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POLICY DEPARTMENT
STRUCTURAL AND COHESION POLICIES **B**

Agriculture and Rural Development

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**TECHNICAL DEVELOPMENT
AND IMPLEMENTATION OF
EVENT DATA RECORDING IN
THE ROAD SAFETY POLICY**

STUDY





DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

TRANSPORT AND TOURISM

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This document was requested by the European Parliament's Committee on Transport and Tourism.

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Abstract

The study provides an analysis of the technical developments and implementation of Event Data Recorders (EDRs) in cars or commercial transport vehicles. EDRs are devices able to record information related to vehicle crashes or accidents. They have been used since the 1970s by US car manufacturers to investigate accident causation and to improve vehicle design; at present, increasing applications in the insurance market and public and private fleet management are emerging. The EU is giving increasing attention to these and other Intelligent Transport System devices as they could help meet road safety targets set in the 2011 Transport White Paper. This study provides an overview of existing application of EDRs in the EU, Switzerland and the US, presenting evidence on their scope of application, technical features, data processing system and outcomes achieved. It concludes with recommendations on factors that should be considered when shaping policies to sustain effective implementation of EDRs in the EU.

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LIST OF ABBREVIATIONS

AEBS	Advanced Emergency Braking Systems
CADaS	Common Accident Data Set
CARE	European Centralised database on Road Accidents
CPR	Crash Pulse Recorders
CSI	Collision Safety Institute
DARR	Digital Accident Data Recorders
DLC	Diagnostic Link Connector
DPA	Data Protection Act
ECR	Electronic Crash Recorder
EDR	Event Data Recorders
EETS	European Electronic Toll Service
EPIC	Electronic Privacy Information Center
ETSC	European Road Safety Council
EU	European Union
EU28	The current Member States
GM	General Motors
IPTM	Institute of Police Technology and Management
IRU	International Road Union
ITS	Intelligent Transport Systems
JDR	Journey Data Recorders
Km	Kilometre
LDWS	Lane Departure Warning Systems
MS	Member State
NHTSA	National Highway Traffic Safety Administration
OEMs	Original Equipment Manufacturers

PSAPs Public Safety Answering Points

ROSPA Royal Society for the Prevention of Accidents

RSAP European Road Safety Action Programme

VEDRs Video Event Data Recorders

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EXECUTIVE SUMMARY

This research study is intended to inform the parliamentary debate with a clear and comprehensive overview of the technical development and implementation of EDR devices in cars and commercial transport vehicles. Particular attention is given to the contribution these devices can give to improving safety on EU roads.

ROAD SAFETY

Road Safety in Europe has been improving constantly over recent decades. The number of fatalities in the EU-27 in 2010 was almost 31,000, against 54,302 registered in 2001. Notwithstanding the substantial decline, the EU did not achieve the target, set in 2003, of a 50% decrease road fatalities between 2001 and 2010.

Data on road accidents at European level are collected in CARE, the European centralised database on road accidents. Although significant steps have been made to improve the quality of the statistical information provided, the CARE database has limitations regarding both the reliability of data and the lack of information about accident causation factors.

Over the past decade, efforts have been made at the EU level to investigate better the circumstances leading to fatal accidents, and a number of studies state that driver error is the main cause of road accidents. These investigations show how Intelligent Transport Systems (ITS), Driver Assistance Systems, Event Data Recorders and eCall could all be relevant to improving road safety through reducing driver error and providing more accurate data collection about factors causing accidents.

TECHNOLOGY, POTENTIAL BENEFITS AND ISSUES

There are currently a number of different vehicle data recorder models on the market. These can be classified as either Journey Data Recorders (JDR), tools that record vehicle status parameters throughout the entire trip, or Event Data Recorders (EDR) that record only in the case of an event exceeding certain threshold parameters and triggering a sensor. In addition there are Video Event Data Recorders (VEDRs), which allow the system to add video recording of the environment surrounding the vehicle.

The drive to encourage the deployment of these devices comes from both the EU and the private sector. The EU seeks their implementation to increase road safety through improved road safety research and the effects that EDRs have on driver behaviour. The private sector sees the benefits related to improved legal certainty in litigation, more transparent insurance procedures, and improved monitoring of public transport and fleet operations.

The main issue regarding the development of EDRs relates to the privacy of collected data. Without appropriate privacy safeguards, drivers and passengers of smart vehicles might be unable to monitor and control the data being processed; or even unaware that data is being processed. This issue has yet to be addressed fully in the EU, as different national legislative provisions account for it in different ways, and EDR data is not regulated consistently.

EXISTING IMPLEMENTATION

EDR device implementation and expansion has developed differently across the globe. The country with the most widespread use of EDR devices among public and private vehicles is the United States, which can therefore be considered a reference case. In Europe the development of this technology has been less diffuse and it varies between different countries.

The type of vehicles in which EDRs are installed also varies between states. In the United States and Sweden, EDRs have been installed in private cars mainly by car manufacturers; in Switzerland, Germany and Austria they have been installed on some emergency and police vehicles; in Italy, Germany and Austria EDRs have been installed on public transport vehicles; while in the UK, Switzerland and Germany some companies use EDRs to improve commercial car fleet management. In addition, EDR insurance-based contracts for both private cars and commercial vehicles are available in Italy, UK, Switzerland and US. EDRs have different technical specifications in different countries though.

POSSIBLE COSTS AND BENEFITS

The cost of installing EDRs can range from EUR20 to EUR100 per device. To this should be added the cost of collecting, processing and managing data, though this will vary depending on their use, and unit costs will fall as the network grows.

EDR data has been useful in crash reconstruction and vehicle design, providing information on accident reconstruction parameters and the causes of injuries. Furthermore, installation on public or commercial vehicle fleets can result in a reduction in the number of accidents and related costs in the range of 20-30%.

In the insurance market, the unbiased information gathered by EDRs can be a fundamental tool for insurance companies assessing in more detail road safety risks, and drafting more accurate risk profiles of their clients. EDR devices can also benefit cautious drivers, who can get cheaper premia.

Another benefit of EDRs is the ability, when they are associated with emergency call functions, to improve emergency or recovery interventions: this can lead to a reduction of fatalities, the seriousness of injuries and the congestion costs caused by traffic accidents.

Once the costs and benefits of installing EDRs in vehicles and developing the infrastructure network needed to process the recorded data are considered, the overall economic case for a large scale introduction of these devices seems greater for public transport, coaches, HGVs and other public or private vehicle fleets such as logistics vehicles. This is confirmed by a recent study in Germany assessing the costs and benefits of a wide scale introduction of EDRs in the different types of vehicles in the country¹.

As yet, however, there is no statistical evidence on the link between EDRs and road safety improvements to support the case for their wide scale introduction in private vehicles. Further research would be required to in this area.

A preliminary assessment of the cost of the EU-wide installation of EDR devices on private cars undertaken as part of this study, showed that a decline in the serious accidents rate, from a 2011 baseline, by around 0.7-1.5% annually for 20 years, would be sufficient to cover the cost of installing EDR devices on all vehicles.

CONCLUSIONS

Significant evidence suggests that the installation of EDRs or similar devices (such as VEDRs) on buses, coaches and HGVs has the potential to return high positive benefits in terms of improved economic efficiency and reduced costs of use of these fleets. It would also have social benefits from a reduction in accident rates and risks.

For private cars, while the installation of these devices as part of insurance policy contracts has often led to a reduction in the insurance premium paid by drivers, as yet no evidence has been found on the presence of a clear, causal relationship between the use of EDRs and an improvement in road safety. Nevertheless, this study shows that, given the limited unit cost of installing EDRs, even a marginal positive impact on road safety from their widespread introduction in private cars would be cost-effective. However, the approach adopted has a number of limitations, and a full impact assessment is recommended, to evaluate the effects of policy options that require a wider introduction of EDRs on EU vehicles.

The policy options to be considered should include building on existing private interest in the introduction of EDRs, and should be differentiated by vehicle type, giving priority to those where higher benefits are expected. Among other options, mandatory introduction of the devices in new vehicles should be considered and evaluated.

When deciding what approach to adopt, it will be important to understand who should bear the cost of the installation of the devices. Adoption would be facilitated if the ultimate user was not required to pay for the device, or if the long-term benefit led to a monetary saving for the user.

Data privacy issues remain a concern for a number of parties. While the use of EDR data for research purposes does not seem to generate concerns, provided that they are treated as anonymous, further potential uses - linked to insurance-based contracts, fleet management or other applications - would need to be treated carefully and in some cases be subject to individual formal expression of consent regarding the treatment of data. In any case, the collection and processing of EDR data would need to fulfil the provisions included in the revised text of Directive 95/46/EC currently under discussion.

A consistent approach should be adopted in determining which devices are made compulsory in new vehicles and how they communicate with each other. Current policy is moving towards having an eCall, an EDR and an EETS device. Before any are made compulsory, the EU should consider how to integrate their functions into one device, to ensure that the benefits of increased interoperability within single devices are not lost due to a lack of integrated functionality. This can either be legislated by the EU or developed by the industry through processes such as standards setting.

