vehicle investigated the average lag for brake switch activation was 1.15 s, with a maximum of 1.95 s; for clutch switch activation was on average of 0.57 s, with a maximum of 1.04 s; and vehicle speed was on average 0.70 s, with a maximum of 1.29 s.

Appendix D Legal Report

D.1 Questions Raised

TRL contracted the Data Protection and Information Governance team at Weightmans LLP, a UK national law firm, to analyse the legal situation with respect to EDRs in Europe, and to use their network of law partners in other European countries to ensure that any jurisdiction-specific issues within significant European Union territories are addressed by locally qualified lawyers. In total, reviews were conducted in Austria, England, France, Germany, Italy and Spain.

The following issues were addressed by the legal review in each country:

1. Analyse the issue of access to EDR data, its use and confidentiality issues in the context of the Study from an English law perspective and provide an in depth analysis in the form of a written report in relation to the following questions:
 - a. To what extent does EDR data comprise personal data (or special categories of particularly sensitive personal data) for the purposes of the Directive 95/46/EC?
 - b. Who owns the data recorded by the EDR system?
 - c. Who is the controller (or controllers) in respect of such EDR data for the purposes of the Directive?
 - d. How can controllers comply with their data protection obligations in respect of EDR data and do any exemptions to their data protection obligations apply?
 - e. Who has access to the data recorded by the EDR system?
 - f. Under which circumstances will these data be accessible?
 - g. What are the acceptable uses of the data?
 - h. What are the confidentiality concerns and how can they be addressed?
 - i. What is the adequate/feasible legal framework to address these issues?
2. Liaise with five agreed local law firms in France, Germany, Italy, Spain and Austria to identify any differences in the answers to these questions pursuant to the applicable national law in each of these jurisdictions.

D.2 English Law

D.2.1 Question 1

To What Extent Does EDR Data Comprise Personal Data (or Special Categories of Particularly Sensitive Personal Data) for the Purposes of the Directive 95/46/EC?

The Data Protection Act 1998, (the "**Act**") implements European Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data, (the "**Directive**"), in the UK.

The Act sets out certain rights and duties which are intended to safeguard the personal data of living individuals, (known as “**data subjects**” in the Act). To the extent that any “**data controller**” for the purposes of the Act is processing any “**personal data**” or “**sensitive personal data**” within the meaning of the Act in the context of the Study, such data controllers must comply with the Act.

For the purposes of the Act a “**data controller**” is defined to mean any person who, (either alone or jointly or in common with other persons), determines the purposes for which and the manner in which any personal data are or are to be processed.

What is “Data” for the purposes of the Act?

Broadly, the Act covers four types of information:

- Information processed, or intended to be processed, wholly or partly by electronic means (that is, information in electronic form, usually on a computer);
- Information processed in a non-automated manner which forms part of, or is intended to form part of a “relevant filing system”, (that is usually paper records in a filing system);
- Information that forms part of an “accessible record”, (that is, certain health records, educational records and certain local authority housing or social services records, regardless of whether the information is processed automatically or is held in a relevant filing system); and
- Information held by a public authority (referred to as “category “e” data” as it falls within paragraph (e) of section 1.1 of the Act).

It is likely that only the first (and possibly the second) category of data is likely to be relevant in the context of the Study.

What is “Personal Data” for the purposes of the Act?

The Act defines “**personal data**” to mean any data which relate to a living individual who can be identified either from those data alone or from those data and other information which is in the possession of, or likely to come into the possession of the data controller.

What is “Sensitive Personal Data” for the purposes of the Act?

The Act also defines some categories of personal data as “**sensitive personal data**”. The rules regarding the processing of sensitive personal data are more stringent than the rules regarding non-sensitive personal data.

The Act defines sensitive personal data to include personal data consisting of information in respect of:

- The racial or ethnic origin of the data subject;
- His political opinions;
- His religious beliefs or other beliefs of a similar nature;

- Whether he is a member of a trade union (within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992);
- His physical or mental health or condition;
- His sexual life;
- The commission or alleged commission by him of any offence; or
- Any proceedings for any offence committed or alleged to have been committed by him, the disposal of such proceedings or the sentence of any court in such proceedings.

Does the EDR Data Comprise Personal Data and/or Sensitive Personal Data?

We understand from TRL that the data recorded by EDR devices typically includes the categories of data set out at Annex 1 to this advice.

The data recorded by EDR devices appears to be information processed, or intended to be processed, wholly or partly by electronic means (i.e. information in electronic form) however, based on the information provided so far, none of the data recorded by EDRs appears to comprise "personal data" or "sensitive personal data" for the purposes of the Act in and of themselves.

The data recorded by EDR devices appears to relate solely to various aspects of the performance and the location of the vehicle in the context of "events" in which the relevant vehicles that the EDR devices are installed in are involved. It appears that none of the data recorded by the EDRs, in and of themselves, comprise data which relate to living individuals who can be identified from those data alone. If this is the case then the Act will not apply to any such data as no living individuals can be identified from it.

Although this is not listed in the information provided, in the course of our research, it has been suggested that the data recorded by EDR devices may also include vehicle identification numbers and/or vehicle registration numbers. If this was the case, the data recorded by EDR devices would be likely to be held to be personal data to which the Act would apply to the extent that it was possible to identify living individuals from such vehicle identification numbers and/or vehicle registration numbers (which are generally regarded as constituting personal data for the purposes of English law).

If the data recorded by EDR devices were combined by a data controller with other information which is in the possession of, or likely to come into the possession of that data controller, then the data recorded by EDR devices could become personal data and/or sensitive personal data for the purposes of the Act if such living individuals could be identified from such combined data. In these circumstances, the relevant data controller who was collecting, holding and/or processing such personal data and/or sensitive personal data would be obliged to comply with all of the relevant provisions of the Act.

Possible examples of personal data that could be created in these circumstances could include the combining of data recorded by EDR devices with other data from which a living individual could be identified, such as a vehicle identification number and/or a vehicle registration number.

Possible examples of sensitive personal data that could be created in these circumstances could include the combining of EDR data with other data from which a living individual could be identified which related to the commission or alleged commission by the relevant individual of any offence (e.g. a driving related offence).

A non-exhaustive list of examples of possible data controllers who could potentially combine the non-personal data recorded by EDR devices with other information in their possession (or likely to come into their possession) which would mean that living individuals could be identified from the EDR data, rendering such data personal data and also potentially sensitive personal data for the purposes of the Act, are set out in the answer to Question 3.

Please note that we have assumed that video EDR devices will not be analysed for the purposes of the Study. We understand that video EDR devices can be installed on windshields and feature cameras as well as a GPS unit and collect performance data such as accelerating, braking and turning. The recorded data is stored automatically to a secure digital (SD) card similar to those that are used in digital cameras and can be reviewed on a computer. The recorded data can include details of the time, location and direction of driving as well as the driver's view.

It is possible that video EDR devices could capture images of data subjects (both the driver and third parties) from which living individuals could be identified. In these circumstances, the data recorded by EDR devices would constitute personal data (and potentially also sensitive personal data e.g. if the racial/ethnic origin of individuals, or any information regarding the physical or mental health/condition of individuals in the circumstances of an accident was recorded). In these circumstances, relevant data controllers would need to comply with all relevant obligations in respect of their collecting, holding and/or processing of such personal and/or sensitive personal data.

Conclusion

In conclusion:

- The data recorded by EDR devices (with the potential exception of certain data which is recorded by video EDR devices) do not appear, in and of themselves, to comprise personal data and/or sensitive personal data which relate to living individuals who can be identified from those data alone;
- If this is the case then the Act will not apply to any such data as no living individuals can be identified from them;
- If, however, the data recorded by EDR devices is combined by a data controller with other information which is in the possession of, or likely to come into the possession of that data controller, then the data recorded by EDR devices could become personal data and/or sensitive personal data for the purposes of the Act if living individuals could be identified from such combined data; and

- In these circumstances, the relevant data controller would be obliged to comply with all of the relevant provisions of the Act in respect of such personal data and/or sensitive personal data.

D.2.2 Question 2

Who Owns the Data Recorded By the EDR Systems?

The question of who owns any data which is recorded by an EDR device is not a straightforward one under English law. Currently, we are not aware of any legislation in English law which definitively states who the owner of data recorded by an EDR device will be in any particular circumstances and the ownership of data recorded by EDR devices is likely to depend on a number of factors.

A non-exhaustive list of possible owners of the data recorded by EDR devices is set out below, (please note that there could well be other potential “owners” of the data recorded by EDR devices in any particular case).

Different Types of EDRs

EDR data is recorded by EDR devices. It can be argued that whoever owns the EDR device owns the data that is recorded within it.

It can also be argued that whoever is responsible for recording the data captured by the EDR device owns the data. These concepts are explored further below.

We understand that there are a number of different types of EDR devices:

- **“Event Only EDRs”** – some EDRs only permanently record information in the form of digital data related to the vehicle’s status and driving performance if the vehicle in which the EDR device is installed is involved in an “event” (e.g. a collision), when the EDR device will record data every second or every few seconds for the duration of the “event”, often before, during and after airbag deployment.

When driving performance crosses a safety threshold, predefined by several variables and materialises into an “event” (or collision), then the data in the EDR device is frozen in order to be used for investigation purposes. Typically the frozen data will cover a fixed period of around 45 seconds divided into 30 seconds before the event and 15 seconds afterwards with no data recorded on normal driving behaviour. No continuous data on location is recorded nor is data transmitted (with the exception of the post impact position and crash severity if the trigger is also used for e-call applications). Accident data recorded by Event Only EDR devices covers a time period of less than one minute.

Typically an Event Only EDR will record data from sensors contained in the airbag module itself and from other vehicle systems and the data monitored by Event Only EDRs are stored only if the airbags go off however, some may also record up to three previous “events” such as heavy braking when the system thought a crash might be imminent. After two accident events, data in respect of the first one are often automatically deleted if they have not already been deleted subsequent to a download procedure.

We understand that in the case of Event Only EDRs, the data that these EDR devices record is recorded and stored by and within the EDR device itself. Such EDR devices are often interrogated using a laptop connected to a data-retrieval device, which in turn is plugged into the vehicle's diagnostics socket or, if the vehicle is badly damaged, directly into the EDR itself.

- **"Continuous EDRs"** - some EDRs record data typically once every thirty seconds that a vehicle is being driven, with the recording frequency increasing to once every second if the vehicle is involved in an "event" such as a collision. Alternatively, EDR devices can record data as a function of distance travelled rather than elapsed time.

We understand that in the case of Continuous EDRs, the data being recorded by such EDR devices is usually recorded remotely by a third party. The identity of that third party is often stated in the original sale agreement in respect of the vehicle that is entered into between the vehicle manufacturer and the original vehicle purchaser. The original purchaser of the vehicle, or any subsequent purchaser can ask for the EDR device to be removed from the relevant vehicle so that no data is recorded remotely by the third party.

Event Only EDRs

If a vehicle is sold with an Event Only EDR device installed in it, that Event Only EDR device will record and store any relevant EDR data on the device itself. In these circumstances, it can be argued that whoever owns the vehicle in which the EDR device is installed, also owns the EDR device and, by extension, any EDR data recorded on it.

Once title to the vehicle has passed from the seller to the buyer then it can be argued that the EDR and arguably the data recorded on it belongs to the vehicle owner.

Hire Purchase/Finance Leasing

This position can be further complicated if the purchaser of the vehicle to which an EDR device has been fitted buys the vehicle through a hire purchase or finance lease type arrangement, as this may affect the time at which title to the vehicle (and thus title to the EDR device and any data recorded on it) passes to the buyer.

Any relevant hire purchase or finance leasing agreements would have to be analysed in such situations to determine which party owned the vehicle and the EDR device installed within it at the time that any relevant data was recorded.

Continuous EDRs

If a vehicle is fitted with a Continuous EDR device and the data being recorded by that device is being recorded remotely by a third party it could be argued that the third party that records the EDR data owns that data, rather than the owner of the vehicle in which the EDR device is installed.

EDRs Provided By and/or Installed at the Request of Insurers

Pursuant to some contracts of insurance, one of the conditions that is imposed on the insured vehicle drivers by the relevant insurance company is that the insured drivers must install or utilise an existing EDR or other telematics device in the insured vehicle and provide the insurance company with access to any data recorded by that EDR or other telematics device.

We understand that insurance companies typically use the data recorded by such EDR or other telematics devices to assess the risk in respect of the insured drivers when deciding on levels of insurance premiums and also to investigate any incidents that occur involving the insured vehicle.

In these circumstances, it could be argued (and the relevant contracts of insurance may well provide that) the relevant insurance companies are the owners of any data which is recorded by the EDR devices.

EDRs Provided By and/or Installed at the Request of Employers

If an employer has provided and/or installed EDR devices in vehicles, or otherwise owns vehicles in which EDR devices are installed, which vehicles are driven by its employees and/or other third parties, then it could be argued that the employer, as the owner of the relevant vehicles, owns any data recorded by such EDR devices.

Vehicle Drivers

It can also be argued that vehicle drivers (who are not vehicle owners) are the owners of any data recorded by such EDR systems to the extent that such data are recorded during the periods when the relevant drivers are driving the vehicles.

Intellectual Property Rights

To the extent that a party compiles a collection of data recorded by EDR devices, then certain intellectual property rights in respect of such data may arise.

Under English law copyright can arise in both databases and also tables and compilations of data other than databases as original literary works. Pursuant to the Copyright, Designs and Patents Act 1988, (the "**CDPA**"), to qualify for copyright protection, a database must comprise a collection of independent works, data or other materials which are arranged in a systematic or methodical way and are individually accessible by electronic or other means. A database would also have to be an original work, be made by a qualifying person and the selection and arrangement of the contents of the database would have to constitute the author's intellectual creation in order for the database to qualify for copyright protection.

If a database does not satisfy these criteria, then other compilations of data may still qualify for copyright protection under the CDPA.

The first owner of copyright in a database will be the author of a database (i.e. the person who creates it). There are a number of exceptions to this rule, for example, if a work is made by an employee in the course of his employment the employer will be the first owner of any copyright in the work, subject to any contrary agreement. If a

business commissions a contractor to create a database for it, the contractor is likely to be the first owner of copyright in the database in the absence of contrary agreement, even though the commissioner of the work has paid for the work to be done.

In addition to copyright, there is also a separate database right can arise in respect of databases. Generally, copyright protection is regarded as covering the structure of a database, while the database right is regarded as protecting the data stored in the database. The separate database right will subsist in a database if there has been "a substantial investment in obtaining, verifying or presenting the contents of the database".

The maker of a database (who must be based in an EEA state) will be the first owner of database right in it. The maker of the database for the purposes of database right is the person who takes the initiative in obtaining, verifying or presenting the contents of a database and assumes the risk of investing in that obtaining, verification or presentation. Again, an employer is regarded as the maker of a database made by an employee in the course of his employment, subject to any contrary agreement. In contrast to the position with the ownership of copyright in a database, however, a business which commissions a contractor to produce a database is likely to be the owner of any database right in the database as the business will assume the risk of investing in the obtaining, verification or presentation of the contents of the database.

The ownership of any such intellectual property rights in any databases and compilations of data obtained from EDR systems is likely to depend on the relevant facts in any particular case however, the ownership of any such intellectual property rights may well help to determine who owns the data.

Conclusion

In conclusion:

- in our opinion the position regarding ownership of data recorded by EDR devices under English law is currently unclear and would benefit from clarification;
- in any given situation, there may be a number of parties who could reasonably claim to be the owner of any data recorded by EDR devices to a greater or lesser degree;
- in some cases ownership of data recorded by EDR devices may be determined contractually;
- the ownership of any intellectual property rights in data and/or databases of EDR related data which are compiled by any parties are likely to depend on the circumstances of each case;
- we understand that some jurisdictions are taking steps to address the issue of ownership of data which is recorded by EDR devices. In the USA, for example, we understand that draft legislation has been proposed recently which, among other things, is intended to clarify the ownership of data obtained recorded by EDR devices installed in vehicles, (further details are set out at the answer to Question 9 below). We are not aware of any similar proposed legislation in the UK at present;

- unfortunately, it is not possible to say with certainty who will own the data which is recorded by EDR devices in all cases under English law - the issue of ownership of EDR data is likely to have to be determined on a case by case basis depending on the facts in any given scenario; and
- it may well be the case that, depending on the facts, because a number of different entities, organisations and/or individuals could arguably be said to “own” the data recorded by EDRs, no one person will “own” the relevant EDR data.

D.2.3 Question 3

Who is the Controller (or Controllers) in Respect of Such EDR Data for the Purposes of the Directive?

Definition of “Data Controller”

The Act defines a “**data controller**” to mean a person who, (either alone or jointly or in common with other persons), determines the purposes for which and the manner in which personal data are or are to be processed.

The Act protects the rights of individuals by imposing obligations on those who decide how and why data which relates to them is processed, i.e. data controllers.

Definition of “Data Processor”

The Act defines a “**data processor**” to mean, in relation to personal data, any person (other than an employee of the data controller) who processes the data on behalf of the data controller.

Data processors are not subject to obligations under the Act in the same way that data controllers are however, data controllers who appoint data processors to process any personal data and/or sensitive personal data on their behalf are subject to various obligations pursuant to the seventh data protection principle (further details of which are set out below) regarding the appointment of data processors.

When Does the Act Apply to Data Controllers?

The Act will apply to a data controller in respect of any data if either:

- a) the data controller is established in the UK and the data are processed in the context of that establishment; or
- b) the data controller is established neither in the UK nor in any other EEA Member State but uses equipment in the UK for processing the data other than for the purposes of transit through the UK.

The Act provides that each of the following is to be treated as being established in the UK:

- a) an individual who is ordinarily resident in the UK;

- b) a body incorporated under the law of, or any part of, the UK;
- c) a partnership or other unincorporated association formed under the law of any part of the UK; and
- d) any person who does not fall within (a), (b) or (c), but maintains in the UK: (i) an office, branch or agency through which he carries on any activity, or (ii) a regular practice, and reference to establishment in any other EEA State has a corresponding meaning.

Meaning of “Processing” Personal Data For the Purposes of the Act?

The Act regulates the “**processing**” of personal data. This is defined very broadly and it is difficult to think of any activities that a data controller might carry out with data which would not constitute processing for the purposes of the Act.

Processing in relation to information or data is defined to mean obtaining, recording or holding the information or data, or carrying out any operation or set of operations on the information or data, including: organisation, adaptation or alteration of the information or data; retrieval, consultation or use of the information or data; disclosure of the information or data by transmission, dissemination or otherwise making available; or alignment, combination, blocking, erasure or destruction of the information or data.

Who could be Acting as a Data Controller in Respect of Data Recorded by EDR Devices for the Purposes of the Act?

For the reasons noted in the answer to Question 1 above, none of the data recorded by EDR devices, in and of themselves, appear to comprise personal data and/or sensitive personal data for the purposes of the Act, as no living individuals can be identified from those data alone. The Act will not apply to any such data as no living individuals can be identified from them. If any individuals, entities and/or organisations collect, hold and/or process such data the Act would not apply to that processing.

If, however, the data recorded by an EDR device were combined by a data controller with other information which is in the possession of, or likely to come into the possession of that data controller, then the data recorded by that EDR device could become personal data and/or sensitive personal data for the purposes of the Act to the extent that living individuals could be identified from such combined data. In these circumstances, any relevant data controller to whom the Act applied and who was collecting, holding and/or processing such personal data and/or sensitive personal data would be obliged to comply with all of the relevant provisions of the Act.

A non-exhaustive list of examples of potential data controllers in respect of personal data and/or sensitive personal data obtained from EDR devices in this way could include:

- **vehicle manufacturers;**
- **vehicle owners;**
- **vehicle drivers;**

- **the police and other law enforcement agencies;**
- **other emergency services;**
- **accident investigators;**
- **insurers;**
- **researchers; and**
- **employers.**

Whether or not all or any of the above parties will be acting as data controllers is likely to depend on the facts and circumstances of every particular case. Unfortunately, in the absence of a specific factual scenario, it is not possible to state definitively that any of the above parties will always be acting as a data controller or will never be acting as a data controller.

To the extent that any of the above parties combined data recorded by EDR devices with other data which allowed them to identify living individuals from such EDR data, then the data recorded by EDR devices would become personal data (and potentially also sensitive personal data) under the Act.

If, for example, the police obtained data from an EDR device which was installed in a vehicle that had been involved in an accident and combined that EDR data with other data in the police's possession which related to the driver of the vehicle at the time of the accident and

the vehicle driver could be identified as a living individual from such combined data, then the relevant police force would be acting as a data controller in respect of the personal data of

living individuals and would have to comply with all relevant provisions of the Act regarding the processing of such data.

In these circumstances, the personal data which the police had created by combining the data which was already in their possession with the data which had been recorded by the EDR device could potentially include sensitive personal data. For example, if the police were in possession of data concerning the physical or mental health or condition of the vehicle driver as a result of their investigations, then such data would be likely to comprise sensitive personal data. As noted above, data controllers are obliged to comply with more stringent conditions when processing any sensitive personal data and this would need to be borne in mind by the police in this example.