¹ E. Petersen, J. Ahlgrimm, (2014): Benefit/Cost-Analysis of mandatory Event Data Recorder Applications, Approach and Results). Published in: ZVS-Zeitschrift für Verkehrssicherheit, Issue 2/2014, Kirschbaum Verlag, Bonn.

1. INTRODUCTION

1.1. Preface

This study has been commissioned to examine Event Data Recorders (EDRs) and assess where and for what purpose they have been implemented inside and outside the EU. The study was also required to examine the relationship between their introduction, road safety and the effect on the wider economy.

The study has been informed by a number of previous studies, desktop analysis and discussions with stakeholders, and provides a review of current developments in a subset of EU Member States and other countries. These countries were selected according to a number of criteria, including the existence of national EDR applications, the coverage of EDR applications, and the evidence available on outcomes resulting from their introduction.

1.2. Study Requirements

The purpose of the study was to provide Members of the Committee on Transport and Tourism with a clear and comprehensive overview of the technical developments and implementation of EDR devices in cars or commercial transport vehicles. The terms of reference required:

- Provision of updated key road safety statistical data in the EU 28, and a synthesis of the objectives and actions set at the EU level in this area, with a focus on the type and quality of road accident causation data currently available.
- Description of the state-of-the-art of technology and of the latest technological developments, including the key technical characteristics and functionalities of the main EDR devices available in different countries.
- Illustration of the existing implementation of EDRs for different purposes, including their actual use inside and outside the EU, and investigating how data protection concerns raised by EDR uses have to be dealt with.
- Identification of outcomes that could be generated by different uses of EDRs, in road safety and other areas, such as enhancements in legal security and insurance procedures.
- Provision of a balanced assessment of the extent to which wider implementation of these devices across different types of road users could contribute to the various measurable road safety targets set in the EU agenda 2011-2020, in particular a significant reduction of deaths and injuries.

Finally this study provides conclusions setting out recommendations for the main elements of an EU legal framework accelerating the adoption of EDRs by Governments and stakeholders. Special attention has been given to the possible impacts on road safety objectives of extending EDRs' use to all EU road users, and how the EDRs can be implemented in reasonable timescales within the EU strategy for road safety.

1.3. Organisation of the research study

The remainder of this research study is structured as follows:

- Chapter 2 provides an overview of current EU road safety targets and available data, discussing the achievements made in recent years and the challenges yet to be addressed.
- Chapter 3 provides a definition of EDR devices and their potential impacts.
- Chapter 4 provides an overview of existing applications of EDRs in different EU and non-EU states.
- Chapter 5 outlines the socioeconomic outcomes resulting from the introduction of EDRs and discusses the potential impacts of a wider distribution of these devices on road safety goals.
- Chapter 6 concludes by outlining key findings and recommendations.

2. ROAD SAFETY IN THE EU

2.1. Introduction

Intelligent Transport System solutions (ITS), including the Event Data Recorders devices considered in this study, are often suggested as means of improving safety on EU roads. They are seen as being able to increase the accuracy and quality of accident data used to inform policy actions and measures in this area and, through their monitoring of driving styles and manoeuvres, to encourage more cautious driving.

To explain the reasons for increasing EU level attention to the link between ITS solutions and road safety, this chapter provides a general overview of recent trends in road safety in the 28 EU Member States and compares them with EU policy objectives and actions. It also focuses on features of existing databases and studies used to shape road safety policy, identifying the limitations of current data for investigating accident causation. Finally, the chapter reviews eSafety and smart technologies used for vehicle-based intelligent safety systems and their connection to EU road safety policy.

2.2. Road safety in the EU

3.2.1 Road safety trends

Road safety is monitored at the EU level through the collection of statistics on road accidents, fatalities and injuries on EU roads. A common data collection process has been established across EU MSs, and standardised statistics are published in CARE², a Community database on road accidents resulting in death or injury. The remainder of Section 3.2.1 is based on this dataset, whose technical features are discussed in Section 3.2.2.

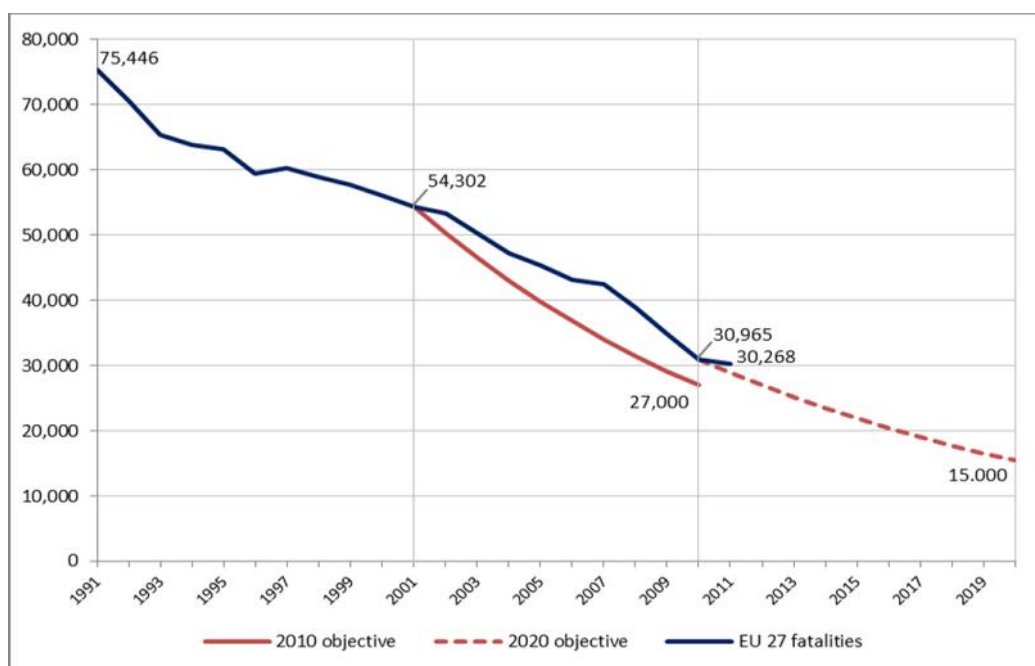
Figure 1 compares the number of road fatalities between 1991 and 2011 with the targets for 2010 and 2020³ set by EU policy. In 2003 the EU set a target of halving fatalities between 2001 and 2010, from 54,000 to 27,000. From 2008 to 2010 fatalities fell by about 10% per annum, against a 4% fall of 4% per annum from 2001 to 2007, and by 2010 fatalities had fallen to 31,500, achieving and 87%⁴ of the target reduction.

² http://ec.europa.eu/transport/road_safety/index_en.htm.

³ See COM(2003) 311 final “Halving the number of road accident victims in the EU by 2010: A shared responsibility” for the 2010 target and COM(2010) 389 final “Towards a European road safety area: policy orientations on road safety for the years 2011-2020” for the 2020 target.

⁴ The target of 50% drop of road fatalities between 2001 and 2010 was set in 2003 for an EU with 15 MS, while the 2010 data reported refer to EU27.

Figure 1: Number of accident fatalities in the EU-27, 1991-2011

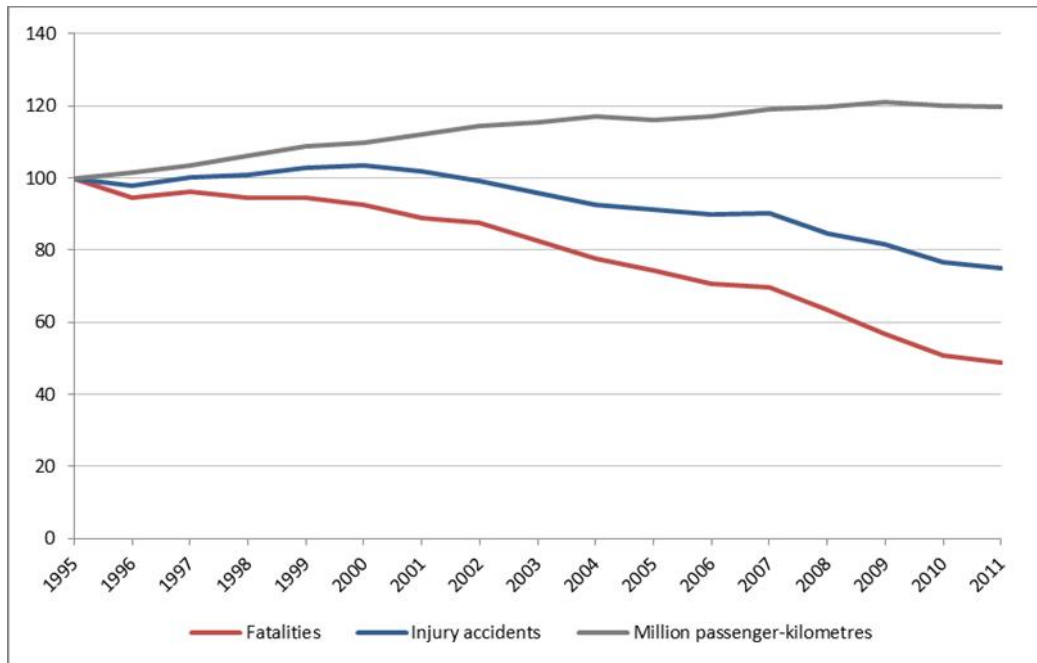


Source: Steer Davies Gleave elaboration on European Commission data (2013).