Conclusion

In conclusion:

- it should be possible to determine relatively easily in the context of any particular set of facts whether or not an individual, entity or organisation is acting as a data controller for the purposes of the Act;

- however, in the absence of any details regarding the circumstances of a particular case it is not possible to say with certainty whether any individuals, entities and organisations would definitely be acting as data controllers in all circumstances, or would definitely not be;
- potential data controllers in respect of personal data and/or sensitive personal data obtained from EDR devices could include, for example, vehicle manufacturers, vehicle owners, vehicle drivers, the police and other law enforcement agencies, other emergency services, accident investigators, insurers, researchers and employers; and
- whether or not a party is acting as a data controller will depend on all of the factors set out above and the circumstances of the particular case.

D.2.4 Question 4:

How Can Controllers Comply With Their Data Protection Obligations in Respect of EDR Data and Do Any Exemptions to Their Data Protection Obligations Apply?

To the extent that the Act applies to any individual, organisation and/or entity as a data controller, unless a relevant exemption applies, that data controller will be obliged to comply with all relevant obligations under the Act.

How Can Data Controllers Comply With Their Data Protection Obligations in Respect of EDR Data?

A data controller's obligations under the Act include, without limitation, notifying the UK Information Commissioner in accordance with the Act about the fact that the relevant individual, organisation or entity is acting as a data controller and identifying the types of personal data that it is holding and processing and the purposes for which it is holding and processing such personal data.

A data controller's obligations also include, without limitation, compliance with the eight data protection principles in respect of any personal data and sensitive personal data that the data controller collects, holds and/or processes in any way.

The eight data protection principles are set out below:

1. Personal data shall be processed fairly and lawfully and, in particular, shall not be processed unless at least one of the conditions set out in Schedule 2 to the Act is met and, in the case of sensitive personal data, at least one of the conditions set out in Schedule 3 to the Act is also met.
2. Personal data shall be obtained only for one or more specified and lawful purposes, and shall not be further processed in any manner incompatible with that purpose or those purposes.
3. Personal data shall be adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed.
4. Personal data shall be accurate and, where necessary, kept up to date.
5. Personal data processed for any purpose or purposes shall not be kept for longer than is necessary for that purpose or those purposes.

6. Personal data shall be processed in accordance with the rights of data subjects, (the living individuals to which the personal data relates), under the Act.
7. Appropriate technical and organisational measures shall be taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of, or damage to, personal data.
8. Personal data shall not be transferred outside the European Economic Area unless that country or territory ensures an adequate level of protection for the rights and freedoms of data subjects in relation to the processing of that personal data.

The First Data Protection Principle

Unless a relevant exemption applies, data controllers collecting, holding and/or processing personal and/or sensitive personal data recorded by EDR devices will need to comply with the requirements of the first data protection principle in respect of all such personal data and/or sensitive personal data. There are various elements to this.

Processing Personal Data Fairly and Lawfully

Data controllers should ensure that they have legitimate grounds for collecting and using the relevant personal data and sensitive personal data and should not use the relevant data in ways that have unjustified adverse effects on the individuals concerned. Data controllers should be transparent about how they intend to use the data and give the relevant individuals appropriate privacy notices when collecting their personal data. Data controllers should handle people's personal data only in ways they would reasonably expect and make sure they do not do anything unlawful with the data.

Schedule 2 Conditions

Data controllers will need to ensure that they process any personal data and sensitive personal data in accordance with at least one of the conditions set out in Schedule 2 to the Act.

There are a number of Schedule 2 conditions and again, in the absence of any specific facts, it is difficult to determine which of these conditions any particular data controller is likely to be able to comply with in any particular circumstances.

We set out below, however, details of a number of the Schedule 2 conditions that the potential data controllers may be able to satisfy depending on the circumstances, (please note that this is not an exhaustive list and that the circumstances of any particular case would need to be analysed to determine which Schedule 2 conditions a relevant data controller would be able to comply with):

"Consent"

Depending on the facts, the relevant data controllers may be able to satisfy the Schedule 2 condition that the data subjects to whom the relevant personal data relates have given their consent to the processing in question.

If the living individuals who can be identified from the relevant data have agreed that the data controller may process their personal data for the relevant purposes, a data controller will be able to rely on this condition.

For example, an insurer may be able to rely on this condition if a vehicle driver has given his/her consent to the processing of personal data pursuant to and for the purposes of an insurance contract which the driver has entered into with the insurance company, (care must be taken to ensure that vehicle driver had a real choice as to whether to give consent in these circumstances in order for the insurer to be able to satisfy this Schedule 2 condition).

"Compliance With Legal Obligations"

Depending on the facts, the relevant data controllers may be able to satisfy the Schedule 2 condition that the processing is necessary for compliance with any legal obligation to which the data controller is subject, other than an obligation imposed by contract.

For example, it may be that data controllers who were the employers of relevant data subjects would be able to rely on this condition to satisfy legal obligations regarding the employment of such relevant data subjects in certain circumstances. A potential example of this would be employers who were subject to rules regarding the use of tachographs in vehicles in some situations.

Tachographs are a form of Continuous EDR device and are used to record driving hours, speed and distance travelled. Tachographs must be used if the vehicle being driven is subject to applicable domestic, European Union and/or European Agreement Concerning the Work of Crews of Vehicles Engaged in International Road Transport ("AETR") rules, (for example, a passenger carrying vehicle or a goods vehicle). Among other things, the rules cover how long a driver can drive before needing a break, how long the break needs to be and how to aggregate these over a period of days for long distance driving. There is also EU regulation on the installation and use of tachographs.

Some non-exhaustive examples of potentially relevant domestic legislation could include the Road Transport (Working Time) Regulations 2005, (which include a legal obligation on employers to record and monitor a driver's hours and rest breaks and to provide an enforcement officer with these details on request) and the Transport Act 1986, (which imposes legal obligations on employers in relation to tachographs).

These legal obligations apply to certain employers and oblige them to collect personal data through the use of vehicle tracking/recording equipment in certain circumstances. Employers collecting personal data through the use of

tachographs would, therefore, potentially be able to rely on this Schedule 2 condition in these circumstances.

"Vital Interests"

Depending on the facts, the relevant data controllers may be able to satisfy the Schedule 2 condition that the processing is necessary in order to protect the vital interests of the data subjects to whom the relevant personal data relates.

This Schedule 2 condition relates to "life or death" type situations, so it is possible that the police or another law enforcement agency, or the emergency services, would be able to satisfy this condition in certain circumstances if the processing of an individual's personal data was necessary in order to protect that person's vital interests.

"Legitimate Interests"

Depending on the facts, the relevant data controllers may be able to satisfy the so called "legitimate interests" condition set out at Schedule 2 to the Act. To fulfil this condition, a data controller would have to show that the processing of the relevant personal data was necessary for the purposes of legitimate interests pursued by the data controller, or by the third party or parties to whom the data are disclosed, except where the processing was unwarranted in any particular case by reason of prejudice to the rights and freedoms or legitimate interests of the relevant data subjects.

It is possible that insurers, for example, might be able to satisfy this condition (e.g. if an insurer could demonstrate that processing the relevant personal data was necessary to fulfil its legitimate interests in determining whether or not a claim made under an insurance policy in respect of an insured vehicle was fraudulent).

Schedule 3 Conditions

Data controllers will also have to satisfy one of the conditions set out in Schedule 3 to the Act in respect of any sensitive personal data that they are holding and processing.

There are a number of Schedule 3 conditions and again, in the absence of any specific facts, it is difficult to determine which of these conditions any particular data controller is likely to be able to comply with in any particular circumstances.

We set out below, however, details of a number of the Schedule 3 conditions that the potential data controllers may be able to satisfy depending on the circumstances, (again, please note that this is not an exhaustive list and that the circumstances of any particular case would need to be analysed to determine which Schedule 3 conditions a relevant data controller would be able to comply with):

"Explicit Consent"

Depending on the facts, the relevant data controllers may be able to satisfy the Schedule 3 condition that the data subjects to whom the relevant personal data relate have given their **explicit** consent to the processing of the sensitive personal data in question. If the living individuals who can be identified from the relevant data have explicitly agreed that the data controller may process their personal data for the relevant purposes, a data controller will be able to rely on this condition.

In order for explicit consent to be valid, the consent from the relevant individuals would have to be absolutely clear and should cover the specific processing details, the type of information, (or even the specific information), the purposes of the processing and any special aspects that may affect the individual, such as any disclosures that may be made.

"Vital Interests"

Depending on the facts, again, it is possible that the relevant data controllers may be able to satisfy the Schedule 3 condition that the processing is necessary: (a) in order to protect the vital interests of the data subject or another person in a case where: (i) consent cannot be given by or on behalf of the data subject; or (ii) the data controller cannot reasonably be expected to obtain the consent of the data subject; or (b) in order to protect the vital interests of another person, in a case where consent by or on behalf of the data subject has been unreasonably withheld.

Again, this Schedule 3 condition relates to "life or death" type situations, so it is possible that the police or another law enforcement agency would be able to satisfy this condition in appropriate circumstances.

"Legal Proceedings"

Depending on the facts, it is possible that the relevant data controllers may be able to satisfy the Schedule 3 condition that the processing: (a) is necessary for the purpose of, or in connection with any legal proceedings (including prospective legal proceedings), (b) is necessary for the purpose of obtaining legal advice, or (c) is otherwise necessary for the purposes of establishing, exercising or defending legal rights.

For example, it is possible that the police or accident investigators would be able to satisfy this Schedule 3 condition in appropriate circumstances.

"Anti-Fraud Organisations"

Depending on the facts, it is possible that the relevant data controllers could satisfy the Schedule 3 condition that the processing: (a) is either: (i) the disclosure of sensitive personal data by a person as a member of an anti-fraud organisation or otherwise in accordance with any arrangements made by such an organisation; or (ii) any other processing by that person or another person of sensitive personal data so disclosed; and (b) is necessary for the purpose of preventing fraud or a particular kind of fraud.

For example, it is possible that insurers who were members of anti-fraud organisations could satisfy this condition if the processing in question was necessary for the purpose of preventing insurance fraud.

"Unlawful Acts"

Depending on the facts, it is also possible that the relevant data controllers may be able to satisfy the Schedule 3 condition that the processing: (a) is in the substantial public interest; (b) is necessary for the purposes of the prevention or detection of any unlawful act; and (c) must necessarily be carried out without the explicit consent of the data subject being sought so as not to prejudice those purposes.

For example, it is possible that the police and/or insurers would be able to satisfy this condition in certain circumstances if processing of a vehicle driver's sensitive personal data (e.g. data regarding the alleged commission by him of any offence) was necessary for the detection of an unlawful driving offence or the crime of insurance fraud and asking for the vehicle driver's consent to the processing of his sensitive personal data in these circumstances would have prejudiced those purposes.

Fair Processing Information

The Act does not define fair processing, but it does provide that unless a relevant exemption applies personal data will only be processed fairly if certain information is given to the individuals concerned. All relevant data controllers must comply with their obligations to provide this "fair processing information" to any individuals whose personal and/or sensitive personal data they are collecting, holding and/or processing in the context of EDR devices in order to ensure compliance with the first data protection principle.

Relevant data controllers will have some discretion as to how they provide this "fair processing information" to the relevant data subjects.

In order to comply with the first data protection principle, the relevant data controllers must give a "privacy notice" to the individuals to whom the personal data that they are holding and processing relates, (this can be oral or written). The privacy notice should state the relevant data controller's identity, (if the data controller was not based in the UK, the data controller would also have to provide the name of its nominated UK representative), the purposes for which the relevant data controller intends to process the relevant data and any extra information that the relevant data controller would need to give to the relevant individuals to ensure that the data controller was processing the information fairly, (e.g. details of any third parties to whom the data controller intended to disclose any of the individuals' personal data).

The UK Information Commissioner has produced a "Privacy Notices Code of Practice" which sets out guidance in respect of the drafting and provision of privacy notices by data controllers to data subjects, which data controllers should take into account when providing privacy notices to individuals whose personal and/or sensitive personal data they are collecting, holding and/or processing in the context of data obtained from EDR devices.

Lawful Processing

In order to comply with the first data protection principle, the relevant data controllers will also need to comply with the requirement to process any relevant personal data and/or sensitive personal data of relevant data subjects lawfully. To ensure that they comply with these requirements, the relevant data controllers should consider whether they comply with any applicable legislation, regulations and other laws and obligations to which they are subject.

For example, the relevant data controllers should consider whether they have any confidentiality obligations, (pursuant to the common law duty of confidence or otherwise), in respect of relevant data subjects whose personal and/or sensitive personal data they are collecting, holding and/or processing and should ensure that they comply with any such obligations to ensure that they are processing personal data "lawfully".

Again, in the absence of any specific facts it is difficult to say with certainty what other legal obligations any particular data controller might be subject to in any specific circumstances and this would need to be considered on a case by case basis

The Second Data Protection Principle

Any relevant data controllers who are collecting, holding and/or processing any personal and/or sensitive personal data of living individuals which are obtained from data recorded by EDR devices will also need to ensure that they comply with the second data protection principle.

As noted above, the second data protection principle provides that personal data shall be obtained only for one or more specified and lawful purposes, and shall not be further processed in any manner incompatible with that purpose or those purposes. This principle aims to ensure that organisations are open about their reasons for obtaining personal data and that what they do with the information accords with the reasonable expectations of the individuals concerned.

The second data protection principle means that the relevant data controllers must be clear from the beginning about why they are collecting personal data and what they intend to do with it and comply with the fair processing requirements including the duty to give privacy notices to individuals when collecting their personal data, (as outlined above). They must also comply with the Act's requirements to notify the Information Commissioner and ensure that if they wish to use or disclose personal data for any purpose in addition to or different from those purposes for which the data were originally collected, that the new use or disclosure is fair.

Purposes must be specified either by giving a "privacy notice" to the relevant individuals when their personal data was originally collected or in a notification given to the Information Commissioner.

Once personal data have been collected for a specified purpose, potentially the relevant data controllers will be able to use that data for other purposes however, the relevant

personal data must not be processed for any purpose that is incompatible with the original purposes. When deciding whether using or disclosing personal data for a purpose that was not contemplated at the time of collection is compatible with the purpose for which the data was originally collected, the relevant data controllers will need to consider whether this will be fair. If it would be unfair because it would go beyond what the individual concerned would reasonably expect or because it would have an unjustified adverse effect on the relevant individual, then the proposed new use or disclosure will be incompatible with the purpose that the information was originally obtained for and its processing for the purpose is unlikely to comply with the second data protection principle.

Again, whether or not a relevant data controller is able to comply with the second data protection principle is likely to depend on the specific facts of each case. This will depend on what purposes any personal and/or sensitive personal data which were recorded by EDR devices were originally obtained from the relevant data subject for and what the relevant data controllers are planning to do with the data recorded by the EDR devices.

Other Data Protection Principles

Any relevant data controllers who are collecting, holding and/or processing any personal and/or sensitive personal data which have been recorded by EDR devices will also have to comply with the other six data protection principles, as set out above. For example, such data controllers will need to ensure that any personal and/or sensitive personal data that they collect, hold and process are adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed, are accurate and where necessary kept up to date and are not kept for longer than necessary for the purpose or purposes for which they are processed, (the third, fourth and fifth data protection principles).

The relevant data controllers should also ensure that all of the relevant personal data are processed in accordance with the rights of data subjects under the Act, (the sixth data protection principle)

The relevant data controllers should also ensure, in particular, that appropriate technical and organisational measures are taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of, or damage to, personal data, (the seventh data protection principle). As noted above, data controllers will also need to take various issues into account under the seventh data protection principle when appointing any data processors to process personal data on their behalf.

The relevant data controllers should also take care to ensure that any relevant personal and/or sensitive personal data that they transfer outside of the European Economic Area is afforded an adequate level of protection for the rights and freedoms of the individuals to whom the relevant data relates in relation to the processing of the personal data in order to ensure their compliance with the eighth data protection principle.

Location Data

Although separate from the Act, the Privacy and Electronic Communications (EC Directive) Regulations 2003, (as amended), (the "**Regulations**") include certain

restrictions regarding the processing of “location data”. To the extent that any relevant parties will be processing “location data” that is collected from any EDR devices, such parties will also need to consider whether the restrictions set out in the Regulations apply to them and, if so how to comply with the relevant rules.

The Regulations define “location data” to include any data processed in an electronic communications network or by an electronic communications service indicating the geographical position of the terminal equipment of a user of a public electronic communications service, including data relating to: (i) the latitude, longitude or altitude of the terminal equipment; (ii) the direction of travel of the user; or (iii) the time the location information was recorded.

For example, location data could include data about a relevant user’s location on a specific road at a specific time, including matters such as their direction of travel.

For the purposes of the Regulations, an “electronic communications network” is defined to include: (a) a transmission system for the conveyance, by the use of electrical, magnetic or electro-magnetic energy, of signals of any description; and (b) such of the following as are used, by the person providing the system and in association with it, for the conveyance of the signals: (i) apparatus comprised in the system; (ii) apparatus used for the switching or routing of the signals; (iii) software and stored data; and (iv) subject to certain exceptions, other resources including network elements which are not active.

An “electronic communications service” means a service consisting in, or having as its principal feature, the conveyance by means of an electronic communications network of signals, except in so far as it is a content service.

Regulation 14 applies to the processing of location data by public communications providers, third parties providing value added services, or persons acting under the authority of either of them. Regulation 14(5) provides that processing of location data in accordance with Regulation 14 shall only be carried out by: (i) the public communications provider in question; (ii) the third party providing the value added service in question; or (iii) a person acting under the authority of a person falling within either (i) or (ii). Where the processing is carried out for the purposes of the provision of a value added service, the processing of location data in accordance with Regulation 14 shall be restricted to what is necessary for those purposes.

A “public communications provider” is defined to include a provider of a public electronic communications network or a public electronic communications service. A “public electronic communications network” means an electronic communications network provided wholly or mainly for the purposes of making electronic communications services available to members of the public and a “public electronic communications service” means any electronic communications service that is provided so as to be available for use by members of the public.

A “value added service” means any service which requires the processing of traffic data or location data beyond that which is necessary for the transmission of a communication or the billing in respect of that communication.

Location data relating to a user or subscriber of a public electronic communications network or a public electronic communications service may only be processed: (a) where that user or subscriber cannot be identified from such data; or (b) where necessary for the provision of a value added service, with the consent of that user or subscriber,. In other words, location data relating to a relevant user or subscriber may only be processed where the location data does not include any personally identifiable information, or where the relevant user/subscriber has agreed to such processing if this is necessary for the provision of a value added service.

If a public communications provider obtains the consent of a user/subscriber of a public electronic communications network or a public electronic communications service to the processing of location data relating to that user/subscriber where this is necessary for the provision of a value added service, prior to doing so, the public communications provider must provide certain information to the user/subscriber to whom the data relate including: (i) the types of location data that will be processed; (ii) the purposes and duration of the processing of those data; and (iii) whether the data will be transmitted to a third party for the purpose of providing the value added service.

A user/subscriber who has consented to such processing must be able to withdraw his consent at any time and, in respect of each connection to the public electronic communications network in question or each transmission of a communication be given the opportunity to withdraw his consent using a simple and free means.

If location data includes or is combined with any personally identifiable information, as well as having to comply with their obligations under the Regulations, the party processing such location data will also be acting as a data controller for the purposes of the Act and will be obliged to comply with the Act as well as the Regulations.

Again, it is difficult to say with certainty in the absence of a specific factual scenario whether Regulation 14 is likely to apply to any particular party who is processing EDR related data in any particular case and this is likely to depend on the facts and circumstances of each case. Any party who is processing location data should consider whether Regulation 14 applies to it and comply as necessary.

Conclusion

In conclusion:

- again, in the absence of specific facts and circumstances, it is difficult to state definitively the ways in which any relevant data controllers who are collecting, holding and/or processing any EDR related data will be able to comply with their obligations under the Act;
- as there are various possible ways for them to comply, in many cases it is likely that such data controllers will be able to find a way to comply with the Act in most circumstances;
- this will require consideration on a case by case basis;
- regarding the first data protection principle, there are likely to be a number of conditions set out in Schedule 2 and Schedule 3 to the Act that data controllers may potentially be able to satisfy;

- the ways in which a data controller will be able to comply with its data protection obligations in respect of its processing of any EDR related personal and/or sensitive personal data are likely to differ depending on the facts; and
- depending on the facts, a party who is processing “location data” obtained from EDR devices may also have to comply with Regulation 14 of the Regulations.

Do Any Exemptions Apply to the Obligations of Data Controllers Under the Act Regarding Their Processing of EDR Related Data?

The Act sets out a number of possible exemptions to certain obligations of data controllers under the Act which apply in certain circumstances.

Again, in the absence of any specific factual scenario, it is difficult to tell which exemptions might be available to particular data controllers in any particular circumstances however, we set out below a non-exhaustive list of some examples of certain exemptions under the Act which might apply to certain data controllers, depending on the facts of the case.

Crime and Taxation Exemption - Section 29(1) of the Act

Pursuant to section 29(1) of the Act, personal data processed for the purposes of the prevention or detection of crime, or the apprehension and prosecution of offenders, (among other purposes) are exempt from:

- i. the first data protection principle, but not the duty to satisfy one or more of the conditions set out in Schedules 2 and 3; and
- ii. an individual’s right to make a subject access request, but only to the extent that applying those provisions to the data would be likely to prejudice any of the matters mentioned in section 29(1).

In other words, there must be a substantial chance that complying with these provisions would noticeably damage the purposes of the prevention or detection of crime, or the apprehension or prosecution of offenders, (among other purposes).