Both road fatalities and injury accidents in the EU have been declining, despite a general EU-wide growth in road passenger transport, measured in passenger-kilometres, of 1.1% per annum between 1995 and 2011.

Figure 2 compares the trends between 1995 and 2011 in total passenger-kilometres, road fatalities and injury accidents. From 1995 to 2000, total passenger-kilometres increased rapidly, while the total number of fatalities fell only marginally (1.5% per annum) and the number of injury accidents increased marginally. Between 2001 and 2007 the rate at which road fatalities and injury accidents fell increased, but was still insufficient to meet the goal of a 50% drop by 2010. Fatalities fell at an average of about 4.0% per annum, less than the 7.5% per annum needed to achieve the target, although total passenger-kilometres continued to increase by 1.1% per annum. It was only between 2008 and 2010 that the rate of reduction in the number of both fatalities and injury accidents rose to 10% per annum. This may be partially explained by the stabilisation of road transport volumes.

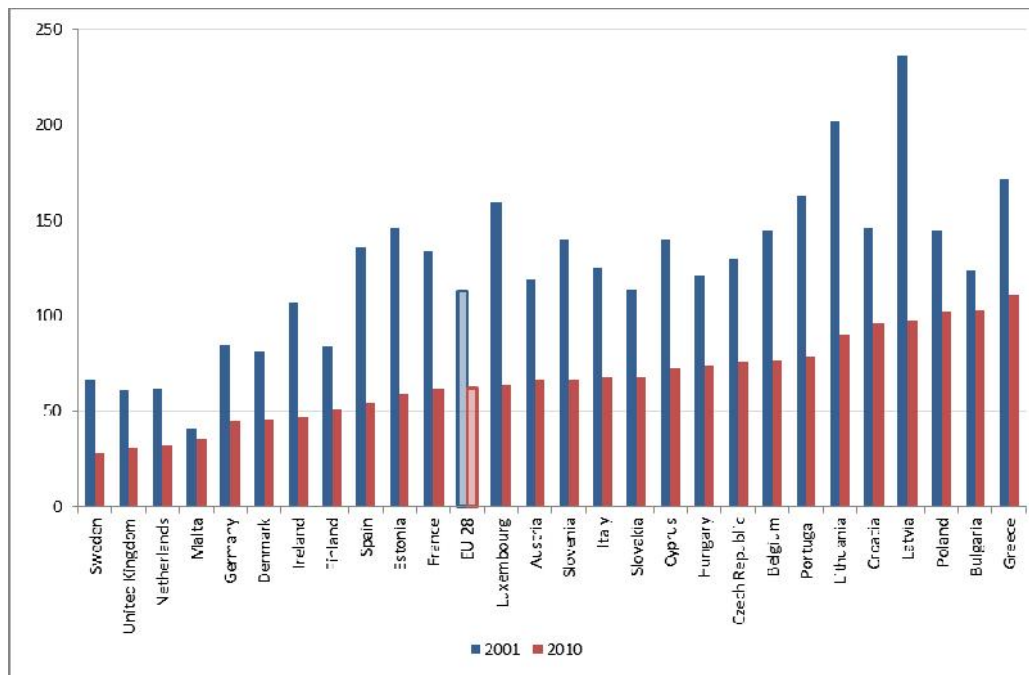
Figure 2: Number of fatalities, number of injury accidents and million passenger transport, 1995-2011 (1995 = 100)



Source: Steer Davies Gleave calculations based on UN Economic Commission for Europe and EC data

The situation varies substantially across the different MSs, as shown in Figure 3 below. Southern and eastern MSs tend to have fatality rates higher than the EU average, as result of both history and culture and of the trends in car use in different MSs.

Figure 3: Road fatalities per million inhabitants in EU MS, 2001 and 2010



Source: Steer Davies Gleave elaboration on European Commission data.

This variation can be seen in the positive achievements obtained in countries like the UK, the Netherlands, Germany, Ireland and Spain through safety policy and road network improvements in those MSs. The poorer performance of Poland, Romania, Greece and Bulgaria needs to be balanced against the sharp increase in car use in these MSs between 2001 and 2010: car ownership increased by 69% in Poland, 37% in Romania, 34% in Greece and Bulgaria, and road traffic increased by 73% in Poland, 63% in Romania, 58% in Greece and 42% in Bulgaria.

In 2010, car users accounted for the highest share of fatalities (47.8%), more than two third of them drivers and the balance passengers. Pedestrians account for approximately 20% of road deaths, followed by motorcyclists (14.8%), cyclists (6.7%) and occupants of goods vehicles (4.3%). Pedestrians formed 37% of all fatalities in urban areas and had the highest risk death when involved in an accident. Between 2000 and 2009, the overall number of fatalities fell at a steady rate for cars (-45%), goods vehicles (-40%), cyclists (-33%) and pedestrians (-34%), while the number of fatalities in accidents involving motorcycles remained constant, suggesting that there is still work to be done in improving motorcycle safety.

3.2.2 Road accident data in the EU

Developing policies and tools to improve road safety in the EU depends on the availability of accurate data on road accidents. These are currently collected at European level in CARE, the centralised European database of non-confidential information on deaths or injuries across the EU. Production of annual road safety statistics is the responsibility of each MS, which carries out this task following its own standards and statistical formats, but CARE returns a harmonised and comparable EU-wide dataset using the CAREPLUS protocol⁵.

While significant effort has been made in recent years to standardise the approach to data collection and improve the quality of the statistical information provided by CARE, there remain a number of issues that limit the effectiveness of the dataset.

A first issue relates to the reliability of data which depends primarily on the statistics provided by single MS, the quality of which can differ across the EU, as argued also by the European Transport Safety Council (2006)⁶. There is relatively accurate reporting of fatalities but, in a number of MSs, under-reporting of injuries and accidents that only result in vehicle damage.

A second issue relates to the type of data available. CARE database version 3.2, released in February 2013, contains 55 common road accident variables, but more variables and data are needed to describe and analyse road accidents better at EU level. The European Commission created a new protocol CADaS (Common Accident Data Set) for this purpose, integrating the variables and values in the CARE database with other international data files, as in the US - MMUCC⁷, WHO⁸. This new protocol aims to improve accident data compatibility throughout Europe and to provide a common framework for use by all MSs

⁵ CARE database protocol version 3.2 available at http://ec.europa.eu/transport/road_safety/pdf/statistics/cadas_glossary.pdf.

⁶ European Road Safety Council – ETSC (2006), Road accident data in the enlarged European Union, Brussels, available at: http://www.etsc.eu/documents/Road_accident_data_in_the_Enlarged_European_Union.pdf

⁷ Data files available at: <http://www.mmucc.us/data-elements>.

⁸ Objectives available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/68/368; data files available at <http://internationaltransportforum.org/irtadpublic/datasets.html>.

seeking to update their national road accident collection system. CADaS variables are divided into four basic categories identified by a letter: (A) Accident related variables, (R) Road related variables, (U) Traffic Unit (vehicle and pedestrian) related variables, and (P) Person related variables.

While the CADaS protocol represents a valuable benchmark for MSs that wish to improve their road accident collection system, the quality of the data recorded, and the extent to which they can contribute to the reconstruction of accident causation factors, depend on the methods and instruments used to collect them. More specifically, if the data are to inform the introduction of measures and actions to mitigate the risk of accident occurrence and severity, greater attention should be given to collecting information to identify the causes of road accidents.

In the past decade, two EU level studies, conducted within the framework of the EU research project SafetyNet, have investigated the circumstances leading to fatal accidents:

- The Fatal Accident Database Development and Analysis⁹ (Working Package 5.1)
- In-depth accident causation database and analysis report¹⁰ (Working Package 5.2)

The Fatal Accident Database Development and Analysis project¹¹ investigated 1298 fatal accidents over a period of 4½ years in Germany, Finland, France, Italy, the Netherlands, Sweden and the UK. This database, containing 100–150 variables (against the 55 provided by the CAREPLUS protocol) and collected mainly from factual police reports of fatal accidents, provides useful information on key accident causes, including driver characteristics, vehicle features, road specification, weather and lighting conditions. It showed that, in 41% of the fatalities investigated, the accident type was described as a “driving accident” with no turn-off or intersection involved, but the data collected did not allow for a more detailed assessment of the causes of each accident.

The parallel study (WP 5.2) provided a deeper analysis of accident causation to identify contributory risk factors, and developed a method to assist the investigators of accident contributing factors¹². The analysis showed that “timing”, such as the “promptness” of reaction to unexpected circumstances, was the most frequent critical event behind the occurrence of an accident, accounting for 51% and 52% of accident causes for cars and large vehicles respectively. This indicates that human factors are a key determinant in road accidents. A similar point was raised by a joint EU-IRU (International Road Union) study investigating truck accident causation factors, which concluded that around 86% of the accidents investigated were linked to human error of one or more of the road users¹³.

Although these studies represent a step in the right direction towards the collection and investigation of more detailed information on accident causation factors, the validity and representativeness of their results is limited by sample sizes of only a thousand accidents each for the two EU research projects and six hundred for EU-IRU one. They are also

⁹ Deliverable 5.7 of SafetyNet project (2008) “Fatal Accident Database Development and Analysis - Final Report” available at: <http://erso.swov.nl/safetynet/fixed/WP5/D5%207%20final%20report.pdf>.

¹⁰ Deliverable 5.2 of SafetyNet project (2005) In-depth Accident Causation Data Study Methodology Development Report.

¹¹ Final report available at: <http://erso.swov.nl/safetynet/fixed/WP5/D5%207%20final%20report.pdf>

¹² Final report available at: http://erso.swov.nl/safetynet/fixed/WP5/SN_D5_8_In-Depth_accident_causation_database_and_analysis_report.pdf.

¹³ IRU (2007), A scientific study “ETAC” European Truck Accident Causation, Brussels.

limited by the type of data collected, which in some cases does not allow for an effective investigation of the causes of accidents.

Several experts¹⁴ argue that future investigations of accident causation factors would benefit significantly from the use of electronic collection forms, which could contribute to improving data quality and facilitate access to disaggregated data. Linking accident databases with medical and other relevant data sources could also support the analysis and allow road accident data to be used in a more coherent manner. ITS equipment can make a significant contribution to achieving road safety goals, as is already envisaged in EU policy on ITS instruments described in the next section.

3.2.3 EU road safety policy

Road safety is one of the key intervention areas of the EU common transport policy. Building on the transport strategy set out in the 2001 Transport White Paper¹⁵, in 2003 the 3rd European Road Safety Action Programme (RSAP)¹⁶ set the challenging goal of halving the number of road fatalities registered in 2001 by 2010.

Figure 4 illustrates the strategic objectives and areas of intervention included in the EU 3rd RSAP.

Figure 4: The 3rd EU Road Safety Action Programme



Between 2000 and 2010, many actions were undertaken to achieve this objective, including the introduction of legislative provisions introducing harmonised minimum safety standards for road tunnels (Directive 2001/54/EC), requiring the use of seatbelts (Directive 2003/20/EC), or introducing harmonised safety management on TEN-T road networks (Directive 2008/96/EC).

¹⁴ IRTAD (2009), CADaS - A common road accident data framework in Europe, oral presentation, Seoul Korea.

¹⁵ COM(2001) 370 final, European transport policy for 2010: time to decide, Brussels. This was then endorsed by the Transport Council on 5 June 2003.

¹⁶ COM (2003) 311 final, Saving 20 000 lives on our roads. A shared responsibility, Brussels.

A number of actions were also introduced to improve the working conditions of professional drivers, including Directive 2002/15/EC on the organisation of working time of persons performing mobile road transport activities, Directive 2003/59/EC on training of commercial drivers, and Regulation 561/2006/EC to improve the monitoring of driving time regulations using digital tachographs on road vehicles and harmonisation of road safety checks.

In its July 2010 Communication "Towards a European road safety area: policy orientations on road safety for the years 2011-2020"¹⁷, the European Commission reiterated its objective of halving the number of road fatalities between 2010 by 2020. This policy has been accompanied by a change in approach, with the focus of policy and provisions moving to enforcement of road rules through the use of modern technologies (a task that is primarily the responsibility of single MSs), improvement of emergency and post-injury services, and protection of more vulnerable road users.

Promoting the use of modern technology to increase road safety was Objective 5 of the Communication, and two specific areas were mentioned as crucial areas for immediate intervention: Advanced Driver Assistance Systems and e-call.

Figure 5: EU policy orientations on road safety 2011-2020



¹⁷ COM(2010) 389 final, Towards a European road safety area: policy orientations on road safety for the years 2011-2020, Brussels.

Box 1: eSafety

ITS and road safety

Technical devices and ITS applications have accompanied and supported the implementation of the EU road safety policy. One example is the digital tachograph, implemented through Regulation (EC) No 68/2009, an adaptation of Regulation (EEC) No 3821/85 on the use of recording equipment in road transport for professional drivers.

In addition to this, between 2001 and 2010 the EU adopted other measures were adopted to support road safety through ITS solutions such as:

- Directive 2002/85/EC, a modification of Council Directive 92/6/EEC, on the installation and use of speed limitation devices for certain categories of motor vehicles;
- Recommendation COM(2003) 2657 for the development of location-enhanced emergency call services ;
- Regulation (EC) No 661/2009 on the introduction of ABS brake assistance as a prerequisite for certain categories of new four-wheel passenger and goods vehicles.

The adoption of ITS solutions to improve road safety is commonly ascribed as “eSafety”, a category which includes all vehicle-based intelligent safety systems that can improve road safety through exposure, crash avoidance, injury reduction and post-crash assistance.

Examples include Intelligent Speed Adaptation, seat belt reminders in all seating positions, electronic stability control, alcohol interlocks for repeat offenders and fleet drivers, and event and journey data recorders. In some cases, the safety effects of measures are known e.g. anti-lock braking in cars, but in other cases the available evidence does not indicate clear safety benefits of some of these devices.

Some of these systems have the potential to contribute to the achievement of the EU road safety goals providing support on the following areas:

- Enforcement of traffic rules through better monitoring and control of drivers’ behaviour;
- Informing road users of real time road conditions, traffic congestion, and vehicle status, thus favouring an improvement in driving behaviour;
- Facilitating emergency help in case of an accident; and
- Recording data that can be used to investigate accident causation factors and, consequently, ultimately support the introduction of mitigation actions.

The performance of each of these systems needs to be evaluated in comparison to their installation and activation costs.

This attention to ITS solutions built on the 2008 “Action Plan for the Deployment of Intelligent Transport Systems in Europe”¹⁸ (the “ITS Action Plan”), a strategic document that paved the way for the wider introduction of ITS solutions in the EU transport market. This indicated as key areas to be addressed:

- Promotion of advanced driver assistance systems and safety-related ITS, aiming to increase the take-up of the advanced emergency braking systems (AEBS) and lane departure warning systems (LDWS) in heavy goods vehicles.
- Installation in new vehicles of eCall devices (equipment that automatically dials Europe’s single emergency number 112 in the event of a serious accident and communicates the vehicle’s location to emergency services), accompanied by an upgrade of Public Safety Answering Points¹⁹ (PSAPs) to enable them to handle eCalls, and achievement of full-scale roll-out of eCall throughout Europe.
- Introduction of safe on-board human–machine interfaces which aim to set the optimal parameters for the safe use and operation of electronic devices while driving.
- Assessment of the positive and negative impacts of ITS applications and services on the safety and comfort of vulnerable road users.
- Introduction of services for safe and secure truck parking areas, to provide truck drivers, hauliers and service providers with information and forecasts on available parking places, so as to optimise the use of the existing parking infrastructure.

In 2010 Directive 2010/40/EU, building on the 2008 ITS Action Plan, aimed to set the framework for the deployment of ITS in road transport and the creation of interfaces with other modes of transport.

This Directive is an important instrument for ITS implementation²⁰, reinforcing the measures envisaged in the ITS Action Plan with a set of enforceable legal provisions, and helping to accelerate the deployment of innovative transport technologies. It is intended to establish interoperable and seamless ITS services for road safety, including data and procedures for the provision of road safety related to minimum universal traffic information, free of charge to users, and harmonised provision for an interoperable, EU-wide, eCall system. An additional aim was to promote harmonisation, while leaving EU Member States the freedom to decide which systems to implement.

The Directive also dealt with privacy issues, stating at Art. 10 that Member States shall ensure that:

- processing personal data in the context of the operation of ITS applications and services must be in accordance with Union rules protecting fundamental rights and

¹⁸ COM(2008) 886 final, Action Plan for the Deployment of Intelligent Transport Systems in Europe, Brussels.

¹⁹ A Public Safety Answering Point (PSAP) is a call centre responsible for answering calls to an emergency telephone number for police, firefighting and ambulance services. A PSAP facility runs 24 hours a day, dispatching emergency services or passing emergency calls to public or private safety agencies.

²⁰ No report has yet been published on its implementation status. Pursuant to Article 17(2) of the Directive 2010/40/EU, Member States had until 27 August 2012 to provide the Commission with information on national ITS actions envisaged over the following five year period. Not all MSs provided information. The reports available are at: http://ec.europa.eu/transport/themes/its/road/action_plan/its_national_reports_en.htm.

freedoms of individuals, in particular Directive 95/46/EC and Directive 2002/58/EC, and

- personal data must be protected against misuse, including unlawful access, alteration or loss.

Some of these actions are based on the development of technologies that process information collected by electronic devices installed in vehicles, such as Event Data Recorders (EDR) and eCall tools.

The next chapter provides more detailed information on the technical specification and scope of application of these devices. It also provides an update on the current debate regarding proposals recently advanced by the European Commission for the mandatory adoption of eCall systems in new private and light commercial vehicles.