It is possible, for example, that the police would be able to rely on this exemption if they wished to process any personal and/or sensitive personal data obtained in connection with an EDR device for the purposes of detection of a particular driving related offence, depending on the circumstances.

Another possible example would be if an insurance company sought to rely on this exemption if it wished to process any personal and/or sensitive personal data obtained in connection with an EDR device for the purposes of detecting the crime of insurance fraud.

Relevant data controllers should note, however, that this exemption is not a blanket exemption and can only be relied upon to the extent necessary to protect the purposes of preventing or detecting crime (including fraud) and/or the apprehension and prosecution of offenders. The exemption should be considered on a case by case basis.

It should also be noted that data controllers who seek to rely on this exemption still have to comply with at least one Schedule 2 condition in respect of their processing of any personal data and also at least one Schedule 3 condition in respect of their processing of any sensitive personal data.

Crime and Taxation Exemption - Section 29(3) of the Act

Pursuant to section 29(3) of the Act, personal data are exempt from the “non-disclosure provisions” in any case in which the disclosure is for the purposes of the prevention or detection of crime, or the apprehension or prosecution of offenders, (among other purposes) and applying those provisions in relation to the disclosure would be likely to prejudice any of the matters mentioned in that sub-section.

As well as an organisation’s duty to comply with the first data protection principle (except to the extent it requires compliance with the Schedule 2 and 3 conditions), the “non-disclosure provisions” include an organisation’s duty to comply with the second, third, fourth and fifth data protection principles, an individual’s right to object to processing that is likely to cause damage or distress and an individual’s right, in certain circumstances, to have inaccurate personal data rectified, blocked, erased or destroyed.

Again, it is possible that, for example, the police and insurance companies could seek to rely on this exemption, depending on the facts.

Again, it is important to note that this is not a blanket exemption and would need to be considered on a case by case basis.

Research, History and Statistics – Section 33 of the Act

Among other things, the exemption set out at Section 33 of the Act provides that, for the purposes of the second data protection principle, the further processing of personal data only for research purposes in compliance with the relevant conditions is not to be regarded as incompatible with the purposes for which they were obtained.

“Research purposes” in this context means statistical or historical purposes. The “relevant conditions” in relation to the processing of personal data means the conditions-

- that the data are not processed to support measures or decisions with respect to particular individuals; and
- that the data are not processed in such a way that substantial damage or substantial distress is, or is likely to be, caused to any data subject.

Potentially, this exemption could assist certain of the relevant data controllers, such as research organisations, if the processing of any personal data recorded by EDR devices for purposes of statistical research might otherwise be held to be incompatible with the purposes for which these data were originally collected (in other words, this exemption may assist if the processing might, in the absence of this exemption, be held to be incompatible with the purposes for which the data were originally collected). This exemption would only apply, however, if the processing of the relevant data in this way did not cause substantial damage or substantial distress to the relevant individuals.

Section 33(3) of the Act also provides that personal data which are only processed for research purposes in compliance with the relevant conditions may be kept indefinitely, notwithstanding the requirements of the fifth data protection principle not to keep personal data longer than is necessary for the purpose or purposes for which they are to be processed.

Again, this exemption may also be of assistance to certain relevant data controllers regarding the retention of personal and/or sensitive personal data that they may be processing for the purposes of statistical research, depending on the facts.

Section 33(4) of the Act also provides that personal data which are processed only for research purposes are exempt from the requirement to give the individuals to whom the personal data relate a right of access to their personal data in accordance with the Act if the personal data are processed in compliance with the relevant conditions (as set out above) and the results of the research or any resulting statistics are not made available in a form which identifies data subjects or any of them.

Again, it is possible that this exemption could be of assistance to data controllers who are processing personal and/or sensitive personal data recorded by EDR devices for the purposes of statistical research, depending on the facts.

Disclosures Required by Law or Made in Connection with Legal Proceedings – Section 35 of the Act

Section 35(1) of the Act provides that personal data are exempt from the non-disclosure provisions where the disclosure is required by or under any enactment, by any rule of law or by the order of a court.

Section 35(2) of the Act provides that personal data are exempt from the non-disclosure provisions where the disclosure is necessary either for the purposes of or in connection with any legal proceedings, (including prospective legal proceedings), or for the purposes of obtaining legal advice, or is otherwise necessary for the purposes of establishing, exercising or defending legal rights.

It is possible that certain data controllers who are processing EDR related data may be able to rely on these exemptions from compliance with the non-disclosure provisions (as set out above) in certain circumstances however, again this is likely to depend on the facts and circumstances of each case.

Conclusion

In conclusion:

- it is possible that a number of exemptions under the Act might be available to certain data controllers in respect of certain of their obligations under the Act depending on the circumstances of any given case;
- for example, the exemptions under sections 29, 33 and 35 of the Act may be available to certain data controllers in certain circumstances;
- the availability of any exemptions would need to be determined on a case by case basis; and
- for any relevant data controllers seeking to rely on an exemption under the Act, it is important to remember that many exemptions are not blanket exemptions and do not exempt data controllers from all of their obligations under the Act in all cases, but only specific obligations in specific and limited circumstances, (for example, section 29(1) of the Act, which provides that the data controller is only exempt from the obligations set out in that section to the extent that applying those provisions to the data would be likely to prejudice any of the matters mentioned in section 29(1) i.e. the prevention or detection of crime and the apprehension or prosecution of offenders, among others).

D.2.5 Question 5

Who Has Access to the Data Recorded by EDR Systems?

This is a slightly different question to the issue of who owns data which is recorded by EDR Systems.

General

In practical terms, those persons/entities/organisations who have access to the EDR devices are likely to have physical access to the data recorded by such devices, depending on the type of device in question.

Anyone who has physical access to Event Only EDRs will have access to the data recorded by such devices (provided such persons/entities are able to extract, analyse and interpret the data recorded by the devices, which can typically involve use of a download device, download software, transmission interface, device driver, vehicle knowledge and potentially a certain amount of training in respect of the application of the hardware and software tools).

This could include, for example, vehicle owners, vehicle drivers and employers, depending on the circumstances.

In the case of Continuous EDRs, the third party company who records the EDR data captured by the device will have access to the EDR data.

Depending on the terms of the contract between the vehicle owner and such third party company the vehicle owner and potentially other third parties may also have access to the data.

The Act

Under the Act, data subjects (the living individuals to whom any relevant personal data and/or sensitive personal data which are included within EDR data relate) have a right of access to personal data which is being collected held and processed by any relevant data controller, unless a relevant exemption applies. If, therefore, a third party data controller is collecting, holding and processing any personal data and/or sensitive personal data about a living individual from which that living individual can be identified through an EDR device, that individual has a right to request access to any such personal data/sensitive personal data from the relevant data controller, unless a relevant exemption applies.

The Act does not, however, give specific rights to access and/or use such data to any third parties other than the data subjects themselves. Whether any party other than the relevant data subjects is entitled to access and/or use any of the data recorded by EDR systems as a data controller will depend on whether or not such data controllers are able to comply with the Act in any given set of circumstances, as set out above. Any data controller wishing to access and use personal and/or sensitive personal data recorded by EDR devices must comply with all relevant provisions of the Act and must only process any relevant personal data in a reasonable, proportionate way.

Section 29 of the Act

It should be noted that some organisations, (for example, the police and other law enforcement agencies) sometimes make requests of data controllers (e.g. employers) to provide them with personal data and/or sensitive personal data under section 29 of the Act.

As noted above, section 29(1) of the Act (among other things) provides that personal data which are processed for the purposes of the prevention or detection of crime and/or the apprehension or prosecution of offenders are exempt from compliance with the first data protection principle, which requires data controllers to process personal data fairly and lawfully (although data controllers will still need to comply with at least one Schedule 2 condition and also at least one Schedule 3 condition in the case of any sensitive personal data).

Section 29(1) also exempts data controllers from the obligation to provide access to the relevant personal data to the data subject to whom the data relates, but again only to the extent that complying with those provisions would be likely to prejudice the purposes

of the prevention or detection of crime and/or the apprehension or prosecution of offenders.

Section 29(3) also exempts personal data from the “non-disclosure provisions” (as summarised above) in any case in which disclosure of personal data is for any of the purposes of the prevention or detection of crime and/or the apprehension and prosecution of offenders and the application of the non-disclosure provisions would be likely to prejudice any of those matters.

Section 29 does **not**, however, give third parties (e.g. the police or other law enforcement agencies) a “right” to access personal data which is being held and processed by another data controller (such as an insurance company or an employer, for example). What section 29 does is to allow a data controller who discloses personal data to a third party in the circumstances set out in section 29 to disclose such data without being in breach of the non-disclosure provisions under the Act if it does so.

Notwithstanding the availability of the section 29 exemption, a data controller may choose not to disclose personal data that it is holding/processing to a third party such as the police for the purposes of the prevention and detection of crime and the apprehension or prosecution of offenders – section 29 does not oblige the data controller to disclose data or give any third party a right to access it. In these circumstances, the police would not be able to oblige the data controller to release the relevant personal data under the Act unless they obtained a court order in this regard, (the process of obtaining of a court order in these circumstances is beyond the scope of this question).

Other Applicable English Law

We are not aware of any other applicable English law which gives definitive rights to third parties to access the data recorded by EDR Systems in any circumstances.

The European eCall Initiative

Pursuant to the European e-Call initiative, after entry into force of the regulation concerning the in-vehicle system, all new models of passenger cars and light duty vehicles sold on the EU market will have to be equipped with a minimum amount of embedded equipment compliant with the 112 eCall standards. The 112 eCall will automatically dial Europe’s single emergency number 112 in the event of a serious accident and will communicate a vehicle’s location to the emergency services. This is a form of Event Only EDR device.

We understand that the call to 112 will be made automatically by means of activation of in-vehicle sensors or manually, will carry a standardised set out data (including the type and location of the vehicle) and will establish an audio channel between the vehicle and the most appropriate emergency call centre (also known as Public Safety Answering Points or “**PSAPs**”) through public mobile networks. The eCall in-vehicle system is only active when an accident occurs or if it is manually triggered.

We understand that PSAPs will have access to data related to the eCall for a determined period of time and must process any personal data and/or sensitive personal data included within this information in accordance with the Directive and also the Act in the case of UK based data controllers. In September 2011, the Commission adopted a

Recommendation to ensure the set-up of the emergency call and the transfer of eCall data from vehicles to PSAPs.

Contractual Rights

It is possible that some third parties e.g. insurance companies may have contractual rights to access data which is recorded by EDR devices.

For example, as noted above, insurance companies may contractually require a right of access to EDR data as a condition of insurance contracts that they enter into with drivers which involve the calculation of insurance premiums based on an analysis of data recorded by an EDR device installed in the insured vehicle.

Conclusion

In conclusion:

- those persons/entities/organisations who have access to Event Only EDR devices are likely to have physical access to the data recorded by such devices and may be able to interpret such data (e.g. vehicle owners, vehicle drivers and employers);
- regarding Continuous EDRs the third party company who records the EDR data captured by the device will have access to the EDR data (depending on the terms of the contract between the vehicle owner and such third party company, the vehicle owner and potentially other third parties may also have access to this data);
- under the Act, data subjects have a right to access personal data about them that is being processed by any relevant data controller unless a relevant exemption applies;
- the Act does not give any third parties other than data subjects a right to access personal data;
- whether or not a data controller has a right to access and use personal data and/or sensitive personal data of any living individuals depends on the relevant data controllers' compliance with the Act;
- section 29 of the Act does not give any party a right of access to personal data, but allows a data controller to disclose personal data at the request of third parties in certain circumstances without being in breach of the Act;
- we are not aware of any other applicable English law which gives definitive rights to third parties to access the data recorded by EDR Systems in any circumstances;
- the European eCall initiative will give PSAPs access to certain data (potentially including personal data and sensitive personal data) related to e-Calls for a determined period of time which must be processed in accordance with the Directive and the Act in the case of UK based data controllers;

- certain parties may be granted rights of access to personal data under contracts; and
- the question of who will have a right of access to data recorded by EDR systems and under what circumstances these data will be accessible to any party are likely to turn on the facts and circumstances of any particular case.

D.2.6 Question 6:

Under Which Circumstances Will These Data Be Accessible?

Please see the answer to Question 5 above.

D.2.7 Question 7:

What Are the Acceptable Uses of the Data?

As far as the Act is concerned, the uses to which any personal and/or sensitive personal data which is derived from data recorded by EDR devices can be put by a data controller will be governed to a large extent by the first and second data protection principles, further details of which are set out above.

The First Data Protection Principle

As noted above, the first data protection principle obliges relevant data controllers to process any personal data fairly and lawfully and, in particular in accordance with at least one of the conditions set out in Schedule 2 to the Act and, in the case of any sensitive personal data, in accordance with at least one of the conditions set out in Schedule 3 to the Act as well. All relevant data controllers wishing to use any data which is recorded by an EDR device which comprises personal data must comply with the first data protection principle unless a relevant exemption applies.

What comprises fair and lawful processing by a data controller in any particular circumstances is likely to depend on the facts.

The Second Data Protection Principle

The second data protection principle is also relevant. As noted above, the second data protection principle obliges all relevant data controllers, unless a relevant exemption applies, to obtain personal data only for one or more specified and lawful purposes and not to further process such personal data in any manner which is incompatible with that purpose or those purposes.

What purposes and uses will be regarded as compatible with the purposes for which the relevant data were originally collected in any particular case is likely to turn on the facts.

Conclusion

In conclusion:

- in the absence of any specific factual scenario, it is difficult to say with any certainty what the acceptable uses of any personal data and/or sensitive personal data that are obtained by any relevant data controller in connection with an EDR device will be; and
- this is likely to turn on the facts and circumstances in any particular case.

D.2.8 Question 8:

What Are the Confidentiality Concerns and How Can They Be Addressed?

It is possible that data which are recorded by EDR devices may comprise confidential information, particularly if such data are combined with other data through which living individuals can be identified e.g. information regarding an individual's physical or mental health or condition.

If any data which are recorded by EDR devices do comprise confidential information then any party to whom they are disclosed may be subject to confidentiality obligations in respect of such data. Under English law confidentiality obligations can arise in a number of ways.

The Common Law Duty of Confidentiality

Under English law a duty of confidentiality arises in certain circumstances where one party provides information to another. In order for a duty to exist the information must be information capable of giving rise to the duty, in other words it must:

- be confidential in nature, i.e. it must "have the necessary quality of confidence" about it; and
- have been provided in circumstances which imported a duty of confidence.

A person who has received information in confidence cannot take advantage of it. That person must not make use of the information to the prejudice of the person who gave the information or for an unauthorised purpose without obtaining his consent.

If a duty of confidence arises then the information may not be disclosed by the recipient to another party unless:

- the owner of the information gives consent, (this can often be the person to whom the relevant confidential information relates);
- there is a legal duty to do so; or
- public interest in disclosing the information outweighs the duty to keep the confidence.

As this is a duty which arises at common law the categories of information which give rise to the duty are not closed and have developed through case law. It is unclear

whether or not information recorded by EDR devices would be regarded as confidential information in all circumstances and this is likely to depend on the facts in any particular circumstances, what the raw data recorded by the EDR devices is combined with in many cases, who such data is disclosed to, for what purposes and in what circumstances.

Assuming that any data recorded by EDR devices was regarded as confidential information in any particular circumstances, then a recipient of such data would either have to:

- obtain the consent of the original disclosing party that the confidential information relates to before disclosing it to a third party; or
- be able to show that he/she was under a legal duty to disclose such data; or
- be able to argue that disclosure of the information was justified in the public interest. The public interest in disclosing the information would need to be weighed against the interests of the party to whom the confidential information relates in maintaining the confidentiality of such information.

The issue is likely to turn on the facts in any given case.

Any disclosure of confidential information by a recipient of confidential information where the consent of the owner of the confidential information has not been obtained and was not made pursuant to a legal obligation would need to be proportionate and limited to the purposes necessary to meet the public interest aim of disclosure.

Contractual Obligations of Confidentiality

Confidentiality obligations can also arise under contracts (both oral and written) under English law e.g. non-disclosure agreements.

For example, regarding data recorded by an EDR device in the context of an insurance contract, it is possible that the insurance contract would allow such data to be accessed and used by the relevant insurance company for certain specified purposes connected with the insurance contract. However, except for such specified uses by the insurer, the insurance contract could also provide that such data should be regarded as the insured driver's confidential information which cannot be used or disclosed to any third parties for any other purpose and which must be regarded as confidential.

First Data Protection Principle

It is important to bear in mind that any data controllers in respect of any personal data and/or sensitive personal data which is derived from any data recorded by EDR devices must comply with any confidentiality obligations that they are subject to in respect of any such data (however such confidentiality obligations arise) not only in order to comply with such obligations, but also because the first data protection principle, among other things, requires data controllers to process all personal data "lawfully".

If a data controller was in breach of an obligation of confidence it is likely that this would be regarded as unlawful and could also lead to a breach of the first data protection principle under the Act.

How Can These Issues Be Addressed?

Recipients of any data recorded by EDR devices which comprise confidential information must ensure that they comply with any obligations of confidence that they are subject to in respect of such information. If recipients of such confidential information wish to use or disclose any such data in a way that would otherwise be in breach of their confidentiality obligations, then such recipients should either obtain the consent of the owners of the information to such disclosure, or they should be able to show that they are subject to a legal duty to disclose the information, or they should be able to justify the reasonable and proportionate disclosure of such confidential information as being in the substantial public interest (which is quite a stringent test).

Conclusion

In conclusion:

- it is possible that data which are recorded by EDR devices may comprise confidential information depending on the circumstances;
- if so, under English law the recipients of such confidential information may be subject to confidentiality obligations, both contractual and at common law;
- recipients of such confidential information should comply with any such confidentiality obligations in respect of such information;
- not least, this is to ensure that they comply with their obligations as data controllers under the first data protection principle in respect of the lawful processing of any personal and/or sensitive personal data which is included within such confidential information; and
- disclosure of any confidential information in circumstances which would otherwise constitute a breach of any obligations of confidence can potentially be justified in certain limited circumstances, including:
 - if the consent of the owner of the confidential information to disclosure has been obtained; and/or
 - if the recipient of the confidential information is under a legal duty to disclose such information; and/or
 - if disclosure of the information is justified in the public interest which outweighs the interests of the party to whom the confidential information relates in maintaining the confidentiality of such information.

D.2.9 Question 9:

What is the Adequate/Feasible Legal Framework to Address These Issues?

Current Position Under English Law

Currently under English law, we are not aware of any legislation which specifically addresses issues such as the ownership of data recorded by EDR devices, who has access to the data recorded by EDR devices, the circumstances under which such data will be accessible and what the acceptable uses of such data will be in any given circumstances.

Furthermore, at this time, we are not aware of any proposed legislation or regulations which will specifically address these issues in the UK (other than the limited issues of access which are addressed by the European eCall initiative, as referred to above). As noted above, this means that the position under English law regarding some of the issues raised in connection with data recorded by EDR devices is somewhat uncertain.

Currently the Act, (together with the common law duty of confidence and any contractual obligations of confidence which may apply to recipients of data recorded by EDR devices), governs the issues of access to and use of any personal data and sensitive personal data which is derived from data recorded by EDR devices however, the Act does not specifically address many of the issues set out above.

Reform of European Data Protection Regime

Although a reform of the current European data protection regime is currently ongoing, we are not aware of any specific provisions within the proposed new regime (the nature and details of which remain very unclear at this stage) which specifically addresses any issues in respect of data recorded by EDR devices in any detail.

Position in Other Jurisdictions

Other jurisdictions have taken steps to specifically address certain of the issues which arise in respect of EDR data. We are aware, for example, of US rules which specifically require disclosure of EDRs in vehicles, with 14 US States specifically enacting legislation relating to EDR devices and prohibiting the download of data from EDR devices in vehicles, except in certain limited circumstances by certain third parties.

For example, all of the 14 States who have specifically addressed this issue allow the download of EDR data with the vehicle owner's consent (subject to certain minor variations) and if required by a court order, while others are silent on this point. Some States specifically allow the download of EDR data for the purposes of emergency medical care or the despatch of emergency medical personnel, while others do not. Some States allow the download of EDR data for the purposes of legal discovery, while others allow the download of data in connection with the probable cause of an offence, while others do not address this. A small number of US States prohibit the giving of permission to download EDR data as a condition of payment/settlement of an insurance claim, or a lease or insurance agreement however, many do not.

This is a non-exhaustive list of the types of types of issues that have been addressed by such US States.

With effect from the 1st September 2012, the National Highway Traffic Safety Administration, (the "NHTSA") in the USA implemented a rule standardising the data

collected by EDR devices in all light-passenger vehicles and how it can be achieved. The NHTSA has proposed a further new rule requiring EDRs to be installed in all light passenger vehicles from 1st September 2014.

In August 2006 the NHTSA issued a rule requiring car manufacturers to tell new car buyers if an EDR was installed in a vehicle, beginning with model year 2011 cars. The NHTSA is also of the view that data captured by EDRs is the property of the vehicle owner.