KEY FINDINGS

- Between 2000 and 2010 road safety improved significantly across the EU. The number of road fatalities fell to 31,500, 57% of the number in 2001, but falling short of the target set in the 3rd European Road Safety Action Programme (RSAP) of halving fatalities between 2001 by 2010. This reduction was achieved despite a general growth of road traffic over the same period. The European Commission renewed its objective of halving road fatalities by 2020 through increased focus on the enforcement of road rules.
- The situation varies substantially between EU MSs, with southern and eastern MSs having higher than average fatality rates. Car users account for the highest share of accident fatalities, followed by pedestrians and motorcyclists. Pedestrians are the most exposed in urban areas.
- Different studies state that driver error is the main cause of road accidents. Weather, the condition of the infrastructure and technical failures all have a marginal impact on road safety. The use of ITS tools, in particular Driver Assistance Systems, Event Data Recorders and eCall can all contribute to reducing driver error, and improve the mapping of the causes of driver error to address them in a more targeted manner.

3. EDR TECHNOLOGY, POTENTIAL BENEFITS & ISSUES

3.1 Introduction

This chapter provides an overview of vehicle data recording devices that can be installed on road vehicles, and in particular “Event Data Recorders” and the findings of the VERONICA project, a research study, co-funded by the European Commission, which assessed different EDR standards and applications and mechanisms for their implementation in all vehicles. It also examines the potential applications and benefits of EDRs and the privacy of the data they collect, an issue which will be discussed in more detail in Chapter 5. It ends with a discussion of the main benefits and recent policy developments of e-Call technology and describes how it interacts with EDR devices.

3.2 EDR technology and latest technological developments

3.2.4 Different types of in-vehicle data recorders

While a number of vehicle data recorder models are currently on the market, they share the function of monitoring vehicle data such as speed, acceleration and braking, and engine parameters. They differ in their intended uses and hence in the amount, type, rate/frequency, duration, and quality of data they collect.

Vehicle data recorder families can be classified as Journey Data Recorders (JDR) or Event Data Recorders (EDR), although other terms (such as Accident Data Recorders, Incident Data Recorders, Sensing and Diagnostic Modules) are also used.

Journey Data Recorders (JDRs) record vehicle status parameters throughout the entire trip. They can monitor driver and vehicle performance and thus be used to check and improve driver behaviour, particularly with regard to commercial transport and young or inexperienced drivers. However, these devices record at a low frequency (typically 1Hz, or once per second) and the resulting data are largely inadequate for accident purposes.

Event Data Recorders (EDRs) allow the monitoring of vehicle data at far higher levels of detail. The data is collected at a frequency of 20-500Hz and can be used to reconstruct the dynamics and the pattern of an accident. An EDR differs from a JDR in that data are only recorded in the device’s long-term memory if an event exceeding a certain threshold occurs and triggers a sensor. EDR data is constantly overwritten, unless a specific event occurs.

An EDR comprises a sensor data buffer which permanently receives data from other sensors. When an event of a certain severity is reached, the EDR stores data in the sensor data buffer which can be extracted to be used for investigation or research. The stored data typically covers approximately 30 seconds before and 15 seconds after the trigger event.

This document focuses on this second type of accident data recorder, consistent with the EU definition of EDRs as: “devices which continuously record and store the values taken by a series of vehicle parameters so that a sequence of those records covering some seconds before, during and after a crash can be recovered.” We note, however, that some other studies use the term EDR to include any on-board data collecting device.

Video Event Data Recorders (VEDRs) are an upgraded version of EDRs which add video recording of the environment surrounding the vehicle. In certain cases the VEDR can also record audio. There has been a high adoption of VEDRs in public transport and taxi fleets.

3.2.5 The use of EDRs

EDRs are an important tool for monitoring and researching data relating to road safety. These devices are recognised as particularly efficient at:

- Increasing accuracy and quality of accident data, thus enhancing accident reconstruction.
- Evaluating new safety technology.
- Improving the design of a crashworthy road transport system.
- Better understanding the causes and mechanisms of injuries.
- Speeding and refining legal processes.
- Enhancing pre-crash investigation and crash reconstruction.
- Enhancing driver training and infrastructure enhancements.

Further details of the existing application of EDR devices in the EU and US, and the issues encountered in their use, are presented in Chapter 4 and Chapter 5 of this report.

3.3 The VERONICA Project

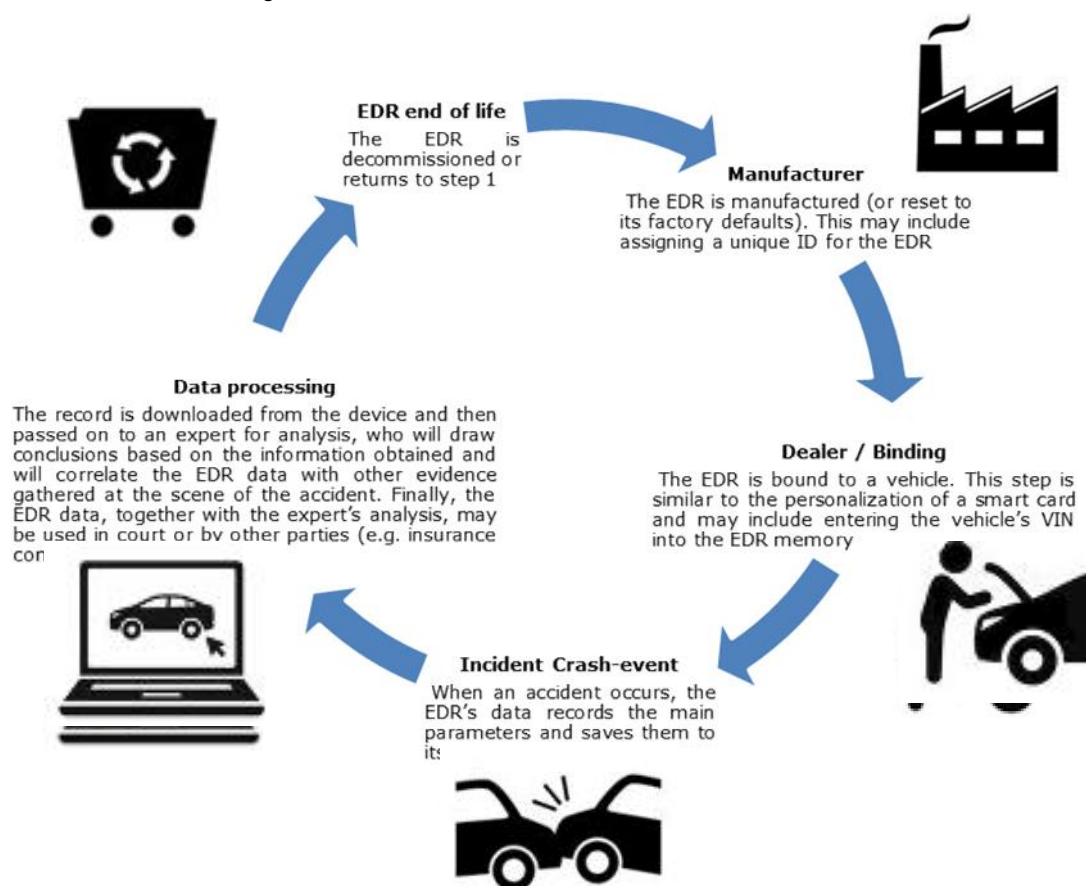
The first projects involving research on EDRs devices were carried out in the EU MS in 1991 and 1992²¹, but it was only within the EU Road Safety Action Plan 2003 that the European Commission decided to fund a project aimed at providing in-depth information on the feasibility of EDR technology in Europe. The project, called VERONICA (Vehicle Event Recording based ON Intelligent Crash Assessment), was carried out in 2006 by Siemens with the assistance of 30 other industry partners. Its aim was to assess the possibility of implementing EDRs to improve the understanding of why collisions occur but also to understand and recognise the potential benefits for road accident prevention, road safety and litigation. The project objectives included examining and evaluating currently available and necessary standards, solutions and requirements, and the legal framework required to channel accident data into European Accident Databases.

3.3.1 The main recommendations and outcomes of the VERONICA project

VERONICA provided a typical life-cycle analysis of EDR implementation (see below) and identified a series of short and medium term recommendations in the field of technical, administrative and legal requirements for the implementation of EDRs in the context of road safety policy. EU interest in this area is justified by the fact that related knowledge of accident causation factors, road safety performance and policy actions can lead to a collective good.

²¹ Salomonsson, O.; Koch, M. 1991. Crash Recorder for Safety System Studies and as a Consumer's Product. Mannesmann Kienzle, Germany/ Volvo Car Corporation, Göteborg, Sweden. 13 p. Frontal Crash Safety Technologies for the 90's. Warrendale, SAE, 1991. Pp. 21-33. Report No. SAE 910656. UMTRI-80924.

Figure 6: EDR life cycle



Source: SDG elaboration on VERONICA (2006).

Technical recommendations

VERONICA provided a number of recommendations on the type of data to be recorded to improve the assessment of accident causation.

First was a list of 20 parameters to be recorded, as set out in the table overleaf. Second was a series of technical requirements for EDRs. These included a minimum storage capacity of 3 accident events, with one accident event consisting of several impacts a vehicle may cause or have suffered. The project also recognised the need to leave manufacturers the option to record additional data for safety and diagnostics purposes.

The conclusions also stressed the importance of assuring the use of "intelligent triggering" (the process that activates the recording of a number of parameters after an event of a certain magnitude "triggers" the threshold of a sensor) in order to be able to collect all the information relevant to reconstructing the causes of accidents. VERONICA pointed out, for example, that the airbag-linked "trigger" used in the US was not sufficient to provide accurate data for accident investigation as it could lead to the exclusion of low speed collisions and collisions with pedestrians²². The project also suggested that it was necessary to standardise intelligent triggering for different vehicle categories.

²² EC (2006), Vehicle Event Recording based ON Intelligent Crash Assessment Final Report, p. 17, Bruxelles.

Table 1: Key parameters to be recorded by EDRs - VERONICA

N	Recorded data	Description
1	Collision Speed	Speed at moment of impact
2	Initial Speed	Speed at start of recording a/o braking
3	Speed Profile	Pre- and Post-crash
4	Change in velocity due to a collision	$v = \Delta v = \text{Change in velocity}$
5	Longitudinal acceleration (IP)	Impact phase (high resolution)
6	Transverse acceleration (IP)	Impact phase (high resolution)
7	Longitudinal acceleration	Pre- and Post-crash (low resolution)
8	Transverse acceleration	Pre- and Post-crash (low resolution)
9	Yawing	Pre-crash yawing
10	Tracking	Displacement tracking of collision sequence.
11	Position	Absolute position
12	Status of signals	Brake light, indicator, lights, blue light, horn, etc.
13	Trigger Date and Time	Convertible into real time after download
14	User Action	Throttle, brake, steering, horn, clutch, etc.
15	Monitoring of Restraint Systems	Airbags, Seat Belts, etc.
16	Monitoring Active Safety Devices' actions	Active Safety Devices (ESP, brake assistant, ABS) go/no-go self-diagnosis for exoneration purposes of manufacturer
17	Monitoring of whether the Active Safety Devices displayed an error message	Messages on faults of ABS Systems etc. for the purposes of exonerating manufacturers
18	VIN/VRD	Vehicle Identification No/Vehicle Registration No
19	Driver-ID	Key, Smart Card, Code
20	Monitoring Driver	Visual Monitoring

Target groups

The project concluded that a number of groups with increased likelihood of having an accident can be targeted to improve collision investigation. These target groups include vehicles transporting hazardous goods, coaches and buses; commercial vehicles, emergency/service vehicles, motorcyclists and young drivers. In the case of the transportation of hazardous goods, coaches, buses and other commercial vehicles,

VERONICA concluded that EDR implementation could learn from the experience of tachographs.

General implementation for passenger cars was not recommended in the short term, but a wider adoption of the devices was suggested following the results of the experiment on target groups.

Other conclusions

The project also provided the legal basis for other EU initiatives and identified broad guidelines for legislative activities by MSs in criminal and civil law and in particular in insurance and liability law.

Particular attention was paid to privacy issues. In the conclusions of VERONICA, project coordinators expressed concern regarding the implications of Union-wide adoption of EDRs. They clarified that EDRs recording only specific events (as opposed to JDRs, for example) do not continually monitor drivers' behaviour and should therefore allay privacy concerns. They also pointed out that use of EDR-recorded data could also increase public awareness in order to improve road safety.

As a further step, VERONICA included a special workshop with representatives of the official consultation body of the EU Data Privacy Directive. The workshop, held in March 2006 in Berlin by the "European Academy for Freedom of Information and Data Protection" (EAID), concluded that EDR implementation could benefit society and meet data privacy provisions provided that the data was processed in an appropriate manner.

3.3.2 A critical assessment of the Veronica project

The VERONICA project was able to provide an extensive assessment of available EDR technologies and the extent to which they could contribute to improving the assessment of road accident causation. It also showed how EDRs could help to provide evidence on crash dynamics in court cases. It defined the main requirements for EDR devices to be considered a valid means of improving the investigation of road accidents, and provided useful insights into the privacy issues that might arise with wide scale implementation.

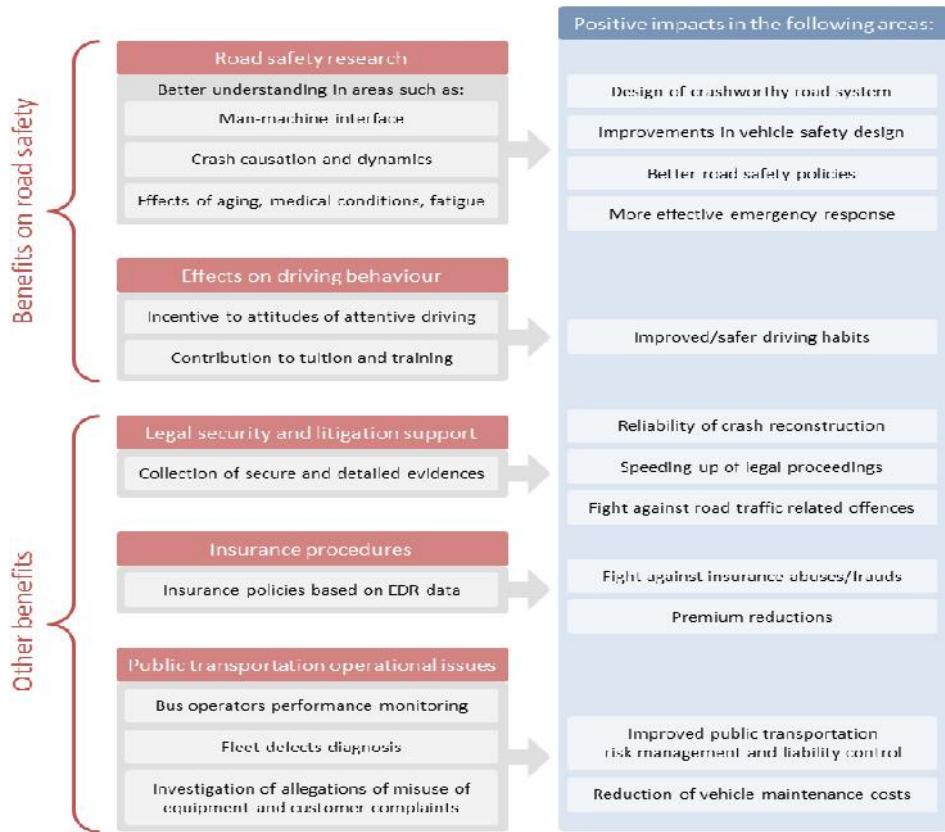
Notwithstanding the efforts of the Veronica project, privacy concerns remain. In particular, as discussed in Chapters 4 and 5, in most cases where data is recorded, the owner of the vehicle with the EDR device must approve the use of the information according to specific national laws.

To facilitate the achievement of VERONICA's goals in relation to creating an EU-wide accident causation database, issues also need to be addressed relating to infrastructure and the harmonised collection of data. A common approach to the homologation of EDR devices, ensuring data accuracy and integrity, is also needed. Similar issues are being reviewed in the discussion of the measures to be taken at the EU level to support the introduction of eCall devices.

3.4 The potential benefits of EDRs: an overview

An assessment of the potential benefits of EDRs is fundamental, as they include not only road safety, the main focus of EU policy, but also the private sector interest in the devices. The figure below provides an overview of the potential benefits of EDRs.

Figure 7 : The potential benefits of EDRs



Source: SDG analysis of VERONICA (2006) and other sources.

3.4.1 Effects of EDRs on road safety

From a perspective of road safety, EDR devices can contribute to the goal of reducing the number of road fatalities and injuries as well as providing other benefits. The benefits from improved road safety research, discussed earlier in this chapter, generally occur over the long term. The benefits from the effects of on-board devices on driving behaviour, which may emerge more rapidly, are the focus of this section.

As noted in Chapter 2, the main cause of accidents is human error, and policies aimed at training road users could therefore contribute to significantly reducing the number of road accidents. The presence of a device that monitors driver performance is likely to be an effective way to improve road user behaviour. By installing a passive device such as an EDR, drivers' awareness of their behaviour increases. Drivers who know their driving performance is being monitored are incentivised to drive in a more risk-averse manner.

3.4.2 Contribution of EDRs to legal security and litigation issues

The availability of secure and reliable data would provide further evidence for court decisions and improve the protection of accident victims' rights. Use of a standardised technology could also assist in accelerating compensation claims and legal procedures, thus reducing the costs of these processes. The use of EDRs could also significantly reduce criminal actions related to accidents including:

- Hit-and-run incidents.
- Deliberate breach of road safety rules.
- Drink driving or other substance abuse.
- Deliberate collision with fraudulent intentions.
- Vehicle theft.
- Overloading or incorrect load distribution.

3.4.3 Benefits of EDRs on the insurance market

Insurance companies can also benefit from EDRs, through a better understanding of the risk profile of drivers. The main potential benefits include:

- The ability to decline insurance protection in the event of serious negligence, where permitted by law.
- Optimum premium prices: higher premia might be higher for high risk drivers, optimising cost management and to benefitting the customer base as a whole.
- Data from EDRs can improve the identification of insurance fraud and abuses.

However, as mentioned above and discussed below, use of EDRs in the insurance market raises a number of concerns, in particular in relation to privacy issues and on the costs of installation, maintenance and removal of the EDR devices, which could be borne by the insurance company, the client, or both.