As noted above, we are also aware that the US Senate has introduced a draft bill in January 2014 to limit the retrieval of data from vehicle EDR devices, (the "**Driver Privacy Act**"). This draft bill addresses, among other things, the ownership of data recorded by EDR devices installed in vehicles, the privacy of such data, the circumstances in which such data can be accessed and used by third parties other than the owner or lessee of the relevant vehicle and limitations on data retrieval regarding data that is recorded during an "event" (as defined in section 563.5 of title 49, Code of Federal Regulations). The draft bill also makes provision for an EDR study to determine the length of time EDR devices installed in passenger motor vehicles should capture and record for retrieval vehicle related data in conjunction with an event in order to provide sufficient information to investigate the cause of motor vehicle crashes.

Conclusion

In conclusion:

- as far as we are aware, no equivalent legislation to that being adopted in the USA currently exists or is planned to be introduced in the UK whether by the UK Government directly, or in response to EU initiatives;
- we are aware, however, of the recommendations of the EC Projects VERONICA I and VERONICA II that the EU should introduce a Directive regarding the implementation of Event Only EDRs and this could be an appropriate starting point for greater regulation in this area;
- we believe that this area would benefit from closer scrutiny and regulation to ensure consistency and harmonisation of approach, both across the UK and the EU generally; and
- greater certainty regarding the legal position in this area would hopefully lead to greater benefits being obtained from data recorded by EDR devices in maximising the road safety benefits that could be obtained from such data.

Annex 1
Data Recorded by EDR Devices

Data element
Lateral acceleration
Longitudinal acceleration
Normal Acceleration
Longitudinal delta-V
Lateral delta-V
Maximum delta-V, longitudinal
Maximum delta-V, lateral
Time, maximum delta-V, longitudinal
Time, maximum delta-V, lateral
Time, maximum delta-V, resultant
Vehicle Roll Angle
Speed, vehicle indicated
Engine throttle, percent full (accelerator pedal percent full)
Engine rpm
Service brake
ABS activity
Stability control
Steering input
Ignition cycle, crash
Ignition cycle, download
Safety belt status, driver
Safety belt status, right front passenger
Frontal air bag warning lamp
Frontal air bag suppression switch status, right front passenger
Frontal air bag deployment, time to deploy/first stage, driver
Frontal air bag deployment, time to deploy/first stage, right front passenger
Frontal air bag deployment, time to nth stage, driver

Frontal air bag deployment, time to nth stage, right front passenger
Frontal air bag deployment, nth stage disposal, driver
Frontal air bag deployment, nth stage disposal, right front passenger
Side air bag deployment, time to deploy, driver
Side air bag deployment, time to deploy, right front passenger
Side curtain/tube air bag deployment, time to deploy, driver side
Side curtain/tube air bag deployment, time to deploy, right side
Pretensioner deployment, time to fire, driver
Pretensioner deployment, time to fire, right front passenger
Seat track position switch, foremost, status, driver
Seat track position switch, foremost, status, right front passenger
Occupant size classification, driver [from seat position etc. – used by the restraint system control system to decide on e.g. the level of airbag deployment]
Occupant size classification, right front passenger [from seat position etc. – used by the restraint system control system to decide on e.g. the level of airbag deployment]
Occupant position classification, driver [from seat position etc. – used by the restraint system control system to decide on e.g. the level of airbag deployment]
Occupant position classification, right front passenger [from seat position etc. – used by the restraint system control system to decide on e.g. the level of airbag deployment]
Multi-event, number of event
Time from event 1 to 2
Complete file recorded

D.3 Austrian Law

D.3.1 Question 1

To what extent does EDR data comprise personal data (or special categories of particularly sensitive personal data) for the purposes of the Directive 95/46/EC?

The Austrian Data Protection Act 2000 (“DPA 2000”) distinguished between

- personal data: information relating to data subjects being identified or identifiable “only indirectly personal data”: data relating to a subject in such a manner that the controller, processor or recipient of the transmission cannot establish the identity of the data subject by legal means;
- manual data used in a filing system: structured set up of personal data which are accessible according to at least of one specific criterion; and
- data of juridical persons: also the data of juridical persons are covered by the scope of the DPA 2000.

In essence if the data being transmitted by the EDR system are linked to the car holder via an identification number, such data would be considered personal data in the meaning of the DPA 2000. If not – according to literature – such data would in any way qualify as “only indirectly personal data” meaning that at least some of the provisions of the DPA 2000 would be applicable. The data would not qualify as manual data used in a filing system because they would be transmitted in an electronic way.

If the data are recorded via a video system, than they would always be considered as personal data because under such circumstances the identification can be easily achieved by the authorities respectively even by private parties.

D.3.2 Question 2

Who owns the data recorded by the EDR system?

No legal provisions are currently specifically regulating this issue. Thus, ownership is regulated by the general civil law provisions. Personal data linked to a specific person is normally owned by this person. In this context it would be the car holder or if the person driving the car can be identified, the driver of the car.

The owner of the car can – via consent – transfer the rights to any third party. It is unlikely that in this context implicit consent would be sufficient. This consent would not relate to any person driving the vehicle. This would be a contract to the detriment of a third party, thus not permissible under Austrian law.

With respect to only indirect identifiable data, the DPA 2000 stipulates that the use of only indirectly personal data shall not constitute an infringement of interests in secrecy deserving protection by such data subjects. Thus, the data are owned by the person collecting such only indirect identifiable data. For indirect identifiable data no right of correction or erasure exists.

Most of the logistic companies have installed EDR devices. Such installation is normally done via a Work Council Agreement (Betriebsvereinbarung) regulating the ownership of

the data and the use thereof. The general rule is that in case such devices are used in a “professional fleet” the data are owned by the employer.

D.3.3 Question 3

Who is the controller (or controllers) in respect of such EDR data for the purposes of the Directive?

The term controller is defined as follows: natural or legal person, group of persons or organ of a territorial corporate body (Gebietskörperschaft) or the offices of these organs, if they decide alone or jointly with others to use data (sub-para.8), without regard whether they use the data themselves (sub-para. 8) or have it done by a service provider (sub-para. 5). They are also deemed to be controllers when the service provider instructed to carry out an order (sub-para. 5) decides to use data for this purpose (sub-para. 8) except if this was expressly prohibited or if the contractor has to decide under his own responsibility, on the basis of rules of law or codes of conduct.

So, finally the controller will be the person deciding about the actual use of the collected data. This can either be the driver him/herself or if the driver has consented to the transfer of such data the person receiving such data. However, the controller can only use the data for the purposes the controller has described when obtaining consent. Thus, the controller could be either:

- the holder of the car;
- the manufacturer;
- the insurance company;
- the garage;
- etc.

In context of a professional fleet, the controller will always be the employer of such person.

In the context only indirectly personal data the controller will be the person collecting the only indirectly personal data.

D.3.4 Question 4

How can controllers comply with their data protection obligations in respect of EDR data and do any exemptions to their data protection obligations apply?

The DPA 2000 requires that the data shall only:

- Be used fairly and lawfully;
- Be collected for specific, explicit and legitimate purposes and not further processed in a way incompatible with those purposes; further uses for scientific and statistical purposes is permitted subject to § 46 and 47 of the DPA 2000;
- Be used insofar as they are essential for the purpose of the data application (Datenanwendung) and are not excessive in relation to the purpose;
- Be used so that the results are factually correct with regard to the purpose of the application, and the data must be kept up to date when necessary;

- Be kept in a form which permits identification of data subjects (Betroffene) only as long as this is necessary for the purpose for which the data were collected; a longer period of storage may be laid down in specific laws, particularly laws concerning archiving, such as for tax reasons.

The principles require that any and all data are only collected in accordance with the DPA 2000 or any other applicable law allowing the collection of such personal data. The purpose for the collection must be clearly defined prior to the collection of such data and the categories the collected data must not be excessive for the purpose intended. The use of the data shall occur only in this pre-defined context. The DPA 2000 requires also that from the moment the use of personal related data is not any longer strictly necessary for achieving the purpose, the data shall be anonymised. Furthermore, the data must be kept accurate and must be archived in a way to prevent destruction of such data or access by non-authorized persons.

Thus, before collecting data via an EDR system the purpose must be clearly defined for which they are collected and whether it is indeed necessary that personal-related data shall be collected. If the same purpose can be achieved by collecting only indirectly personal data this would be the preferred way.

Furthermore, it has to be ensured that the collection of data would not allow to establish a profile of the driver, meaning that the system would track the driver's route allowing to identify its habits etc. This would be considered as a measure having an impact on human dignity. In an employment relationship this requires the consent of the work council where it specifically is regulated which data will be collected and whether such data can be analysed by the employer and/or third parties and which data will be transferred, for instance, to the insurance company or to the authorities.

Please be informed that if the data could be potentially used in criminal proceedings such data would qualify as criminal related data in the meaning of the DPA 2000 and such recording would need prior consent by the Austrian Data Protection Commission.

D.3.5 Question 5

Who has access to the data recorded by the EDR system (including access to the vehicles in which EDR devices are stored in order to download data recorded by EDR devices)?

- In case of a professional fleet, the employer has access to such data.
- When enforcement bodies obtain a respective order by the public prosecutor, then also such enforcement officers will have access to the data.
- If a specific law allows such access, for instance in the health field it is regulated who will have access to certain health related data;
- For only indirectly personal data access must be granted by the holder of such databank containing the only indirectly personal data;
- If indirectly personal data are collected for scientific purposes, than the researcher will decide who will have access; in case of personal related data, access must be covered by the consent of the data subject given within the research context;

- If the data are anonymised than theoretically everybody can have access;
- In all other cases, access will be granted via obtaining consent of the owner of the data, thus in the consent declaration it must be regulated who and under which circumstances access will be granted.

D.3.6 Question 6

Under which circumstances will this data be accessible?

See our answer to question (e).

D.3.7 Question 7

What are the acceptable uses of the data?

Data are only allowed to be collected for legitimate purposes. Thus the object to be achieved by collecting such data must be legitimate. So, if the data would be collected for preventing care accidents or to enhance road safety these would be legitimate purposes. Also if authorities will consult such data to investigate or uncovering a criminal offence this would be acceptable. Also insurance companies can use such data for calculating/fixing the premiums to be charged to the insured persons if consent is freely given.

What would not be acceptable would be if the data would be collected for tracking purposes of the data subject, for instance using such data for marketing purposes or to prepare a profile; especially if the data subject cannot easily opt out, e.g. if the data subject would have each time when starting to drive the car to opt-out. This would not be considered a legitimate use.

D.3.8 Question 8

What are the confidentiality concerns and how can they be addressed?

- The DPA 2000 regulates it as a constitutional right that any person has the right that his/her data will be treated as private, thus confidential. Consequently, the DPA 2000 requires that if it is possible to achieve the same goal with anonymous data, this way should be preferred.
- The owner of the data can decide who should have access to his/her data.
- The Austrian administrative law requires that any and all data submitted by an applicant must be treated as confidential.
- The protection of the family rights under the European Human Rights Convention as well as under the Charta of the European Union on Human Rights (see Article 8 of the Charta) would prevent authorities from establishing a profile when no suspicion exists that the person "tracked" is involved in criminal offences or their like.
- Furthermore the right of fair trial has to be respected, namely the principle of "nemo tenetur" Article 6 of the Human Right Convention respectively also Article 6 of the European Charter).

D.3.9 Question 9

What is the adequate/feasible legal framework to address these issues?

Due to the fact that Austrian law “upraises” the right of data protection as a constitutional right, a legal basis is needed for implementing such a legal system.

D.4 French Law

D.4.1 Question 1

To what extent does EDR data comprise personal data (or special categories of particularly sensitive personal data) for the purposes of the Directive 95/46/EC?

[As a preliminary comment, please note that for the purpose of conducting our analysis, we have excluded video EDR devices as well as geolocation devices used by employers to control the vehicles of their employees.]

Law No78-17 on Information Technology, Data Files and Civil Liberties dated 6 January 1978, as modified (the “French DPA”), implements the Directive in France. The French DPA provides for a similar definition of Personal Data:

- “Personal Data means any information relating to a natural person who is or can be identified, directly or indirectly, by reference to an identification number or to one or more factors specific to him. In order to determine whether a person is identifiable, all the means that the data controller or any other person uses or may have access to should be taken into consideration.”

The French DPA also considers the same categories of data to be Sensitive Data.

It is our understanding that the data recorded by the EDR are those exhaustively listed in Annex 1. They consist in technical data only and do not appear, as such, to comprise any Personal Data as long as living individuals cannot be identified from those data alone. In such case, the French DPA would not apply.

However, where the data recorded by EDR Devices are to be combined with other data that directly or indirectly allow identifying an individual, the processing of EDR Data would be considered as a processing of Personal Data under the French DPA.

This would in particular be the case where the EDR Data are combined with vehicle identification or registration numbers, which shall be deemed Personal Data as they allow identifying the owner of the vehicle.

In this respect, please note that the data controller of the Vehicles Registration System (the “SIV”) is the Ministry of Interior. The purpose of this file is the management of all elements and all administrative operations related to the circulation of the vehicles. The SIV includes in particular personal data relating to the holder of the vehicle registration certificate, as well as data relating to the vehicle. The information recorded in the SIV may be disclosed to a number of persons, upon their request and within the limits of their attributions, including without limitation, the police for road controls purpose, public prosecutors in case of driving offense, insurers within the context of indemnification procedures, etc.

In addition, where the EDR Data are used for the purpose of processing data relating to offences, convictions and security measures, they shall be deemed Sensitive Data.

D.4.2 Question 2

Who owns the data recorded by the EDR system?

Our point of view is that, if the EDR Data are used alone, without being combined with Personal/Sensitive Data as indicated in Question 1 above (i.e., processed on an anonymous basis, for statistical or study purposes for instance), the owner of the EDR Data should be the entity that installs or requires the installation of such device on a vehicle, and which may access and use such data. A non-exhaustive list of potential owners would include the vehicle manufacturers, State authorities such as the National Council for Road Safety (Conseil National de la Sécurité Routière "CNSR") or insurers.

However, it is our understanding that the purpose of EDRs is to record technical information in the event of a car accident, not only for statistical or study purposes but also for investigation purposes in order to determine the circumstances of the event and the potential liability of the driver (or the car manufacturer in case of technical default).

In such case, the EDR Data will necessarily be combined with Personal Data relating to the driver. The question of who owns the EDR Data is therefore closely linked to the identity of the data controller.

In any case, the position regarding ownership of data recorded by EDR devices under French law has not been settled and we cannot say with certainty who will own such data. This issue is likely to have to be determined on a case by case basis depending on the facts in any given scenario.

D.4.3 Question 3

Who is the controller (or controllers) in respect of such EDR data for the purposes of the Directive?

Pursuant to the French DPA, the Data Controller means the person, public authority, department or other organisation which determines the purposes and means of the data processing, unless expressly designated by legislative or regulatory provisions relating to this processing.

The Data Controller of the EDR Data will therefore be the entity(ies) which have decided to install the EDR in the vehicle and which determine the purpose for which the data recorded by such device will be processed.

Please note that, same as for the UK, the application of the French DPA depends on the location of the Data Controller. The French DPA will indeed apply in the two following situations:

1. the data controller is established on the French territory, being specified that the data controller who carries out his activity on French territory within an establishment, whatever its legal form, shall be deemed established on French Territory;
2. the data controller, although not established on the French territory or in any other Member State of the European Union, uses means of processing located on the French territory, with the exception of processing used only for the purposes

of transit through this territory or that of any other member State of the European Union.

As previously mentioned, if the EDR Data are used on a standalone basis, the owner of such data shall not be deemed a Data Controller as it will not process Personal Data; the French DPA will therefore not apply.

If, however, the EDR Data are combined with Personal Data, their processing will be deemed a processing of Personal Data and the Data Controller will have to comply with the provisions of the French DPA if it is established in France or if it is established outside the EU but uses means of processing in France. Please note that the French Data Protection Authority (the CNIL) has an extended conception of the notion of "means of processing", which could, for instance, include the EDR.

This therefore raises the question as to which entity decides to install an EDR and to process the data collected that way.

If the purpose of the EDRs is to collect technical information on car accidents, the Data Controller would likely be the Ministry of Interior or other State investigation authorities. It could also be the insurers or vehicle manufacturers.

In the absence of additional information, we cannot definitively determine which entity(ies) will act as Data Controller.

D.4.4 Question 4

How can controllers comply with their data protection obligations in respect of EDR data and do any exemptions to their data protection obligations apply?

To the extent the French DPA applies (processing of Personal Data by a Data Controller established in France or using means of processing in France), the Data Controller shall comply with all obligations under this act.

Prior formalities with the CNIL

a) Declaration to the CNIL

The majority of personal data processing shall be declared to the CNIL. Such declaration can be "normal" or "simplified" for most common categories of processing (clients/prospects files, management of employees, geolocation of employees' vehicles, etc).

b) Authorisation of the CNIL

Some categories of data processing are subject to a prior authorisation of the CNIL. This includes, without limitation:

- processing, whether automated or not, of data relating to offences, convictions or security measures, except for those implemented by justice representatives for the purpose of carrying out their defence duty;
- automated processing which may, due to their nature, importance or purposes, exclude individuals from the benefit of a right, a service or a contract in the absence of any legislative or regulatory provision.

c) Ministerial Authorisation

The processing of personal data carried out on behalf of the State and:

- which involve State security, defence or public safety, or
- the purpose of which is the prevention, investigation, establishment or prosecution of criminal offences, or the execution of criminal sentences or security measures,

shall be authorised by a Ministerial order (Arrêté), after a motivated and published opinion of the CNIL.

d) Authorisation by Decree

The processing relating to racial or ethnic origin, political, philosophical or religious opinions, trade union membership, medical or sexual life shall be authorised by a decree in Conseil d'Etat issued after a motivated and published opinion of the CNIL.

This would also be the case for processing implemented on behalf of the State, a public entity or a private entity managing a public service, relating to data that include the registration number to the individuals identification national registry (INSEE), as well as for processing implemented on behalf of the State relating to biometric data necessary to certify or control the identity of a person.

Depending on the Personal Data with which the EDR Data will be combined, the Data Controller will be concerned by one of the above-mentioned formalities.

Please note that, in any case, the processing of personal data relating to offences, convictions and security measures may be implemented only by:

- the courts, public authorities and legal entities that manage public services, within the framework of their legal attributions;
- the representatives of the law, solely for the needs of their legal functions;
- other bodies in the context of the defence of intellectual property rights [not relevant for the purpose hereto].

Lawfulness of the Data Processing

A processing of personal data shall comply with the following conditions:

1. the data shall be collected and processed fairly and lawfully;
2. the data shall be collected for specified, explicit and legitimate purposes, and shall not subsequently be processed in a manner that is incompatible with those purposes. However, further data processing for statistical, scientific and historical purposes shall be considered compatible with the initial purposes of the data collection, provided that it is carried out in conformity with the principles and procedures of the French DPA and that it is not used to take decisions involving the data subjects;

3. data shall be adequate, relevant and not excessive in relation to the purposes for which they are collected and their further processing;
4. data shall be accurate, complete and, where necessary, kept up-to-date. Appropriate steps shall be taken in order to delete and rectify data that are inaccurate and incomplete with regard to the purposes for which they are collected and processed;
5. data shall be stored in a form that allows the identification of the data subjects for a period no longer than is necessary for the purposes for which they are collected and processed.

Processing of personal data is subject to the data subject's consent, unless it meets one of the following conditions:

1. compliance with a legal obligation of the data controller;
2. protection of the data subject's life;
3. performance of a public service mission entrusted to the data controller or the data recipient;
4. performance of either a contract to which the data subject is a party or steps taken at the request of the data subject prior to entering into a contract;
5. pursuit of the data controller's or the data recipient's legitimate interest, provided this is not incompatible with the interests or the fundamental rights and liberties of the data subject.

Security and confidentiality measures

The data controller shall take all useful measures, with regard to the nature of the data and the risks of the processing, to preserve the security of the data including without limitation, prevent their alteration and damage, or access by unauthorised third parties.

Only the Recipients and some authorities are authorised to access the personal data (please refer to Question 5 below).

Information of the data subjects

The Data Controller shall provide some specific information to the data subjects, including without limitation:

1. identity of the data controller and of his representative, if any;
2. purposes of the processing for which the data are intended;
3. the recipients or categories of recipients of the data;
4. their right to access, modify and object to the processing of their personal data;
5. when applicable, the intended transfer of personal data outside the European Union.

When the data have not been obtained from the data subject (indirect collection), the data controller shall provide such information upon recording the personal data or, if disclosure to a third party is contemplated, no later than upon first disclosure of the data.

Exemptions:

- If the Personal Data collected is aimed at being shortly anonymised (provided that the anonymization process has been previously agreed by the CNIL), information provided by the Data Controller shall be limited to points 1 and 2 above.
- The Data Controller is not bound by any information obligation when the purpose of the processing is the prevention, investigation, establishment or prosecution of criminal offenses.
- No information of the data subject is required where the data have been indirectly collected and are used for a processing implemented on behalf of the State and regarding State safety, defence, public security or aimed at performing criminal sanctions or security measures, provided that such limitation is necessary to achieve the purposes of the processing.
- No information of the data subject is required where the data have been collected for another purpose and are further processed in order to keep such data for historical, statistical or scientific purposes.
- No information of the data subject is required where the data have been indirectly collected and any such information appears to be impossible or would require disproportionate efforts as compared to the interest of the process.

Other Exemptions

The right to object to the processing of personal data granted to each individual (on legitimate grounds) shall not apply where the processing answers a legal obligation or where the authorisation act has expressly excluded this right.

D.4.5 Question 5

Who has access to the data recorded by the EDR system (including access to the vehicles in which EDR devices are stored in order to download data recorded by EDR devices)?

Access by the Recipient(s)

The French DPA defines the "Recipient" as any authorised person to whom the data are disclosed, other than the data subject, the data controller, the processor and persons who, due to their functions, are in charge of processing the data.

The Recipients of the data shall be expressly mentioned in the declaration or in the authorisation request to the CNIL.

In any case, the Recipients shall have a legitimate need to access the data within the scope of their activities and the CNIL may issue recommendations as to which entities may be Recipients.

For instance, with respect to the implementation of geolocation devices by insurers and vehicle manufacturers, the CNIL has specified the categories of Recipients, depending on the purpose for which such devices are used:

- for Pay As You Drive (PAYD): authorised persons of the insurers and/or their suppliers;
- for fight against theft: authorised agents of telemonitoring companies and relevant judicial authorities;
- for assistance to individuals (emergency calls): emergency call centre, emergency team, authorised persons of the insurers and/or vehicle manufacturers and accidents study laboratories.

Access by the legal Authorities

Some authorities (police, tax administration, judicial bodies, etc.) are legally entitled to request personal data from the data controller in the context of a specific mission or in the exercise of a disclosure right.

Right of access of the individuals

Under the French DPA, individuals may request the following from the data controller:

1. confirmation as to whether personal data relating to them are processed;
2. the purposes of the processing, the categories of processed personal data and the recipients or categories of recipients to whom the data are disclosed;
3. if applicable, the transfers of personal data outside the European Union;
4. communication, in an accessible form, of his/her personal data as well as any available information on the origin of the data;
5. information allowing to know and to object to the logic involved in the automated processing, in case a decision is taken on the basis of the automated processing and having legal effects on the data subject.

Data subjects may receive a copy of the personal data at their request.

Exemptions:

The right of access shall not apply where the personal data are stored in a form that clearly excludes all risk of violating the privacy of the data subject and for a period that does not exceed that necessary for the sole purpose of creating statistics, or for scientific or historical research. The exemptions contemplated by the data controller shall be mentioned in the application for authorisation or in the declaration to the CNIL.

Where the processing involves State security, defence or public safety, the data will be disclosed only once the CNIL has determined, with the data controller's consent, that the disclosure of the data does not undermine its purposes, State security, the defence or public safety.

The same rules (indirect right of access) apply to processing carried out by public authorities and departments and private legal entities entrusted with a public service mission for the prevention, investigation or prosecution of criminal offences, or the assessment or collection of taxes, where the authorisation (by the CNIL, by Ministerial order or by decree in Conseil d'Etat) provides for this right.

D.4.6 Question 6

Under which circumstances will this data be accessible?

Please see the answer to Question 5 above.

D.4.7 Question 7

What are the acceptable uses of the data?

In the same manner as for the UK, and as far as Personal Data are concerned, acceptable uses of the EDR Data would be uses in compliance with the provisions of the French DPA and other relevant applicable legislation relating to privacy.

We would also insist on the lawful collection of the data, their use for a defined purpose and for that purpose only, the erasure of the data after a reasonable storage duration (or in accordance with the recommendations of the CNIL as the case may be).

D.4.8 Question 8

What are the confidentiality concerns and how can they be addressed?

Our position would be that the EDR Data (as listed in Appendix 1) would not comprise confidential information as such.

The confidentiality concerns would lie in the potential uses that would be made of the data collected by the EDR, together with Personal Data regarding the driver, to take decisions involving the driver: liability in the origin of a car accident, insurance coverage, or else.

In such case, the confidentiality concerns would be the same as for access to the Personal Data files:

- Only the authorised Recipients and legal authorities would be entitled to receive such data.
- The data cannot be used for other purposes than the purpose for which they have been collected.

We remind that the processing of personal data relating to offences, convictions and security measures may be implemented only by:

- the courts, public authorities and legal entities that manage public services, within the framework of their legal attributions;
- the representatives of the law, solely for the needs of their legal functions;
- other bodies in the context of the defence of intellectual property rights [not relevant for the purpose hereto].

As previously mentioned, the data controller shall take all useful measures, with regard to the nature of the data and the risks of the processing, to preserve the security of the data including without limitation, prevent their alteration and damage, or access by unauthorised third parties.

Confidentiality measures can be addressed in two different (and potentially cumulated) manners:

- by implementing technical means that will require the use of specific technology in order to access the data, including without limitation, encryption means,
- by entering into confidentiality agreements with all persons that may access the data or to which the data may be disclosed, including the Recipients and the data processors.

Please note that, under French law, some information are considered by nature as confidential and can be accessed/disclosed only in specific circumstances and to specific entities. This is for instance the case for private correspondence, information about judicial convictions, trade secrets, etc.

D.4.9 Question 9

What is the adequate/feasible legal framework to address these issues?

Currently under French law, no legislation specifically addresses the use of EDRs and specific issues such as the ownership of data recorded by EDR devices, who has access to the data recorded by EDR devices, the circumstances under which such data will be accessible and what the acceptable uses of such data will be in any given circumstances.

Furthermore, at this time, we are not aware of any proposed legislation or regulations which will specifically address these issues in France. As noted above, this means that the position under French law regarding some of the issues raised in connection with data recorded by EDR devices is somewhat uncertain.

The subject of EDRs has however been discussed for several years in France.

In June 2013, the Minister of the Interior requested the Conseil National de la Sécurité Routière (i.e. the National Road Safety Council, the "CNSR") to conduct a study regarding the introduction of EDR devices in vehicles. The Minister clearly stated that such devices should be used for the sole purpose of recording technical information in the context of a road traffic accident, with the exclusion of any image or vocal recording, and that the information should be used only by the police or such.

In November 2013, the CNSR recommended the adoption of several recommendations including one for the recovery of data collected by EDR devices. According to the President of the CNSR, the use of these devices would be an effective mean to raise the awareness of the drivers. These new developments are supported by associations promoting road safety.

D.5 German Law

D.5.1 Question 1

To what extent does EDR data comprise personal data (or special categories of particularly sensitive personal data) for the purposes of the Directive 95/46/EC?

The German legislator implemented Directive 95/46/EC in the Bundesdatenschutzgesetz (German Federal Data Protection Act), last amended 14 August 2009, as well as numerous amendments of area specific legislation. For the purpose of this study, we will focus on the BDSG, as the area specific laws will in large parts not be applicable.

The purpose of the BDSG is to protect individuals against infringement of their - constitutionally protected - right to privacy as the result of the handling of their personal data (Section 1 (1) BDSG, Article 2 (1) Grundgesetz ("GG", German Federal Constitution)).

The definition of a data controller under German law seems to be broader than the definition under English Law as the German definition includes not only the processing, but also the collection and the use of personal data as well as sensitive personal data (Section 3 (7) BDSG):

"Controller" means any person or body collecting, processing or using personal data on his, her or its own behalf, or which commissions others to do the same.

What is "Data" for the purposes of the Act?

The BDSG does not contain such abstract categorisation of "Data". Instead the scope of the BDSG is limited to "Personal Data" as defined below and focuses on the proposed or actual use of that personal data.

The BDSG covers both, personal data which are processed electronically as well as non-automated collection, use and processing of personal data.

What is "Personal Data" for the purposes of the Act?

The BDSG defines "Personal Data" as any information concerning the personal or material circumstances of an identified or identifiable individual (the "data subject") (Section 3 (1) BDSG) irrespective of current or potential possession of such data by a controller.

What is "Sensitive Personal Data" for the purposes of the Act?

The catalogue of "sensitive data" according to the Act is almost identical with the German definition of sensitive data in Section 3 (9) BDSG, except that the BDSG does not include and/or refer to any form of offences nor to proceedings concerning such offences as foreseen in the last two bullet points above.

EDR-data as defined in Appendix 1 contains detailed information about the status of the car and its systems shortly before and during the accident. As long as no information is collected which allows the identification of the owner and/or driver of the car and/or third parties affected during the accident, the data would not be considered "Personal Data" under German law.

This data would, however, be considered personal or even sensitive personal data if it was possible to combine this data with other data that allowed identifying the holder, driver

and/or other third persons. The same analysis relevant under UK law consequently also applies under German law:

It was suggested during VERONICA I and VERONICA II that the vehicle identification number and/or the vehicle registration numbers and/or a Driver-ID could be included in the collected data. This information would potentially allow identifying the owner and/or the driver and connect then with other EDR-data.

Conclusion

The conclusion under UK law is true under German law as well.

D.5.2 Question 2

Who owns the data recorded by the EDR system?

The same basically applies under German law as under UK law: A number of academical approaches towards the question of "ownership of data" exist in German legal commentaries and essays, exhaustively analysing potential ownership under circumstances like the ones discussed below.

Current Position Under German Law

There is no German legislation definitely regulating the ownership of data recorded by an EDR device and we are not aware of any legislation in Germany comparable to the one in the USA referred to above.

However, most recently several German courts had to discuss the question of ownership of data in the light of the statutory offence of data tampering [Sec. 303a Strafgesetzbuch (StGB), German Criminal Code]. In its judgment, the Higher Regional Court of Nuremberg - taking into account several of the academic approaches mentioned above - came to the conclusion that only the (technical) producer of data could be the "owner" of such data. Applying this piece of jurisprudence to EDR devices, one could come to the conclusion that only the driver (and not even the owner of the vehicle, if they are two individuals) can be the owner of the data collected by the EDR device.

This legal approach seems to be in line with the general principle under German data protection law stating, that "the collection, processing and use of personal data (i.e. the data concerning a data subject under German data protection law) shall only be lawful if permitted or ordered by the BDSG or other law, or if the data subject has provided consent" [Sec. 4 (1) BDSG].

Third parties like insurers or employers usually ask for a contractual right to access personal data unless the personal data is only required to create, perform or terminate a legal or quasi-legal obligation with the data subject. Consequently, unless otherwise foreseen by the German legislation and/or on the basis of informed consent, it is likely that insurers, employers and other third parties will not be considered "owner" of personal data recorded by an EDR device.

We are not aware of any legal difference between the ownership of personal data recorded by Event Only EDR and Continuous EDR devices being discussed in Germany and there is currently no indication that these two kinds of EDR might be treated differently in the near future from a data protection perspective.

Intellectual Property Rights

This copyright and database approach is discussed in Germany as well. Most likely, however, it will only apply to data which is not personal data as defined above (unless of course there are specific statutory grounds to collect such personal data, cf. page 11).

D.5.3 Question 3

Who is the controller (or controllers) in respect of such EDR data for the purposes of the Directive?

Definition of “Data Controller” under German law

cf. Question 1.

Definition of “Data Processor”

A formal definition of a “data processor” does not exist under German law; Sec. 11 (1) BDSG, however, stipulates that the data controller shall be responsible for compliance with provisions of the BDSG and other data protection provision, if “other bodies” (= data processors) collect, process or use personal data on behalf of the controller.

When Does the Act Apply to Data Controllers?

German law applies the above principles (laid out in Art. 4 of the Directive) with one slight modification: The BDSG will apply to data controllers if either:

- a) the controller is located in Germany; or
- b) the controller is located in third party countries (not within the EU or EEA Member State) collecting, processing or using personal data within Germany; or
- c) the controller is located in another EU or EEA Member State and collects, processes or uses personal data within Germany, if such collection, processing or use is carried out by a branch inside Germany.

The second and third alternative, however, do not apply where data storage media are used solely for the purpose of transit through Germany [Sec. 1 (5) BDSG].

The UK advice mentions “office, branch or agency”. The BDSG does not foresee a definition of “branch”. On the basis of recital (19) of the Directive “branch” in terms of BDSG simply requires “the effective and real exercise of activity through stable arrangements in Germany”. The legal form of such branch or establishment is not relevant.

Meaning of “Processing” Personal Data For the Purposes of the Act?

“Processing” is defined in Sec. 3 (4) BDSG as follows:

“Processing” shall mean the recording, alteration, transfer, blocking and erasure of personal data. Specifically, irrespective of the procedures applied,

1. “recording” shall mean the entry, recording or preservation of personal data on a storage medium so that they can be processed or used,
2. “alteration” shall mean the modification of the substance of recorded personal data,
3. “transfer” shall mean the disclosure of personal data recorded or obtained by means of data processing to a third party either
 - a) through transfer of the data to the third party, or

- b) by the third party inspecting or retrieving data available for inspection or retrieval,
4. "blocking" shall mean the identification of recorded personal data so as to restrict their further processing or use,
5. "erasure" shall mean the deletion of recorded personal data.

Who Could be Acting as a Data Controller in Respect of Data Recorded by EDR Devices for the Purposes of the Act?

Additional examples cf. the UK advice:

- car garages/workshops, e.g. if data is stored for later repairs
- hospitals (according to VERONICA II, detailed information about an accident and the injured might be accessible for hospitals; this data will usually include special categories of personal data (i.e. sensitive data))
- rental companies (as owner of the vehicle)

D.5.4 Question 4

How can controllers comply with their data protection obligations in respect of EDR data and do any exemptions to their data protection obligations apply?

Before carrying out any automated processing operations, private data controllers shall notify the competent supervisory authority, which usually is the relevant State Data Protection Authority of the state where the branch/establishment of the data controller is located [Sec. 4 d (1), 38 BDSG].

Federal controllers and controllers of postal and telecommunication companies shall notify the Federal Data Protection Authority in accordance with Sec. 4 e BDSG.

The obligation to notify does not apply if the controller has appointed a data protection officer in accordance with Sec. 4 d (2), 4 f and g BDSG.

Further, the obligation to notify does not apply, if the controller collects, processes or use its personal data for its own persons and, as a rule, no more than nine employees are permanently employed in collecting, processing or using personal data, and either the data subject has given his/her consent or the collection, processing or use is needed to create, carry out or terminate a legal obligation or a quasi-legal obligation with the data subject [Sec. 4 d BDSG].

The exceptions to notification mentioned above do not apply in cases of automated processing in which the controller commercially records personal data for the purpose of transfer or market/opinion research [Sec. 4 d (4) BDSG].

Where automated processing operations present special risks to the rights and freedoms of data subjects, namely if special categories of personal data (sensitive data) are to be processed, or the processing of personal data is intended to assess the data subject's personality and his/her abilities, performance or behaviour, these automated processing operations shall be examined before the start of processing [prior checking/"Vorabkontrolle" in terms of Sec. 4 d (5)]. This, again, does not apply, if the data subject has given his/her consent, or the collection, processing or use of personal

data is needed to create, carry out or terminate legal obligation or quasi-legal obligation with the data subject.

The Data Protection Officer is responsible for conducting potential prior checkings following receipt of relevant information from the data controller in accordance with Sec. 4 g (2) BDSG. Furthermore, the Data Protection Officer has the duty to consult the competent Data Protection Authorities in cases of doubt, namely with respect to the question of legality of such automated processing operations.

Two leading data protection principles, which the data controller has to comply with in respect of any personal and/or sensitive personal data are - amongst others - set out in Sec. 3 a BDSG:

- Personal data shall be collected, processed and used, and data processing systems (like EDR devices) shall be chosen and organized in accordance with the aim of collecting, processing and using as little personal data as possible.
- Furthermore, personal data shall be rendered anonymous or aliased as allowed by the purpose for which they are collected and/or further processed, and as far as the effort required to do so is not disproportionate to the desired purpose of protection.

While the eight data protection principles set out for the UK above are true under German law as well (even though using slightly different terminology), the following additional principles are foreseen under the BDSG and are relevant for the data protection situation in Germany:

1. The principle of necessity ("Erforderlichkeitsgrundsatz"): Data shall only be collected, if the purpose which they are collected, processed and used for can not be reached without said personal data.
2. The principle of collection from the data subject ("Grundsatz der Direkterhebung"): In general, personal data shall be collected directly from the data subject. They may only be collected without a data subject participation if this is
 - allowed or required by law, or
 - the data must be collected from other persons or entities due to the nature of the administrative task to be performed other commercial purpose, or collecting the data from the data subject would require disproportionate effort,

and there are no indications that overriding legitimate interests of the data subject would adversely be affected [Sec. 4 (2) BDSG].

The First Data Protection Principle

Schedule 2 Conditions

"Consent"

According to German data protection laws, consent shall also only be effective if based on the data subject's free decision, and if the data subject has been informed of the

purpose of collection, processing or use, and, as necessary in the individual case or upon request, of the consequences of withholding consent [Sec. 4 a (1) BDSG]. Furthermore, consent shall be given in writing unless special circumstances warrant any other form; if consent is to be given together with other written declarations, it shall be made distinguishable in its appearance [Sec. 4 a (1) BDSG].

Special legal requirements apply to electronic/online consent.

"Compliance With Legal Obligations"

Similar examples cf. the UK law could be discussed and given under German law, namely the "Fahrpersonalgesetz" as well as the "Fahrpersonalverordnung", transforming - amongst others - EU Regulation 561/2006 of the European Parliament and of the council on the harmonisation of certain social legislation relating to road transport.

"Vital Interests"

Depending on the facts, German law foresees similar permissions concerning the collection, processing and use (even of special categories) of personal data.

Example: Sec. 28 (6) BDSG foresees that the collection, processing and use of such data shall be lawful without the data subject's consent if this is necessary to protect the vital interests of the data subject or of another person where the data subject is physically or legally incapable of giving his or her consent.

"Legitimate Interests"

Similar principles cf. the UK law apply under German law. Depending on the facts, the transfer or use of personal data - even for other purposes than the controller's own commercial purposes - can be lawful where this is necessary to safeguard legitimate interests of a third party, or to prevent threats to state of public security or to prosecute crimes, and there is no reason to believe that a data subject has a legitimate interest in ruling out the possibility of transfer or use of such personal data [Sec. 28 (2) BDSG].

Schedule 3 Conditions

"Explicit Consent"

The requirements concerning "explicit consent" which are very similar to the abstract definition under UK law above are stipulated in Sec. 4 a BDSG. Whether or not explicit consent given meets these requirements is a question of the facts and needs to be evaluated thoroughly on a case by case basis.

"Legal Proceedings"

Similar fact patterns are possible under German law: According to Sec. 14 (1) BDSG, the recording, alteration or use of personal data shall be lawful when required to carry out the tasks for which the data controller (being a public body) is responsible and for the purpose for which the data were collected.

Moreover depending cf. the UK law on the facts, recording, alteration or use for other purposes may be lawful in accordance with Sec. 14 (2) BDSG for public bodies (e.g. the police or public accident investigators) if this is required to prosecute criminal or administrative offences, to enforce sentences or measures within certain sections of the German Criminal Code, or to enforce decisions on fines [Sec. 14 (2) BDSG].

"Anti-Fraud Organisations"

German insurers have been putting a lot of effort into the definition of certain concepts and standardized terminology concerning the collection, processing and use of personal data as well as sensitive data and have usually tried to find a common understanding with all relevant Data Protection Authorities in Germany. Details would - in an abstract way - exceed the scope of this description. However, depending on the facts, we would be happy to comment on additional details at your convenience.

"Unlawful Acts"

Fair Processing Information

Under Sec. 4 (1) BDSG, the use of personal data requires justification by either legal permission or the data subject's consent. There are several legal permissions foreseen under German law, some of which are essential, especially for private commercial companies, as they enable them to lawfully collect personal data for own commercial purposes and/or employment-related purposes.

Unless the collection, processing and use of personal data is justified by a specific legal regulation, the data subjects consent is required. Mere privacy notices do not suffice this requirement [Sec. 4 (1) BDSG].

The data subject's consent shall only be effective if based on the data subject's free decision. As foreseen under UK law, the data subject also has to be informed about the purpose of collection, processing or use of personal data and, as necessary in the individual case or on request, of the consequences of withholding consent. In general, consent has to be given in writing; the electronic form of consent is accepted under special circumstances foreseen and regulated by law [e.g. Sec. 28 (3a) BDSG; Sec. 13 (2) of the German law covering telemedia services ("Telemediengesetz" (TMG))]. Details have to be verified in each case on the basis of the relevant fact pattern.

Other Data Protection Principles

Even though structured differently under German law, the big picture of "principles" under UK law, being based on the principles foreseen in the Directive, is nearly identical under German law.

Location Data

The information given cf. the UK law is true with respect to the German perspective as well: It is difficult to say with certainty in the absence of a specific factual scenario which legal framework is applicable to any particular party who is collecting, processing or using personal data through EDR devices. In certain areas German telecommunication data protection will apply. In any case - well taking into account opinion 13/2011 of the Art. 29 Data Protection Working Party on geolocation services on smart mobile devices (WP 185) - the above general data protection principles will have to be applied to location data as well as a minimum restriction.

We are not aware of any specific German legislation comprehensively and exclusively covering location data at this point in time other than the relevant telecommunication laws. Details will have to be evaluated depending on the facts and circumstances of each case.

Do Any Exemptions Apply to the Obligations of Data Controllers Under the Act Regarding Their Processing of EDR Related Data?