3.5 The privacy issue

EDRs are part of a wider set of technological developments in road transport that could produce greater benefits if they were connected into a network through an Intelligent Transport System. However, without appropriate privacy safeguards, drivers and passengers of smart vehicles might be unable to monitor and control the data being processed; or even unaware that data is being processed. The collection of data from EDR devices thus raises privacy concerns for drivers and passengers, which are part of the broader debate on the technological developments in the Information Society.

Data privacy contrasts with other rights or obligations, including the interest in effective road safety research (discussed above), ensuring that roads are used without infringing the highway code, third party rights (e.g. victims' rights), driver interests, and adherence to a contract with another entity. The continuing debate is aimed at striking a balance between

the public interest in transport network safety and the need to guarantee the protection of private and sensitive data. In several countries this debate is taking place at the legislative level, in order to address this complex trade-off and construct a robust and clear legal framework to regulate privacy-related issues.

Privacy management related to EDR devices must adhere to a series of principles:

- **Transparency:** EDR data processing should be completely transparent to the vehicle's owner and users. They should be aware of the ongoing processing of personal data, able to understand easily which categories of data are collected and for what purpose, and informed about recipients of the data and their access rights.
- **Owner's consent:** mandatory installation of on-board devices capable of storing and communicating personal data to third parties requires an appropriate legal basis. In the absence of clear legal provisions, such devices should only be activated with the consent of the owner and after the user has been informed.
- **Data quality:** it is generally recognised that data gathered and stored by EDRs should be adequate, relevant and limited to the purpose for which it was installed. The use of anonymised data is preferable wherever possible.
- **Personal data access:** it is important to identify clearly who can access personal data recorded in EDRs, and under which conditions.
- **Data security and integrity:** standardised data security measures to prevent unlawful access, alteration or loss need to be defined and universally adopted. Robust cryptography techniques and proper authentication systems should be used to limit the risk of unintended data transfers or harmful attacks.

Box 2: VERONICA PROJECT GUIDANCE ON EDR DATA USE

The VERONICA Project proposed a series of scenarios which identified what data different user groups would require:

- Police and courts: would require personalised data, that related to a specific driver or data owner. The authors of the VERONICA project concluded that there is no reason why data privacy should supersede public obligations related to accident and crime investigation where EDR data could make a significant contribution. However, they also recognised that since procedural law is a matter of national law, issues such as the extent to which legal authorities are eligible to access or use recorded data in court are subject to national legislation.
- Collision experts: qualified experts use and interpret EDR data, either in personal or anonymous form, depending on the specific requirements. Collision experts do not act on their own behalf, but as contractors consigned by public or private parties, and according to the VERONICA authors, they should be required to follow the data protection rules which apply to the entity that requested their assessment.
- Rescue services: The VERONICA project suggested that these should be given access only to information that is necessary for their rescue activities, but that this information should be available quickly to ensure the safety of drivers and passengers involved in an accident.
- Testing institutions: these institutions would work on aggregated and not personalised data. The data downloaded from the diagnosis interface of an EDR device would not allow the identification of a specific driver and, according to VERONICA, this would not be necessary.
- Accident research databases: these databases would not need personalised data and would include only information collected by public authorities and/or insurance companies. The authors of VERONICA suggested that provisions be taken so that these databases cannot access personal information and should remain anonymous.

As EDRs currently only cover a small part of the road transport market, the approach to the processing and treatment of this data is not consistent at the EU level, and only a small subset of MSs are taking steps to address this issue, as discussed in Chapter 4. In 2006, the VERONICA project proposed an approach to balancing the rights of the private individual with the need to improve road safety (see Box 2). The proposal has not made significant progress, as it needs to allow for different national legislation and subsidiarity.

At present, any information that can be directly or indirectly tied to an identified/identifiable person is covered by the provisions of Directive 95/46/EC²³ "On the protection of individuals with regard to the processing of personal data and on the movement of such data". As further discussed in Chapter 6 of this report, this Directive is currently under revision and the new legislative provisions that will result out of the co-decision procedure will have to deal also with the issues risen by new technological developments and challenges posed by tools like EDRs.

²³ Amended by Regulation 1882/2003.

3.6 eCall

As mentioned earlier, another ITS device which is receiving increasing attention (and shares similar implementation issues with EDRs) is eCall.

eCall is a system that automatically dials 112, Europe's single emergency number, in the event of a serious accident and communicates the vehicle's location to emergency services. It has the potential to reduce significantly the severity of road injuries, improving the efficiency of emergency services and the effectiveness of post-accident medical care. The European Commission estimated that eCall could reduce response times by 40% in urban areas and 50% in rural areas, potentially saving up to 2,500 lives a year²⁴. Following this assessment, in 2013 the Commission made proposals that all new types of vehicles should be fitted with eCall by October 2015. This draft legislation consists of:

- A Regulation²⁵ concerning type-approval requirements for the deployment of the eCall system (and amending the related Directive 2007/46/EC), making the vehicle fit for eCall.
- A Decision²⁶ on the deployment of interoperable EU-wide eCall, making the public infrastructure fit for eCall.

The whole package is intended to ensure the creation of the infrastructure necessary for the proper receipt and handling of eCalls, ensuring compatibility, interoperability and continuity of the EU-wide eCall service.

What distinguishes the eCall system from other technological devices is the need to provide public infrastructure to support the on-board system. The system can only be effective if this infrastructure is also effective.

There are many similarities between on-board eCall systems and EDRs. For example, the emergency call is activated after specific events/accidents which trigger sensors in the device. The unit must then automatically transmit a minimum set of data with relevant information about the incident, including the exact location of the crash site. eCall is currently planned to function only to alert rescue services to an accident, but the European Commission has indicated that it could be equipped with other functions and be used for additional added-value services.

It is clear, however, that for eCall systems to incorporate additional functions and/or communicate with other systems, their technical specifications need to be standardised and interoperable. This issue is very important to industry stakeholders, whose September 2013 position paper²⁷ backed in-vehicle implementation of eCall technology to provide significant consumers benefits in safety and complementary convenience services. (The position paper was prepared by eight key stakeholders representing vehicle repairers and motor traders (Airc, Cecra), automotive suppliers (Clepa), manufacturers and importers of garage equipment (Egea), insurance companies (Insurance Europe), motorists (FIA), leasing companies (Leaseurope) and automotive aftermarket distributors (FIGIEFA). However, the stakeholders also pointed out that this new technology must respect the

²⁴ European Commission - MEMO/13/547 13/06/2013.

²⁵ COM(2013) 316 final.

²⁶ COM(2013) 315 final.

²⁷ <http://www.insuranceeurope.eu/uploads/Modules/Publications/ecall---eu-associations-common-position-paper-19-09-2013.pdf>.

principles of fair competition and free choice for consumers and vehicle operators. In particular, they claimed that the eCall functionality and the underlying in-vehicle system must be based on a standardised, interoperable, secure and open-access platform for possible future in-vehicle applications or services.

The debate on the eCall proposal continues. On 26th February 2014, the EU Parliament adopted the first reading a new text of the proposed regulation, which amends the proposal advanced by the Commission by:

- Stressing the importance of linking eCall with the 112 system, though allowing the coexistence of the new system with third party service supported eCall systems on the condition that the public 112-based eCall service is always available at least as the back-up option.
- Strengthening provisions on data protection, stating that any processing of personal data through the 112-based eCall in-vehicle system shall comply with the personal data protection rules; in this respect manufacturers shall ensure that the 112-based eCall in-vehicle system, as well as another installed emergency call system and a system providing added-value services, are designed in such a way that no exchange of personal data between them is possible.
- Asking the Commission to prepare, by 1 October 2018, an evaluation report on the achievements of the 112-based eCall in-vehicle system including its penetration rate. The report should also investigate whether the scope of the Regulation should be extended to other categories of vehicles, such as powered two-wheelers, heavy goods vehicles, buses and coaches, and agricultural tractors.

The process, as far as the Regulation is concerned, will now proceed with the European Council's first reading of the proposition. As far as the Decision is concerned, the vote in the European Parliament plenary was postponed in order to reach a first reading agreement.

A number of lessons can be learned from the issues emerging in the preparation and discussion of the eCall Regulation. The main lesson relates to ensuring that the system is developed according to standardised and interoperable technology, an issue also relevant to EDRs. Also relevant to EDRs is the issue of ensuring that appropriate infrastructure, a system able to manage data and activate emergency services, is in place to support the on-board units. This would also be relevant if EDR devices were used to provide information on accident causation factors: as with eCall, there would be a need for specific tools to read the EDRs' parameters and transmit them to a remote datacentre.

KEY FINDINGS

- Event data recorders are an important tool for monitoring and researching road safety data. They are particularly efficient in increasing data accuracy following an accident, determining accident causation, and providing information that can be used for improving the road system as a whole.
- Their usefulness was further demonstrated by the 2003 VERONICA project, that focused attention on the benefits of a better understanding of accident causation. VERONICA recommended a number of actions to ensure that EDR adoption was effective, including the identification of basic technical specifications and a gradual rollout focused a number of target groups.
- The drive to install EDRs comes from both the EU and the private sector. The EU seeks its implementation to increase road safety through improved road safety research and the effects of EDRs on driver behaviour. The private sector envisages benefits related to improved legal certainty in litigation, more transparent insurance procedures, and improved monitoring of public transport and fleet operations.
- Privacy of the data processed from EDRs remains an outstanding concern, as different national legislative provisions account for it different ways. The VERONICA project sought to categorise which parties should be able to access which data, although implementation must leave it to national legislators to strike the correct balance between data privacy and public well-being.
- The eCall case shows that, before full adoption of EDRs, and to ensure the consistency and usefulness of data, it will be necessary to adopt a standardised and interoperable system, accompanied by appropriate public infrastructure to ensure the efficient collection of data from EDR devices.