Given the different structural approach of the BDSG, there are no “exemptions” to the obligations of data controllers under the BDSG or other German data protection laws. Instead, if there is no data subject’s consent, several regulations foresee “legal justifications” to collect, process and/or use data. Some of the most important legal justifications for the collection, processing and use of data have been touched upon before, namely

1. Sec. 14 and 15 BDSG, foreseeing legal justifications for recording, alteration or use of personal data for public bodies;
2. Sec. 27 to 32 BDSG, including legal justifications for data processing by private bodies and commercial enterprises under public law (including employees’ personal data);
3. Sec. 14 and 15 TMG, containing legal justifications to use personal data of a user of telemedia services; and
4. Sec. 95 to 107 TKG (German Telecommunication Act) foreseeing certain legal justifications concerning the use of personal data of users of telecommunication services (including location data).

Whether or not the justification foreseen in these essential (or other) German pieces of legislation has to be determined on the case by case basis, well taking into account which data exactly is collected, which purpose the data has been collected for, and whether any collection, processing or use of personal data beyond this original purpose is covered by a legal permission (or, again, the data subject’s consent).

The UK examples set under “crime and taxation exemption”, the research/history and statistics exemption as well as an exemption concerning the disclosure required by law or made in connection with legal proceedings are - very generally speaking - also possible scenarios under the relevant German legal framework described above and will have to be evaluated depending on the circumstances of any given case.

D.5.5 Question 5

Who has access to the data recorded by the EDR system (including access to the vehicles in which EDR devices are stored in order to download data recorded by EDR devices)?

The Act

The same principles apply under German law as under UK law: The data subject has a right to be informed/the controller has a duty to inform the data subject, if personal data are recorded for own purposes for the first time without the data subject’s knowledge. In such cases, the data subject has to be notified of the recording itself, the type of data being recorded, the purpose of collection, processing or use as well as the identity of the controller [Sec. 33 (1) BDSG].

If personal data are commercially recorded for the purpose of transfer without the data subject’s knowledge, the data subject shall be notified to their initial transfer and of the type of data transferred [cf. above].

In both cases the data subject shall also be notified of the categories of recipients, where, given the circumstances of the individual case, the data subject need not expect that his/her data will be transferred to such recipients.

Certain exemptions from the duty to notify the data subjects exist, amongst others, if:

- the data subject has become aware of the recording of transfer by other means,
- the data were recorded only because they may not be erased due to legal, statutory or contractual provisions on retention, or only for purposes of monitoring data protection or safeguarding data, and providing information would require a disproportional effort;
- the data must be kept secret by law or due to the nature of the data, namely due to the overriding legal interests of a third party;
- recording or transfer is expressly laid down by law;
- recording or transfer is necessary for the purpose of scientific research and notification would require a disproportional effort;
- the responsible public body has informed the data controller that disclosure of the data would threaten the public security or order or otherwise be detrimental to the Federation or one of the sixteen German states;
- data were recorded for own purposes of the controller and
 - were acquired from generally accessible sources and notification would require a disproportionate effort due to the large number of cases concerned, or
 - notification would seriously endanger the commercial purposes of the controller, unless the interest of notification overrides this danger [Sec. 33 (2) BDSG].

According to Sec. 34 BDSG, the controller shall, furthermore, provide information to data subjects at their request concerning recorded data relating to them, the source of the data, the recipients or categories of recipients to which the data are transferred, and the purpose of recording the data (access to data by the data subject). Certain information about source and recipients maybe withheld if the interest in protecting trade secrets overrides the data subject's interest in the information.

In cases of data collected for commercial/advertising purposes, special duties apply to the controller if data are transferred as well as to the recipient of such data [Sec. 34 (1a) BDSG].

If personal data is used for the purpose of deciding on the creation, execution and termination of a contractual relationship with the data subject, and in doing so probability values for certain future actions by the data subject are calculated (e.g. for purposes of insurance policies through evaluation of EDR-collected data), special regulations will apply under German data protection laws. Most important with respect to access to such personal data will be Sec. 28 b, 34 (2) BDSG.

Under certain circumstances, which have to be evaluated on the case basis, an insurer collecting such data might have to provide information to data subjects at their request concerning probability values, the types of data used to calculate such probability values

and how probability values are calculated, as well as their significance with reference to the individual case. Certain additional requirements will have to be taken into account on the basis of the specific fact pattern to be evaluated.

Section 29 of the Act

Under which circumstances the police/the public prosecutor's office would be allowed to access personal data in EDR systems has largely been discussed in legal commentaries and essays, namely with respect to a potential violation of the "*nemo tenetur se ipsum accusare*"-principle. Details would, again, depend on the case in question. It would certainly also depend on whether the EDR device has been in use as a result of a free decision of the data subject, or whether there is a general duty for the use of certain EDR devices in the automotive industry.

Contractual Rights

Concerning the German perspective: cf. UK law comments.

D.5.6 Question 6

Under which circumstances will this data be accessible?

Please see the answer to Question 5 above.

D.5.7 Question 7

What are the acceptable uses of the data?

As far as the BDSG and other German data protection laws are concerned, the uses to which any personal and/or sensitive personal data which is derived from data recorded by EDR devices can be used by a data controller will be governed to a large extent by the basic principle under German law according to Sec. 4 (1) BDSG: The collection, processing and use of personal data shall be lawful only if permitted or ordered by law, or if the data subject has provided consent. For the avoidance of reiteration, please refer to our comments in questions 1 through 5.

D.5.8 Question 8

What are the confidentiality concerns and how can they be addressed?

Under German law, any information concerning the personal or material circumstances of an identified or identifiable natural person are declared "personal data" [Sec. 3 (1) BDSG]. As long as personal data are concerned, the constitutional right to informational self-determination protects such information. Details with respect to the degree protection can be gathered from the BDSG as well as other (more specific) German data protection laws as discussed above.

Aside from the data protection issues, non-personal data/information can be protected in many different ways under German law, e.g. originating from an employer-employee relationship, arising from fiduciary duties under corporate law, and the like. In many cases, confidentiality obligations arise under contracts, where both parties agree upon certain requirements concerning non-disclosure as mentioned with respect to UK law.

Depending on the fact pattern, the entity implementing an EDR device might have a certain interest in keeping the (non-personal) information collected, processed and used within the EDR device and not allow third persons to access this information. As long as no personal data is concerned (which at least the data subject will have access to) such confidentiality can either be agreed upon if access is easily feasible for anybody, under other circumstances confidentiality concerns might not even arise, as it might be technically too difficult for third parties to access the information.

The Common Law Duty of Confidentiality

The only concept which is roughly comparable to the UK common law duty of confidentiality under German law would be a certain duty to confidentiality arising from general fiduciary duties between two parties (cf. initial comment concerning question 8).

Conclusion

Additional issues with respect to confidentiality (and data protection) currently discussed with respect to EDR devices in Germany:

- It is discussed under German law, which confidentiality and data protection issues are concerned when deciding about storage of data from EDR devices. Questions like “where is the data stored?” and “who has access to it?” need to be answered - both with respect to confidentiality as well as with respect to data protection issues - by implementing adequate technical and organisational measures protecting the data. If data storage takes place outside Germany/the EU/the EEA, additional aspects with respect to international data transfer, commissioned data management (e.g. in cloud-solutions), corporate binding rules and international standard agreements concerning data transfer need to be kept in mind. All these issues can both be resolved on the confidentiality as well as the data protection level by implementing adequate legal agreements in accordance with statutory and contractual legal obligations.

D.5.9 Question 9

What is the adequate/feasible legal framework to address these issues?

Current Position Under English Law

The same applies to German law. However, general data protection laws will be applicable to personal data recorded by EDR devices, if any.

VERONICA I and VERONICA II

At an early stage of the discussion concerning EDR devices, the German Federal Data Protection Authority commented on the minimum requirements concerning the use of such devices as follows:

- An obligatory integration of EDR devices should be limited to vehicles used for the transport of dangerous goods and for buses.
- If at all, EDR devices should be limited to “Event Only EDRs” while “Continuous EDRs” were not acceptable under general data protection laws (unless of course explicit consent of the data subjects concerned was given).

- The data subject/driver is supposed to have the possibility to turn EDR devices on and off at any time (unless otherwise contractually agreed upon with third parties).
- If consent was given with respect to the installation of EDR devices, the requirements for consent under German law (especially in accordance with Sec. 4 a BDSG) will have to be guaranteed. The German Data Protection Authority also touched upon economic pressure on data subjects resulting from cheaper insurance, as well as special protection for employees using vehicles with EDR devices owned by the employer.
- The German Data Protection Authority claimed full transparency concerning each and any recording to and data transfer from an EDR device, at least for the data subject (and within certain limits the owner of the vehicle). He pointed out that in any case possibilities of control amongst several users of a vehicle and/or by the owner of the vehicle (e.g. rental cars) should be prevented.
- Further, the Data Protection Authority claimed decentralized storage of EDR data within the vehicle (ideally controlled by the data subject and/or, within certain limits, the owner of the vehicle), and argued against centralized data storage.
- All personal data are supposed to be technically as well as organisationally protected against fraudulent, ideally using encryption technologies. Access to data shall be limited to those, who are acting on the basis of the legal statutory permission (e.g. in order to investigate an accident) and those who have access on the basis of explicit consent (e.g. service centres/car manufacturers). In each case, the amount of data accessible for each party needs to be clear and any additional access to further data has to be prohibited and prevented.

D.6 Italian Law

D.6.1 Question 1

To what extent does EDR data comprise personal data (or special categories of particularly sensitive personal data) for the purposes of the Directive 95/46/EC?

Please note that the legislative decree no. 196/2003 ("Italian Privacy Code") implements, as well as the Act, the Directive. As a consequence, the answers provided for the UK, according to the Act, are totally in line also with Italian Privacy Code.

In particular, please be aware that, as well as the Act, Italian Privacy Code will apply only in case of "identifiable data subjects", i.e. in case the data controller is able to identify individuals by combing any kind of information related to such individuals. As a consequence, the application of Italian Privacy Code depends on the "concrete" possibility that the data controller has to link and to combine all the information obtained by telecommunication providers in order to identify the single individuals.

On this regard, please note that Italian Privacy Authority has issued recent decisions in the last few years related to geo-location systems which confirmed the above mentioned principle. In particular, Italian Privacy Authority affirmed that the use of data related to the localisation of a person can be considered as a processing of "personal data" and,

therefore, Italian Privacy Code will apply, in case the localisation data may be associated to other data which can be able to identify the data subject (decision on February 18, 2010).

Similarly, Italian Privacy Authority has expressly stated that *"the data on vehicle location are (directly or indirectly) associated with the relevant employees; accordingly, they should also be regarded as personal data relating to the said employees (section 4(1)b. of the Code), which means that the provisions contained in the Code are applicable to the processing of this information. This holds true also if the vehicle location data are not matched immediately by the information system with the names of the relevant employees, given that an employer – i.e. the data controller – can usually identify which vehicle has been allocated to which employee (see, in this regard, the Opinion no. 5/2005 of 5 November 2005 on the use of location data to provide value-added services by the Article 29 Working Party, WP115 – p. 10; see also their Opinion no. 4/2007 on the concept of personal data, WP136 – p. 11). Conversely, data protection legislation is not applicable if information on fleet management such as per-vehicle fuel consumption or distance traveled (usually aimed at effective maintenance planning) is processed in such a way as not to be traced back to the individual employees"* (decision no. 370 on October 4, 2011).

Please note that also Italian Supreme Court expressly affirmed that Italian privacy law shall not apply to data which cannot be associated with any identified or identifiable data subject. In particular, Italian Supreme Court hold that the image of a person cannot be considered as a processing of "personal data" in case such image does not come with other information through which it may be possible to identify the data subject. Indeed, according to the Italian Supreme Court, it is irrelevant for the application of Italian privacy law that such person may be recognized by someone on the basis of his personal knowledge in the absence of the above information (decision no. 12997/2009).

To sum up, in the light of the above decisions, EDR data does not comprise personal data and, therefore, Italian Privacy Code shall not apply as far as the data controller cannot identify individuals through the use of any other kind of information.

D.6.2 Question 2

Who owns the data recorded by the EDR system?

We are not currently aware of any legislation in Italy which definitively states who is the owner of the data recorded by an EDR device.

As a consequence under Italian law the issue of ownership of EDR data is likely to have to be determined on a case by case basis depending on the facts in any given scenario.

D.6.3 Question 3

Who is the controller (or controllers) in respect of such EDR data for the purposes of the Directive?

According to Italian Privacy Code the data controller is any natural or legal person, public administration, body, association or other entity that is competent, also jointly with another data controller, to determine purposes and methods of the processing of personal data and the relevant means, including security matters.

So, on the basis of the above general definition, the data controller shall be determined case by case according to the single circumstances. For example, with reference to the geolocation systems installed on the vehicles drove by employees, the Italian Privacy Authority stated clearly that employers shall be considered the controller of the data recorded by the above systems.

D.6.4 Question 4

How can controllers comply with their data protection obligations in respect of EDR data and do any exemptions to their data protection obligations apply?

According to Italian Privacy Code, data controllers shall comply with the requirements described below.

(i) Information notice to data subjects

According to Article 13 of the Italian Privacy Law, data controllers will need to inform data subjects, from which personal data is collected, of the following:

- a) the purposes and modalities of processing for which the data is intended to be used;
- b) the obligatory or voluntary nature of providing the requested data. (Please note that the processing of the personal data may only be considered obligatory when it is requested by law and may only be considered necessary when the company could not provide a specific service without the requested data);
- c) the consequences if (s)he fails to provide the requested data;
- d) the entities or categories of entities to whom the data may be communicated, or who may have access the data in their capacities as data processors or persons in charge of the processing, and the scope of dissemination of the data;
- e) the rights of the data subject under Section 7, i.e. the right to access, correct, and/or supplement the personal data as well as the right to object, in whole or in part, to the processing of the personal data;
- f) the identification data of the data controller and, where designated, and the data processor and the data controller's representative in Italy.

Please be advised that a breach of Article 13 of the Italian privacy law may trigger a fine between 6,000.00 and 36,000.00 Euros.

(ii) Written consent by data subjects

Once data controller have provided the above information to data subjects, it shall obtain an express consent from data subjects to the processing of their personal data (Article 23 of the Italian privacy law).

(iii) Prior notification to the competent authority

Please be advised that according to the Italian privacy law, data controllers shall notify the competent authority ("*Autorità Garante per la protezione dei dati personali*") of the processing of personal data if it deals with "*data processed with the help of electronic means aimed at profiling the data subject and/or his or her personality, analyzing consumption patterns and/or choices, or monitoring the use of electronic communications services, except for when such processing operations are technically indispensable to delivering such services to users*" (Article 37 of the Italian privacy law).

Please be aware that breach of the above provisions may trigger a fine between 20,000.00 and 120,000.00 Euros.

(iv) Minimum security measures

Finally, please be aware that data controllers shall also comply with the following minimum security measures. In particular, when the processing of the personal data is carried out:

- by electronic means, according to Article 34 of the Italian privacy law, data controllers shall guarantee the adoption of the following minimum security measures:
 - a) computerized authentication;
 - b) implementation of management procedures for authentication credentials;
 - c) use of an authorization system;
 - d) regular updates of the specifications concerning the scope of the processing operations that may be performed by the individual entities in charge of managing and/or maintaining the electronic means;
 - e) protection of the electronic means and the data against unlawful data processing operations, unauthorized access, and unauthorized software;
 - f) implementation of procedures for safekeeping backup copies and for restoring data and system availability.
- without electronic means, according to Article 35 of the Italian Privacy Law, data controllers shall guarantee the adoption of the following minimum security measures:
 - a) regular updates of the specifications concerning the scope of the processing operations that may be performed by the individual entities in charge of the processing and/or by the individual processing departments;
 - b) implementing procedures to ensure the safekeeping of records and documents sent to the entities in charge of processing in order to carry out the relevant tasks;
 - c) implementing procedures to keep certain records in restricted-access filing systems and regulating access mechanisms to enable identification of the entities in charge of the processing.

Please be aware that a breach of the above provisions may trigger a fine between 10,000.00 and 120,000.00 Euros as well as imprisonment up to 2 years.

Do Any Exemptions Apply to the Obligations of Data Controllers Under the Act Regarding Their Processing of EDR Related Data?

Please be aware that Italian Privacy Code provides possible exemptions to certain obligations of data controllers.

So, for example, data controllers are not required to obtain the previous consent from the data subjects for the processing:

- 1) of personal data when the processing:
 - is necessary to comply with an obligation imposed by a law, regulations or Community legislation;

- is necessary for the performance of obligations resulting from a contract to which the data subject is a party, or else in order to comply with specific requests made by the data subject prior to entering into a contract;
- concerns data taken from public registers, lists, documents or records that are publicly available, without prejudice to the limitations and modalities laid down by laws, regulations and Community legislation with regard to their disclosure and publicity;
- concerns data relating to economic activities that are processed in compliance with the legislation in force as applying to business and industrial secrecy;
- is necessary to safeguard life or bodily integrity of a third party. If this purpose concerns the data subject and the latter cannot give his/her consent because (s)he is physically unable to do so, legally incapable or unable to distinguish right and wrong, the consent shall be given by the entity legally representing the data subject, or else by a next of kin, a family member, a person cohabiting with the data subject or, failing these, the manager of the institution where the data subject is hosted;
- is necessary for carrying out the investigations by defence counsel referred to in Act no. 397 of 07.12.2000, or else to establish or defend a legal claim, provided that the data are processed exclusively for said purposes and for no longer than is necessary therefore by complying with the legislation in force concerning business and industrial secrecy, dissemination of the data being ruled out;
- is necessary to pursue a legitimate interest of either the data controller or a third party recipient in the cases specified by the Garante on the basis of the principles set out under the law, also with regard to the activities of banking groups and subsidiaries or related companies, unless said interest is overridden by the data subject's rights and fundamental freedoms, dignity or legitimate interests, dissemination of the data being ruled out;
- except for external communication and dissemination, is carried out by no-profit associations, bodies or organizations, recognized or not, with regard either to entities having regular contacts with them or to members in order to achieve specific, lawful purposes as set out in the relevant memorandums, articles of association or collective agreements, whereby the mechanisms of utilization are laid down expressly in a resolution that is notified to data subjects with the relevant information notice;
- is necessary exclusively for scientific and statistical purposes in compliance with the respective codes of professional practice referred to in Annex A), or else exclusively for historical purposes in connection either with private archives that have been declared to be of considerable historical interest pursuant to Section 6(2) of legislative decree no. 499 of 29 October 1999, adopting the consolidated statute on cultural and environmental heritage, or with other private archives pursuant to the provisions made in the relevant codes.

2) of sensitive data when the processing:

- is carried out for specific, lawful purposes as set out in the relevant memorandums, articles of association or collective agreements by not-for-profit associations, bodies or organizations, whether recognized or not, of political, philosophical, religious or trade-unionist nature, including political parties and movements, with regard to personal data concerning members and/or entities having regular contacts with said associations, bodies or organizations in connection with the aforementioned purposes, provided that the data are not communicated or disclosed outside and the bodies, associations or organizations lay down suitable safeguards in respect of the processing operations performed by expressly setting out the arrangements for using the data through a resolution that shall be made known to data subjects at the time of providing the information notice;
- is necessary to protect a third party's life or bodily integrity. If this purpose concerns the data subject and the latter cannot give his/her consent because (s)he is physically unable to do so, legally incapable or unable to distinguish right and wrong, the consent shall be given by the entity legally representing the data subject, or else by a next of kin, a family member, a person cohabiting with the data subject or, failing these, the manager of the institution where the data subject is hosted.
- is necessary for carrying out the investigations by defense counsel referred to in Act no. 397 of 07.12.2000, or else to establish or defend a legal claim, provided that the data are processed exclusively for said purposes and for no longer than is necessary therefore. Said claim must not be overridden by the data subject's claim, or else must consist in a personal right or another fundamental, inviolable right or freedom, if the data can disclose health and sex life;
- is necessary to comply with specific obligations and/or tasks laid down by laws, regulations or Community legislation in the employment context, also with regard to occupational and population hygiene and safety and to social security and assistance purposes, to the extent that it is provided for in the authorization and subject to the requirements of the code of conduct and professional practice referred to in Section 111.

Apart from the above general exemptions, please be aware that further exemptions are provided by the Italian Privacy Code with reference to specific sectors. So we set out below a non-exhaustive list of such further exemptions:

1. the provision on the information notice for data subjects shall not apply to the processing of personal data that is carried out either by the Data Processing Centre at the Public Security Department or by the police with regard to the data that are intended to be transferred to said centre (article 53, paragraph 1);
2. the provision on the information notice for data subjects shall not apply to the processing of personal data that is carried out by secret service entities or regards data to which State secret applies (article 58, paragraph 1);

3. with reference to the processing for statistical or scientific purposes concerning data collected for other purposes, no information shall have to be provided to data subjects if it entails a disproportionate effort compared with the right to be protected — on condition that those operations have been appropriately publicized as laid down in the relevant code of conduct (article 105, paragraph 4).

D.6.5 Question 5

Who has access to the data recorded by the EDR system (including access to the vehicles in which EDR devices are stored in order to download data recorded by EDR devices)?

Please be informed that, according to article 7 of the Italian Privacy Code, data subjects have the right to have access to their personal data.

Moreover, data controllers may allow the following persons to have access to the personal data:

- a) the data processor, i.e. natural or legal person, public administration, body, association or other agency that processes personal data on the controller's behalf;
- b) persons in charge of the processing, i.e. natural persons that have been authorized by the data controller or processor to carry out processing operations.

However, please be aware that according to article 13 of the Italian Privacy Code, the information notice to be provided to data subjects shall expressly inform data subjects on the entities or categories of entities to whom the data may be communicated, or who may have access the data in their capacities as data processors or persons in charge of the processing, and the scope of dissemination of the data.

In any case, as clearly stated from article 25 of the Italian Privacy Code, the communication and dissemination of the data shall be prohibited for purposes other than those specified in the information notice to be provided to data subjects.

To sum up, according to Italian Privacy Code, third parties can not access freely to personal data of data. Data controllers may disclose such data:

- within the purposes of the processing indicated in the information notice;
- to specific persons such as data processors, persons in charge of the processing and/or particular entities such as external consultants. In any case data subjects have to be previously informed of such disclosure by data controller.

The only exemption to the above general rule is related to the case in which the communication and dissemination of the data is required to the data controller, by police, judicial authorities, intelligence and security agencies and other public bodies, for purposes of defence or relating to State security, or for the prevention, detection or suppression of offences (article 25, paragraph 2).

D.6.6 Question 6

Under which circumstances will this data be accessible?

Please see our comments under Question 5 above.

D.6.7 Question 7

What are the acceptable uses of the data?

Please be aware that Italian Privacy Code provides several general principle according to which personal and/or sensitive data shall be used by the data controller. In particular, article 11 provides that such data shall be:

- a) processed lawfully and fairly;
- b) collected and recorded for specific, explicit and legitimate purposes and used in further processing operations in a way that is not inconsistent with said purposes;
- c) accurate and, when necessary, kept updated;
- d) relevant, complete and not excessive in relation to the purposes for which they are collected or subsequently processed;
- e) kept in a form which permits identification of the data subject for no longer than is necessary for the purposes for which the data were collected or subsequently processed.

Any personal data which is processed in breach of the above principles may not be used.

So, although we are not aware of any factual scenario, it is in any case generally stated that the use of any data made by the data controller shall comply with the general principles provided by article 11 above mentioned.

D.6.8 Question 8

What are the confidentiality concerns and how can they be addressed?

As far as EDR devices allow the identification of single individuals, such devices may comprise confidential information related to the above individuals.

According to Italian Privacy Code, every single person has the right to the protection of their personal information. This means, among the other things, that individuals have the right i) to obtain confirmation as to whether or not personal data concerning them exist ii) to object the use of such data (article 7 Italian Privacy Code).

As a consequence, in order to prevent any possible confidentiality issue which may be raised from individuals, it is necessary to:

1. provide individuals with the information notice described above under paragraph 4;
2. request the consent of individuals for the use of their information save and except the cases of exemption described above under paragraph 4.

D.6.9 Question 9

What is the adequate/feasible legal framework to address these issues?

As already mentioned above, currently under Italian law, we are not aware of any specific legislation on EDR devices. As a consequence, the confidentiality concerns which may arise from the use of such devices are currently addressed according to the general rules provided by the Italian Privacy Code.

However, despite the absence of a specific legislation, we have to underline that Italian Data Protection Authority has noticed the increasing introduction of EDR devices and on this regard it has provided during the last few years several decisions, among which:

- 1) a decision on vehicle geo-location systems used by employers with reference to employee relations;
- 2) a decision on geolocation systems used in public transportation.

So, we believe that probably the absence of a specific legislation on EDR devices may be overcome in the next few years by the decisions of Italian Data Protection Authority on such matter.

D.7 Spanish Law

D.7.1 Question 1

To what extent does EDR data comprise personal data (or special categories of particularly sensitive personal data) for the purposes of the Directive 95/46/EC?

The Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data was implemented in Spain by the Organic Law 15/1999, dated 13 of December, on the Protection of Personal Data (the "Law"), and by the Royal Decree 1720/2007, dated 21 of December, which is the regulation implementing the Law (the "Regulation").

Article 5.1 f) of the Regulation provides that for the purposes of the Regulation personal data shall mean any alphanumeric, graphic, photographic, acoustic or any other type of information pertaining to identified or identifiable natural persons.

The Regulation further provides that an identifiable person shall be any person who may be identified, directly or indirectly, through any information regarding his physical, physiological, psychological, economic, cultural or social identity. A natural person shall not be deemed identifiable if such identification requires disproportionate periods of time and activities.

Under article 7 of the Law data with special protection are defined as personal data which reveal the ideology, trade union membership, religion and beliefs, racial or ethnic origin or sex life. These categories of personal data may be collected when, for reasons of general interest is so provided for by law or the data subject has given his explicit consent.

In the light of the foregoing, we consider that the provisions of the Spanish legislation on Personal Data would only be applicable to data recorded by EDR devices as long as they permit to identify, directly or indirectly, natural persons (e.g. driver or owner of the car). If the data recorded by EDR devices are anonymous information not associated to any natural person, such data would not be considered personal data from a Spanish legal point of view.

D.7.2 Question 2

Who owns the data recorded by the EDR system?

As a general rule, we understand that the ownership of the personal data recorded by the EDR systems should belong to the data subject.

Under article 5 1. a) of the Regulation the data subject is the natural person to whom the data undergoing processing pertain.

Note that the rights of access, rectification, cancellation and objection of personal data are strictly personal and shall be exercised by the data subject.

D.7.3 Question 3

Who is the controller (or controllers) in respect of such EDR data for the purposes of the Directive?

Under article 5 1. q) of the Regulation the data controller is any natural person or legal entity, public or private, or administrative body, who alone or jointly with others, decides on the purpose, content and use of the processing of the personal data, although he does not effectively do it.

Depending on the characteristics of the EDR System and the specific circumstances of each particular case, we understand that the controller of the EDR data may be:

- (i) The owner of the EDR devices,
- (ii) The owner of the motor vehicle (e.g. a company which provides vehicles to its employees); or
- (iii) A third party (e.g. insurance company which has obtained from the owner of the vehicle his prior consent for the data collection).

Note that the Spanish legislation on personal data shall govern the processing of personal data when:

- a) The processing is carried out in the context of activities of an establishment of the controller, provided that such establishment is located in the Spanish territory.
- b) The controller is not established in the Spanish territory but the Spanish legislation is applicable by virtue of international public law.
- c) The controller is not established in the European Union and uses means located in the Spanish territory for the processing of data, unless such means are only used for transit purposes. In this case, the controller shall designate a representative established in the Spanish territory.

For the purposes of the preceding paragraphs, establishment shall be considered, irrespective of its legal structure, as any stable installation in which real and effective business can be conducted.

D.7.4 Question 4

How can controllers comply with their data protection obligations in respect of EDR data and do any exemptions to their data protection obligations apply?

Under article 4 of the Law personal data may be collected for processing, and undergo such processing, only if they are adequate, relevant and not excessive in relation to the scope and the specified, explicit and legitimate purpose for which they were obtained.

Processing of personal data shall require the unambiguous consent of the data subject, unless laid down otherwise by law. For instance, consent shall not be required where the personal data relate to the parties to a contract or preliminary contract for a business, employment or administrative relationship, and are necessary for its maintenance or fulfilment.

The request for consent shall refer to specific processing or series of processes, stating the purpose for which they are collected, as well as the other conditions applying to the processing or series of processes.

The data controller shall be responsible for proving the existence of the data subjects' consent by any means of legally admissible evidence.

Do any exemptions to their data protection obligations apply?

Some exceptions are provided by article 4 of the Regulation:

- a) The files or processing created or maintained by a natural person in the exercise of activities which are exclusively personal or domestic. Those relating to personal or domestic activities shall only be considered as processing relating to activities arising within the framework of the private or family life of individuals.
- b) The files and processing subject to the legislation on the protection of classified materials.
- c) The files and processing established for the investigation of terrorism and serious forms of organized crime. The aforesaid notwithstanding, in such cases, the data controller shall previously inform the Spanish Data Protection Agency of their of their data, general characteristics, and purpose.

D.7.5 Question 5

Who has access to the data recorded by the EDR system (including access to the vehicles in which EDR devices are stored in order to download data recorded by EDR devices)?

Assuming that the data recorded by the EDR systems contain personal data, the following parties may have access to the data recorded by the EDR system:

- a) Data subject: the right of access is the data subject's personal right to ascertain whether his personal data are being processed and the purpose for which they are processed, and to obtain any information available on the origin of such data and the past or planned disclosure thereof.
- b) Data controller: the natural person or legal entity, public or private, or administrative body, that alone or jointly with others decides on the purpose, content and use of the processing of personal data, although he does not effectively do it.
- c) Data processor: the natural person or legal entity, public or private, or administrative body that, alone or jointly with others, processes personal data on behalf of the data controller, due to the existence of legal relations binding them and delimiting the scope of his action for the provision of a service.
- d) Third parties (see answer to next question below).

D.7.6 Question 6

Under which circumstances will this data be accessible?

Personal data subject to processing may be disclosed to third parties only for purposes directly related to the legitimate functions of the transferor and the transferee with the prior consent of the data subject. When consent of the data subject is requested for the assignment of his data, he shall be informed in such a way to understand unequivocally the purpose for which the relevant data shall be used and the type of activity performed by the recipient. Otherwise consent shall be null and void.

The consent of the data subject shall not be required when:

- a) the transfer is authorized by a law;
- b) the data have been collected from publicly accessible sources;
- c) the processing corresponds to the free and legitimate acceptance of a legal relationship whose course, performance and monitoring necessarily involve the connection between such processing and files of third parties. In that case, communication shall be legitimate to the extent of the purpose justifying it.
- d) the communication to be effected is destined to the Ombudsman, the office of Public Prosecutor, judges, courts or the court of Auditors in the exercise of the functions assigned to them. Not shall consent be required when the communication is destined to regional government authorities with functions analogous to the Ombudsman or the Court of Auditors.
- e) the transfer is between public administrations and concerns the retrospective processing of the data for historical, statistical or scientific purposes.
- f) the transfer of personal data on health is necessary for resolving an emergency which requires access to a file or for conducting epidemiological studies within the meaning of central or regional government health legislation.

Also note that under article 22 of the Law collection and processing, for police purposes, of personal data by the Spanish security forces without the consent of the data subjects shall be limited to those cases and categories of data necessary for the prevention of a genuine threat to public safety or for the suppression of crime. Such data shall be stored in special files established for the purpose, which must be classified according to their degree of reliability.

In addition, according to the legal report 0133/2008 of the Spanish Data Protection Agency (AEPD), the members of the police acting directly under the orders of the courts are entitled to collect and process personal data which are necessary for the prevention of a real and serious danger to public safety or for the repression of criminal offenses and that, being data with special protection, are absolutely necessary for the purposes of a specific investigation.

D.7.7 Question 7

What are the acceptable uses of the data?

Under article 8.3 of the Regulation personal data subjected to processing may not be used for purposes incompatible with those for which they were collected. Further

processing of the data for historical, statistical or scientific purposes shall not be considered incompatible.

Article 8.4 of the Regulation further provides that personal data may only be processed if they are adequate, relevant and not excessive in relation to the specific, explicit and legitimate purposes for which they were obtained.

Personal data shall be erased when they have ceased to be necessary or relevant for the purpose for which they were obtained or recorded.

D.7.8 Question 8

What are the confidentiality concerns and how can they be addressed?

In case the data recorded by the EDR systems contain personal data they will be subject to the confidentiality and security duties set forth in the Spanish legislation on Personal Data.

Article 10 of the Law provides that the controller and any persons involved in any stage of processing personal data shall be subject to professional secrecy as regards such data and to the duty to keep them. These obligations shall continue even after the end of the relations with the owner of the file or, where applicable, the person responsible for it.

Article 9 of the Law further provides that the controller or, where applicable, the processor shall adopt the technical and organizational measures necessary to ensure the security of the personal data and prevent their alteration, loss, unauthorized processing or access, having regard to the state of art, the nature of the data stored and the risks to which they are exposed by virtue of human action or the physical or natural environment.

No personal data shall be recorded in files which do not meet the conditions laid down by rules regarding their integrity and security, as well as the rules governing the processing centres, premises, equipment, systems and programs.

Article 88 of the Regulation provides that the data controller shall draw up a security document including the technical and organizational measures according to current legislation on security that shall be binding on the personnel with access to the information systems.

In the event of data processing on behalf of third parties, the agreement for the provision of services shall expressly laid down that the processor shall not communicate the personal data to other persons even for their preservation, and the agreement shall also set out the security measures that the processor is obliged to implement.

Also note that in case of communication of data, the person to whom personal data are communicated is obliged, by the mere fact of communication, to abide by the provisions of the Law.

D.7.9 Question 9

What is the adequate/feasible legal framework to address these issues?

Currently under Spanish law, we are not aware of any legislation which specifically addresses issues such as the ownership of data recorded by EDR devices, who has access to data recorded by EDR devices, the circumstances in which data will be

accessible and what are the acceptable uses of such data will be in any given circumstances.

Furthermore, at this moment, we are not aware of any proposed legislation or regulations which specifically address these issues in Spain.

Appendix E Stakeholder List for Consultation

Stakeholder organisation/company/government	Number of stakeholders contacted
AA	1
ACEA	2
ACEA/MPSA PSA Peugeot-Citroën	1
ACFO (UK only, cars and LGVs)	1
ACPO	2
Allianz	1
ANEC	3
Association of Chief Police Officers' Intelligent Transportation Systems Working Group	1
Aston Martin	1
Austria	3
Autoliv	1
AXA Winterhur	1
BASt	1
Germany	3
Belgian road safety institute IBSR	1
Belgium	2
BEUC	1
Bulgaria	2
BMW	11
Bosch	3
CERTH/HIT	1
Switzerland	1
CITA	2
CLEPA	3
Continental	4
Croatia	3
Cyprus	2
Czech Republic	2
DAF	2
Mercedes-Benz/Daimler	2
Danish Transport Authority	1
Delphi	1
Denmark	2
Dutch Police	1
DVR, German Road Safety Council	1
EARPA	1
ECF European Cyclists' Federation	1

Stakeholder organisation/company/government	Number of stakeholders contacted
ECTRI	1
Estonia	2
Spain	1
ETSC (European Transport Safety Council)	4
EUDARTS-group / TRDARTS / ASDARTS / Accident Investigator Dutch Police	2
Euro NCAP	2
European Federation for Transport and Environment (T&E)	3
EVU	1
FERSI	1
FEVR European Federation of Road TRaffic Victims	1
Finland	2
FIA	2
Fiat-Chrysler	1
FIM	1
Finnish Motor Insurer's Centre	1
Finnish Transport Safety Agency	2
Ford	2
France	5
GM	2
Greece	1
Hungary	2
Hyundai	1
Republic of Ireland	3
IEEE	1
Insurance Europe	7
German Insurance Association	1
IRU (International Road Transport Union)	1
Italy	2
JAMA	1
JLR	1
JPPConsult	1
KAMA	1
KFV (Kuratorium fuer Verkehrssicherheit, Austrian Road Safety Board)	1
Laboratório Nacional de Engenharia Civil	1
Latvia	2
Leasedrive	1
Lithuania	2
Livedrive - Portugal	1
López Leza consultores	1

Stakeholder organisation/company/government	Number of stakeholders contacted
Luxembourg	2
Malta	1
MAN	2
Member of the Management Board of German Road Safety Association for Lower Saxony	1
MIRA Ltd.	1
National Police Agency from the Netherlands	1
Bulgarian National Police Chief Directorate	1
Netherlands	2
OICA	1
Poland	2
PL	1
Portugal	2
PSA	1
RAC	2
RDW Netherlands	4
Renault	2
Romania	3
Scania	1
Sweden	4
Slovenia	3
Spain	1
Sweden	1
Thames Valley Police, UK	1
Thatcham	2
Toyota	1
TRW	1
UK	4
VDA	2
Volvo	3
Total	193

Appendix F Representation at Stakeholder Meeting

Stakeholder organisation/company/government	Number of representatives
Belgian road safety institute IBSR	1
Danish Transport Authority	1
French department for road safety (ministry of interior)	2
KFV (Kuratorium fuer Verkehrssicherheit, Austrian Road Safety Board)	1
National Police Agency from the Netherlands	1
RDW, Dutch Vehicle Registration Authority	3
Road and Rail Department, Swedish Transport Agency	1
Teacher forensic traffic accident reconstruction, Police academy of the Netherlands	1
ACEA	2
ACEA/MPSA PSA Peugeot-Citroën	1
CLEPA	1
Continental Automotive GmbH	3
DEKRA	1
DVR, German Road Safety Council & European Association for Accident Reconstruction and Accident Research EVU	1
ETSC (European Transport Safety Council)	2
EUDARTS-group / TRDARTS / ASDARTS / Accident Investigator Dutch Police	2
FEVR European Federation of Road TRaffic Victims	1
FIA Fédération Internationale de l'Automobile (Region I)	2
GDV German Insurance Association	1
Hampshire & Thames Valley Police JOU, Forensic Vehicle Examination Unit	2
Insurance Europe	1
JPPConsult	1
Leaseurope	2
Thatcham	1
Volvo Group	1

Appendix G Stakeholder Questionnaire

The following is a list of the questions contained within an online questionnaire used to obtain stakeholder information for a study commissioned by the European Commission (EC) on *the benefits for road safety resulting from the installation of event data recorders*.

Survey background

TRL – the UK’s Transport Research Laboratory – is working on a European Commission project on Event Data Recorders (EDRs) , specifically EDRs that record information for a short time interval before, during and after a road traffic accident. This survey was designed to gather input and views on EDR fitment, costs and technical requirements.

What is the purpose of the research?

The aim of the study is to assist the Commission in deciding whether the fitting of EDRs in all vehicles, or certain categories of vehicles, could result in an improvement of road safety or have other possible consequences that would justify any costs associated with the adoption of EU legislative measures.

Who will see my answers?

Only the researchers at TRL will see your answers. There will be a report based on our findings, including what we find out from this survey, but we will only report on general themes and not individual answers.

How long will it take?

Most people take about 5-15 minutes to complete the survey. You can start the survey and finish it at a later date by clicking on the link.

How long will the survey be available?

You will be able to complete the survey until 13th May 2014.

Who can I contact if I have any questions?

If you require any more information, please contact edr@trl.co.uk

* European Commission Contract Notice 2013/S 089-150444: Study on the benefits for road safety resulting from the installation of event data recorders

CONSENT QUESTIONS

Before you start the survey we need to check a few things with you. Please state whether you agree with the following:

- I feel well-informed of the survey’s purpose
- I understand that I am free to stop doing the survey at any time
- I agree to participate in this survey

Background information

2) Which of these best describes your area of work? (Tick all that apply)

- OEM / Supplier - Cars
- OEM / Supplier - Light Goods Vehicles
- OEM / Supplier - HGV, Bus or Coach
- Operator - Car Fleet
- Operator - Light Goods Vehicle Fleet
- Operator - HGV Fleet
- Operator - Bus or Coach Fleet
- Insurer
- Police / Emergency Services
- Solicitor (or accident investigator working for a solicitor)
- EDR User (you or your organisation currently uses data obtained from EDR units)
- Other (please specify)

3) Do you operate in the EU and/or globally?

- EU
- Globally

4) If you operate in the EU: In which country / countries do you operate?

Background technical information

In the United States, requirements for EDR fitment are outlined in 49 CFR Part 563 , the most recent update of which required all vehicles sold in the U.S. (including those manufactured overseas) which have EDR capability, to comply with the uniform EDR performance requirements in 49 CFR Part 563 by 1st September, 2012 (reviewed and ratified 14th August, 2012).

These requirements cover the collection, storage, and access to on-board event data and the requirements for vehicle manufacturers to make tools and/or methods commercially available so that accident researchers are able to retrieve data from EDRs.

The technical requirements specify 15 data elements (including Delta-V, time, speed, airbag deployment etc.) that must be recorded along with their recording frequency and duration and requirement. Frequency and duration requirements for a further 31 elements are also specified provided they are recorded by the EDR.

OEM / Supplier – Cars

5) Do you currently fit any EDR systems to your vehicles?

- Yes, including European markets
- Yes, but not in European markets
- No (Go to Q20)

6) If you currently fit any EDR systems, in which markets do you currently fit EDR systems to your vehicles?

7) What is the purpose of the EDR systems?

8) When did you first start fitting these systems?

- Less than 3 years ago
- 3-5 years ago
- 6-10 years ago
- 11-15 years ago
- 16-20 years ago
- Over 20 years ago
- Don't know

9) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc.)

10) If you supply to European markets: Thinking about your EUROPEAN markets, please provide an estimate of the percentage of vehicles fitted with EDRs in the 2014 model year.

11) Are the EDRs you fit to your European market vehicles 49 CFR Part 563 compliant?

12) If you have fitted EDRs to some or all of your vehicles in some markets for your own accident investigations, how do you get physical access to the vehicle in order to download EDR data which is being used for SAFETY RESEARCH? Please write 'n/a' if this does not apply.

13) If you have fitted EDRs to some or all of your vehicles in some markets for your own accident investigations, how do you get physical access to the vehicle in order to download EDR data which is being used for LIABILITY INVESTIGATIONS? Please write 'n/a' if this does not apply. Please write 'as above' if this does not differ from your previous answer.

14) 49 CFR Part 563 allows the manufacturer to choose the sampling rate for stored acceleration data. Some manufacturers store data at 1000 Hz. Others store the data at sampling rates as low as 100 Hz. Given that the acceleration data is sampled internally at approximately 3-4 kHz, what is your company's justification for recording at significantly lower frequency?

15) Some papers indicate that US-spec EDRs 'wake up' when two successive acceleration samples exceed 2g. However, pedestrian protection systems may trigger from sensors in the bumper, and advanced systems may trigger in the pre-crash phase based on a range of sensors. Are pedestrian sensing systems in your vehicles used to 'wake up' the EDR and initiate data recording?

16) If the pedestrian sensing systems in your vehicles do not 'wake up' the EDR: Is there any technical reason that pedestrian sensing systems are not used in your vehicles? Please describe.

17) Do you envisage extending the data recorded by the EDR to include the activation status of any new driver assistance (e.g. lane departure warning) or active safety system (e.g. pre-collision seat-belt tensioning) activation?

18) Do you have yaw rate measurement (e.g. as part of the ESC system) in your vehicles?

19) If the EDR systems in your vehicles do not measure the Yaw Rate:

What would be the cost of adding angular rate measurement (at least vehicle yaw) to an EDR?

20) To what extent do you agree or disagree with the following statement: Compliance testing is adequately defined in 49 CFR Part 563.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

21) If you (Strongly) Disagree: Why do you disagree with the statement that compliance testing is adequately defined in 49 CFR Part 563?

22) To what extent do you agree or disagree with the following statement: I am concerned with legal barriers regarding the access to recorded data.

- Strongly disagree
- Disagree
- Neither agree nor disagree

- Agree
- Strongly agree

23) If you (Strongly) Agree: Please describe your concerns with legal barriers regarding the access to recorded data.

OEM / Supplier - Light Goods Vehicles

24) Do you currently fit any EDR systems to your vehicles?

- Yes, including European markets
- Yes, but not in European markets
- No (Go to Q39)

25) If you do currently fit EDR systems to your vehicles: In which markets do you currently fit EDR systems to your vehicles?

26) What is the purpose of the EDR systems?

27) When did you first start fitting these systems?

- Less than 3 years ago
- 3-5 years ago
- 6-10 years ago
- 11-15 years ago
- 16-20 years ago
- Over 20 years ago
- Don't know

28) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

29) If you do supply to European markets: Thinking about your EUROPEAN markets, please provide an estimate of the percentage of vehicles fitted with EDRs in the 2014 model year.

30) Are the EDRs you fit to your European market vehicles 49 CFR Part 563 compliant?

31) If you have fitted EDRs to some or all of your vehicles in some markets for your own accident investigations, how do you get physical access to the vehicle in order to download EDR data which is being used for SAFETY RESEARCH? Please write 'n/a' if this does not apply.

32) If you have fitted EDRs to some or all of your vehicles in some markets for your own accident investigations, how do you get physical access to the vehicle in order to download EDR data which is being used for LIABILITY INVESTIGATIONS? Please write 'n/a' if this does not apply. Please write 'as above' if this does not differ from your previous answer.

33) 49 CFR Part 563 allows the manufacturer to choose the sampling rate for stored acceleration data. Some manufacturers store data at 1000 Hz. Others store the data at sampling rates as low as 100 Hz. Given that the acceleration data is sampled internally at approximately 3-4 kHz, what is your company's justification for recording at significantly lower frequency?

34) Some papers indicate that US-spec EDRs 'wake up' when two successive acceleration samples exceed 2g. However, pedestrian protection systems may trigger from sensors in the bumper, and advanced systems may trigger in the pre-crash phase based on a range of sensors. Are pedestrian sensing systems in your vehicles used to 'wake up' the EDR and initiate data recording?

- Yes
- No
- Don't know

35) If pedestrian sensing systems in your vehicles aren't used to 'wake up' the EDR: Is there any technical reason that pedestrian sensing systems are not used in your vehicles? Please describe.

36) Do you envisage extending the data recorded by the EDR to include the activation status of any new driver assistance (e.g. lane departure warning) or active safety system (e.g. pre-collision seat-belt tensioning) activation?

37) Do you have yaw rate measurement (e.g. as part of the ESC system) in your vehicles?

38) If the EDR systems in your vehicles do not measure the Yaw Rate:

What would be the cost of adding angular rate measurement (at least vehicle yaw) to an EDR?

39) To what extent do you agree or disagree with the following statement: Compliance testing is adequately defined in 49 CFR Part 563.

40) If (Strongly) disagree: Why do you disagree with the statement that compliance testing is adequately defined in 49 CFR Part 563?

41) To what extent do you agree or disagree with the following statement: I am concerned with legal barriers regarding the access to recorded data.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

42) If (Strongly) agree: Please describe your concerns with legal barriers regarding the access to recorded data.

OEM / Supplier - Bus, HGV or Coach

43) Which of these are you an OEM or supplier of? Please tick all that apply.

- HGVs
- Buses
- Coaches

44) Do you currently fit any EDR equipment to your vehicles?

- Yes
- No (Go to Q48)

45) If EDR equipment is fitted: What is the purpose of these systems?

46) When did you first start fitting these systems?

47) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

48) Do you fit any other equipment that incorporates some components of EDR functionality, such as vehicle speed recording, in the ECU (such as that incorporated on most US heavy duty vehicles)?

49) If other equipment is fitted: What is the purpose of these systems?

50) When did you first start fitting these systems?

- Less than 3 years ago
- 3-5 years ago
- 6-10 years ago
- 11-15 years ago
- 16-20 years ago
- Over 20 years ago

- Don't know

51) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

52) If you do not fit other equipment to your vehicles: Is there any technical reason why a system similar to that used on most US heavy duty vehicles cannot be used on European vehicles? Please describe.

HGV Fleet Operators

53) Please describe your fleet, including:

- Vehicle type(s)
- Vehicle purpose(s)
- Vehicle numbers
- Whether vehicles are leased or owned

54) Do you install driver and/or vehicle monitoring systems on your vehicles (e.g. CCTV, status of driver controls)?

- Yes
- No (Go to Q62)

55) If monitoring systems are fitted: What is the purpose of these systems? Please tick all that apply.

- Liability / claims
- Reduce insurance premiums
- Driver training
- Risk management
- Other (please specify):

56) When did you first start fitting these systems?

57) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

58) Are your drivers aware of the presence of these systems?

59) Is your right of access to the data as an employer covered in each employee's contract?

60) Has there been any effect of installing these systems on your vehicle damage and injury accident rates?

- Yes (please describe below)
- No
- Don't know

61) If the fitment of an event data recorder (as defined in the introduction) was mandated for HGVs, would you still fit your own, more comprehensive systems (e.g. for driver monitoring, CCTV etc.)?

- Yes
- No
- Don't know

62) Do you install EDR equipment on your vehicles?

63) If monitoring or EDR systems are currently fitted: Do you install EDR equipment on your vehicles...

- ...as part of a driver or vehicle monitoring system?
(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))
- ...as a separate system? (IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))
- Overview of capabilities:

64) Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company
- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company
- Advantages:

65) If monitoring or EDR systems are not currently fitted: Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company
- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company
- Advantages:

Bus or Coach Fleet Operators

66) Please describe your fleet, including:

- Vehicle type(s)
- Vehicle purpose(s)
- Vehicle numbers
- Whether vehicles are leased or owned

67) Do you install driver and/or vehicle monitoring systems on your vehicles (e.g. CCTV, status of driver controls)?

- Yes
- No (Go to Q75)

68) If monitoring systems are fitted: What is the purpose of these systems?

Please tick all that apply.

- Liability / claims
- Reduce insurance premiums
- Driver training
- Risk management
- Other (please specify):

69) When did you first start fitting these systems?

70) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

71) Are your drivers aware of the presence of these systems?

72) Is your right of access to the data as an employer covered in each employee's contract?

73) Has there been any effect of installing these systems on your vehicle damage and injury accident rates?

74) If the fitment of an event data recorder (as defined in the introduction) was mandated for buses/coaches, would you still fit your own, more comprehensive systems (e.g. for driver monitoring, CCTV etc.)?

- Yes
- No
- Don't know

75) Do you install EDR equipment on your vehicles?

76) If you do currently install EDR equipment on your vehicles...

- ...as part of a driver or vehicle monitoring system?
(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))

- ...as a separate system?
(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))

- Overview of capabilities:

77) Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company

- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company

78) If you do not currently install monitoring or EDR systems: Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company

- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company

Light Goods Vehicle Fleet Operators

79) Please describe your fleet, including:

- Vehicle type(s)
- Vehicle purpose(s)
- Vehicle numbers
- Whether vehicles are leased or owned

80) Do you install driver and/or vehicle monitoring systems on your vehicles (e.g. CCTV, status of driver controls)?

81) If you do install monitoring systems: What is the purpose of these systems? Please tick all that apply.

- Liability / claims
- Reduce insurance premiums
- Driver training
- Risk management
- Other (please specify):

82) When did you first start fitting these systems?

83) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

84) Are your drivers aware of the presence of these systems?

85) Is your right of access to the data as an employer covered in each employee's contract?

86) Has there been any effect of installing these systems on your vehicle damage and injury accident rates?

87) If the fitment of an event data recorder (as defined in the introduction) was mandated for light goods vehicles, would you still fit your own, more comprehensive systems (e.g. for driver monitoring, CCTV etc.)?

88) Do you install EDR equipment on your vehicles?

89) If you do currently install EDR equipment on your vehicles, is it...

- ...as part of a driver or vehicle monitoring system?
(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))
- ...as a separate system?
(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))
- Overview of capabilities:

90) Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company
- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company

91) If you do not currently install EDR equipment on your vehicles:

Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company
- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company
- Advantages:

Car Fleet Operators

92) Do you install driver and/or vehicle monitoring systems on your vehicles (e.g. CCTV, status of driver controls)?

93) If you do fit monitoring systems to your vehicles: What is the purpose of these systems? Please tick all that apply.

- Liability / claims
- Reduce insurance premiums
- Driver training
- Risk management
- Other (please specify):

94) When did you first start fitting these systems?

95) Please give an overview of the capabilities of the equipment (type of data recorded, sampling rate etc).

96) Are your drivers aware of the presence of these systems?

97) Is your right of access to the data as an employer covered in each employee's contract?

98) Has there been any effect of installing these systems on your vehicle damage and injury accident rates?

99) If the fitment of an event data recorder (as defined in the introduction) was mandated for cars, would you still fit your own, more comprehensive systems (e.g. for driver monitoring, CCTV etc.)?

100) Do you install EDR equipment on your vehicles?

101) If you do install EDR equipment or monitoring systems on your vehicles...

- ...as part of a driver or vehicle monitoring system?
(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))
- ...as a separate system?

(IF YES, please give an overview of the capabilities of the equipment (types of data recorded, sampling rate))

- Overview of capabilities:

102) Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company
- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company
- Advantages:

103) If you do not install EDR equipment or monitoring systems on your vehicles: Would it advantageous to your business for EDR systems to be mandated for fitment to your vehicle(s)...

- ...as original equipment?
IF YES, please describe the advantages to your company
- ...as after-market (third party) equipment?
IF YES, please describe the advantages to your company
- Advantages:

Insurers

104) Do you have experience with EDRs (not driver monitoring) in claims handling?

105) Do you include clauses regarding access to EDR data in your insurance policies?

106) If you do include clauses regarding access to EDR data in your insurance policies: Please provide one or more example(s) of a clause regarding access to EDR data in your insurance policies:

107) If you do not include clauses regarding access to EDR data in your insurance policies: Would you envisage including such clauses if EDR data became more widely available?

108) Do you offer driver after-market (third-party) driver monitoring equipment as part of any of your private insurance products? IF YES, please provide an overview of the capabilities of the equipment (e.g. types of data recorded, sampling rate)

- Driver monitoring (without EDR capability)
- EDR (without driver monitoring capability)
- Driver monitoring WITH EDR capability

109) Do you offer reduced insurance premiums to drivers who accept the fitting of after-market (third-party) driver monitoring or EDR systems to their vehicle?

110) Do you ever refuse insurance to drivers who do not accept the fitting of after-market (third-party) driver monitoring or EDR systems to their vehicle?

111) If EDRs were fitted to vehicles as original equipment, would you envisage offering reduced insurance premiums to drivers who allow you access to the EDR data as part of their conditions of insurance?

112) If EDRs were fitted to vehicles as original equipment, would you envisage refusing insurance to drivers who do not allow you access to the EDR data as part of their conditions of insurance?

Police / Emergency Services

113) Has your organisation ever used EDR data in a case?

114) If you have used EDR in a case: Please provide a brief description of the case(s) in which you used EDR data:

115) In what circumstances is access to the vehicle permitted to collect EDR data?

116) In what circumstances is the download and use of EDR data permitted?

117) Are there any circumstances in which a Court Order is required in order to access the vehicle and download EDR data? Please describe.

118) Are there circumstances in which a Court Order is not required in order to access the vehicle and download EDR data? Please describe.

119) Is EDR data considered personal? (I.e. does the storage and handling of the data fall under data protection legislation in Police internal procedures?) Please describe.

120) If permission of the owner or driver is required for access/use of the data, is this ever refused, in your experience?

121) If permission has ever been refused: Please estimate the percentage of refusals, in your experience.

Solicitors and Accident Investigators Working for Solicitors

122) Have you ever used EDR data in a case?

123) If you have not used EDR data: Would you expect to use EDR data if it were more widely available?

124) What are, or what would be the benefits to you and your clients of using EDR data?

125) What are, or what would be the disbenefits to you and your clients of using EDR data?

126) If a vehicle belongs to the 'other side', do you have a right of access to the EDR data under the law in your country? If yes, please note the legislation that allows this.

127) If the permission of the owner or driver of a vehicle belonging to the 'other side' is required for access/use of EDR data, is this often refused?

128) Is EDR data considered personal? (I.e. does the storage and handling of the data fall under data protection legislation your internal procedures?)

EDR Users

129) To what extent do you agree or disagree with the following statement: I think fitting EDRs to vehicles is a good idea.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

130) Have you had any dialogue with your members regarding EDRs?

131) IF YES Please describe the main issues or areas of concern

132) To what extent do you agree or disagree with the following statement:

I think there is sufficient public awareness of EDR fitment in current vehicles.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

All respondents

133) In your opinion, who owns the data recorded by an EDR? (Please tick all that apply)

- Vehicle owner
- Vehicle manufacturer
- Insurance company
- Other (please specify):

134) In your opinion, what are the benefits (or potential benefits) of EDRs?

135) In your opinion, what are the disbenefits (or potential disbenefits) of EDRs?

136) In your opinion, what are the limitations (or potential limitations) of EDRs?

137) If fitment of EDRs were mandatory, what additional costs would be incurred and by whom? Please describe these as far as possible.

138) Download of data from EDRs is typically via the OBD II port or direct from the EDR. In both cases, access to the data is unsecured, allowing the possibility of tampering with the data (in particular deleting data). This may have consequences such as reducing the value of EDR data in legal cases and accident research. Based on this information, to what extent do you agree or disagree with the following statement: The possibility of tampering with EDR data should be addressed.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

139) Securing the EDR data would require either control of physical access to the OBD II port or a software security layer for which authorised persons have the key. If access is controlled, it would be necessary to define who would be entitled to access the unit and to manage a system for providing physical or software keys to authorised persons. Based on this information, to what extent do you agree or disagree with the following statement: The complexities that controlled access would introduce are justified by the risk to data integrity.

- Strongly disagree
- Disagree
- Neither agree nor disagree

- Agree
- Strongly agree

140) Given that access to the vehicle is required in order to access the EDR, to what extent do you agree or disagree with the following statement: The constraints on physical access are adequate to ensure that only appropriate and authorised persons have access to the EDR.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

141) To what extent do you agree or disagree with the following statement: Limits on access to the vehicle constrain the ability of accident researchers to access EDR data

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

142) One option for EDRs in Europe is to mandate EDRs with a similar or identical specification to that in CFR 49 Part 563 in the US. Do you foresee any limitations with this approach? If so, please describe the limitations, e.g...

- Are there any parameters missing from the Part 563 specification?
- Are the sampling rates and durations adequate?
- Is the accuracy of the timing information adequate?

143) Are there any advanced EDR features, not currently in 49 CFR Part 563, that you would recommend for inclusion in an EDR specification for Europe?

- Yes
- No
- If yes, please describe

144) How important is the standardisation of EDR data parameters for the realisation of the benefits of EDR?

- Not at all important
- Not very important
- Neither important nor unimportant
- Quite important
- Very important

145) If you think that the standardisation of EDR data parameters is important: Please give examples of why you believe this.

146) If you DO NOT think that the standardisation of EDR data parameters is important: Please give examples of why you believe this.

147) How important is the standardisation of EDR data formats for the realisation of the benefits of EDR?

- Not at all important
- Not very important
- Neither important nor unimportant
- Quite important
- Very important

148) If you believe the standardisation of EDR data formats for the realisation of the benefits of EDR is QUITE/VERY important: Please give examples of why you believe this.

149) Please give examples of why you believe the standardisation of EDR data formats is not important.

150) How important is the standardisation of EDR data access tools for the realisation of the benefits of EDR?

- Not at all important
- Not very important
- Neither important nor unimportant
- Quite important
- Very important

151) If you believe the standardisation of EDR data access tools is QUITE/VERY important: Please give examples of why you believe this.

152) If you believe the standardisation of EDR data access tools is NOT VERY/ NOT AT ALL important: Please give examples of why you believe this.

153) In your opinion, what are the acceptable uses of EDR data?

- Accident research
- Law enforcement
- Court evidence
- Other (please specify):

154) Do you have any confidentiality concerns relating to EDR data?

- Yes
- No
- Don't know

155) If you DO NOT have any confidentiality concerns - Do you have any further comments related to the confidentiality of EDR data?

156) If you DO have confidentiality concerns - How can your concerns about the confidentiality of EDR data be addressed?

157) Is there an adequate/feasible legal framework in your country to address these issues? Please describe.

158) Is there an adequate/feasible legal framework in the EU to address these issues? Please describe.

159) In your opinion, is EDR data '(sensitive) personal data'?

- Yes
- No
- Don't know

Please explain why you think this:

160) In your opinion, is the crash pulse delta-v recording duration adequate in 49 CFR Part 563?

- Yes
- No
- Don't know

161) Please explain why you do not think the crash pulse delta-v recording duration is adequate in 49 CFR Part 563:

162) In your opinion, is the crash pulse acceleration recording duration adequate in 49 CFR Part 563?

- Yes
- No
- Don't know

163) Please explain why you do not think the crash pulse acceleration recording duration is adequate in 49 CFR Part 563:

164) In your opinion, what is an acceptable PRE-crash recording time for an EDR, and why?

165) In your opinion, what is an acceptable POST-crash recording time for an EDR, and why?

166) In your opinion, is the separation between EDR data and the rest of the vehicle systems adequate to ensure reliable and accurate EDR data?

- Yes (Go to Q168)
- No
- Don't know

167) Why is the separation between EDR data and the rest of the vehicle systems NOT adequate to ensure reliable and accurate EDR data?

168) For accident avoidance systems, EDRs could provide a way of analysing situations where the system prevents an accident.

Do you think it is feasible to trigger the EDR when any advanced system provides a warning or autonomous action (e.g. Lane Departure Warning, Forward Collision Warning)?

- Yes
- No
- Don't know

169) One of the areas with a large potential benefit for EDRs is the management of low-speed (5-25 km/h) rear impact whiplash claims. Some territories have a lower threshold of collision severity (assessed using the change of velocity, delta-v) below which a claim for a whiplash injury is not accepted or is unlikely to be accepted. The threshold velocity is typically low, which puts a relatively high demand on the accuracy of delta-v estimates from the EDR, as well as on the triggering of the EDR – data storage may be triggered by deployment of some part of the restraint system, which is unlikely to happen for low severity rear impacts. Do you consider that EDRs (particularly ones similar to 49 CFR Part 563) are likely to trigger in a low-speed rear impact?

- Yes
- No
- Don't know

170) Do you consider that EDRs (particularly ones similar to 49 CFR Part 563) are accurate enough in low-speed rear impact to be able to determine the collision severity with enough accuracy for the resolution of claims?

- Yes
- No
- Don't know

171) Do you see a need for the download of data from EDRs to be limited to accredited experts only?

- Yes
- No
- Don't know

Please explain your answer:

172) Do you see a need for a centralised storage, either nationally or across the EU, of EDR data?

- Yes
- No
- Don't know

173) What would be the benefits of a centralised store of EDR data?

174) What would be the disbenefits of a centralised store of EDR data?

175) What would be the limitations of a centralised store of EDR data?

176) Article 70 and Article 71 Section 1 lit. d TEC may provide for harmonisation of insurance law, including the simplification and improvement of providing evidence. Do you envisage that this will have an impact on the use of EDR data?

- Yes
- No
- Don't know

177) Please describe the impact that harmonisation of insurance law could have on the use of EDR data.

178) Would it be advisable and appropriate to stipulate EDRs and their data as admitted means of evidence in European law?

- Yes
- No
- Don't know

179) Is the 49 CFR Part 563 definition of data accuracy adequate or are additional specifications required?

- Part 563 definition is adequate
- Additional specifications required

Please explain your answer.

About the respondent

180) What is the name of the organisation you work for?

181) What is your role / job title? *

182) What is your name? (Optional)

183) Would you...

- ...be interested in attending a workshop for this project in Brussels on Tuesday 10th June 2014?
- ...be willing to be contacted by the project team in order to clarify any responses to this survey?

If you answered yes to either question, please provide contact details (phone number and/or email address)

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