4. EXISTING IMPLEMENTATION OF EDRS

4.1 Introduction

A number of different public and private stakeholders are interested in the use of EDR devices, and this Chapter reviews the models of development and application of EDR devices in several countries. In particular it reviews the large scale introduction of EDRs by car manufacturers, their role in the insurance market, and their use in relation to road safety, driver training, emergency operation, fleet management and public transport.

This chapter is based on information gathered through a number of case studies carried out as part of this study on a subset of EU MS, Switzerland and the US. The aim of the analysis is to provide an overview of how the systems have been implemented, to inform policy actions in this field. However, the approaches in the countries reviewed vary widely, making comparison between them difficult, although comparisons have been included where they have been possible. Furthermore, the development of the use of EDRs is at different stages in different countries, and the information available for each market varies considerably. As a result, this Chapter reports by topic rather than by country.

4.2 The take-up of EDRs

4.2.1 Evidence from case studies and the degree of implementation

Levels of adoption of EDR devices vary across the globe, due to national and local strategic choices, the influence of regulation, and the strategies of private investors.

The highest penetration of EDR devices among public and private vehicles is the United States, where development of the technology since the 1970s has been driven mainly by initiatives sponsored by car manufacturers. The penetration rate within vehicle fleets is already high, but EDRs are also used by single individuals. Given this degree of development, the US can be considered the reference case for the study, as it provides the most evidence on the opportunities and issues that could be met following wide introduction of the devices.

The development of EDR devices has been more limited in Europe and varies significantly between Member States. Lack of a common framework on data ownership, EDR standards and how their data is used has created an environment in which only a limited number of countries have introduced the devices on a significant scale. Where EDRs have been installed, this has usually been driven by the commercial interest of insurance companies or the management needs of specific fleets such as emergency vehicles, public transport fleets or leased vehicles. These divergent drivers have led to the development of different standards and legal frameworks and to different user perceptions of the devices.

We describe next the different uses of EDRs across the countries investigated.

4.2.2 Standard equipment installed by car manufacturers

The US and Sweden both have a large scale installation of EDR devices driven by car manufacturers.

In the United States, EDRs have been installed in large numbers of private cars for over 30 years, driven by the desire of manufacturers to obtain more information on driving patterns. To gather the necessary data, General Motors began fitting a small memory unit to the electronic module that triggers the airbags. It was soon followed by Ford, Chrysler and other carmakers. Initially, EDR modules had a limited storage capability and were used by Original Equipment Manufacturers (OEMs) to record data for research purposes only. Following technological developments that made EDRs more affordable to producers, and specific legislation on their use (see below), EDRs are used in the United States today to gather information for safety, insurance and law enforcement purposes. They now also support new technologies and advanced commercial activity such as GPS location and mobile services.

A 2004 study conducted by the National Cooperative Highway Research Program²⁸ estimated that approximately 40 million passenger vehicles in the US were equipped with EDRs. In 2006 the National Highway Traffic Safety Administration (NHTSA) estimated that 64% of new 2005 model year passenger vehicles and other light vehicles were equipped with EDRs, and the equipment rate rose to 92% by 2010. US drivers did not seem to be aware of the presence of EDRs on their cars: the 2004 study reported that almost two-thirds of car buyers did not know that an EDR was fitted to their car. This issue may have been mitigated by a 2006 regulation issued by the NHTSA²⁹, which required each manufacturer to include a disclosure statement in the vehicle owner's manual to inform the owners of the existence of EDRs in the vehicles.

In Sweden Saab fitted EDRs to all cars sold in the country between 1998 and 2012. These models were imported from the American car manufacturer General Motors, which owned a majority stake in Saab until 2010. In addition, all Volvo cars sold in Sweden have been equipped with Digital Accident Data Recorders (DARR) since 1995.

4.2.3 EDR-based insurance contracts for private citizens

EDRs are used in the insurance markets in the UK, Italy, Sweden, Switzerland and the US.

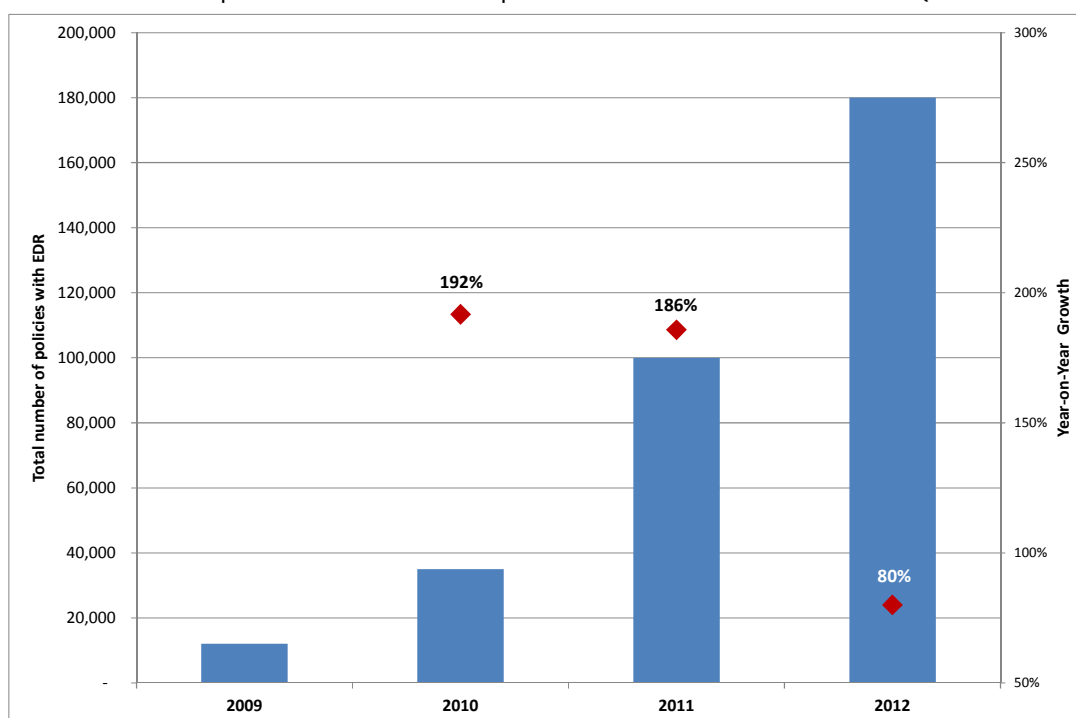
In 2012, 17 different insurance companies in the UK, including the main market players, offered an insurance policy which included an EDR-type device. These ranged from crash recorders to smartphone apps. The upward trend in the adoption of these policies is shown in Figure 8, with an 80% increase between 2011 and 2012. In context, the 180,000 policies with a black box in 2012 was still less than 1% of all insurance policies in the UK.

In the UK, the main target group for EDRs has been new drivers aged 18 to 25 who are on average involved in more accidents, and make more claims, than any other driver group. This results in insurance premia as high as £3,000-5,000 (€3,600-6,000) in the first year of driving. The first national television advertisement promoting insurance policies with a monitoring device was aired in August 2012, and clearly targeted younger drivers.

²⁸ Use of Event Data Recorder (EDR) Technology for Highway Crash Data Analysis, National Cooperative Highway Research Program, Dec 2004.

²⁹ NHTSA (2006) 49 CFR Part 563 Regulation.

Figure 8: The adoption of insurance policies with EDR in the UK (2009-2012)



Source : British Insurance Brokers' Association, Department for Transport.

According to the Royal Society for the Prevention of Accidents (ROSPA), a further driver of the introduction of telematics as part of motor insurance policies has come from the European Court of Justice's gender ruling, which makes it illegal for insurers to take gender into account when calculating premia. This meant that one of the traditional ways in which insurers, particularly in the UK, differentiated between customers, the different accident rates for men and women, is no longer available.

EDR-based contracts were first offered in the Italian car insurance market in 2002. The number of companies offering such policies has increased since 2005, reaching a peak in 2013. There are currently 1.6 million EDR-based policies in Italy, almost all of which are for private vehicles.

The vast majority (18 out of 23) of Italian insurance companies offer EDR-based contracts only for private vehicles, but the remainder also offer them to other categories of vehicles, such as to fleet owners. The majority of Italian insurance companies have voluntarily adapted their cost allocation principles to the legal provisions included in the Italian DL 24/01/2012, which stated that "the costs of installing, removing, replacement, operation and portability shall be borne by the companies". However, this legislation has not been implemented, and the EDR legislative framework is currently stalled in Parliament, as shown in the box below. Accordingly, the extent to which the installation and maintenance costs of EDR devices is borne by insurers or customers still depends on the specific clauses in the insurance contracts signed between the parties.

Box 3: The Italian legislative debate

Italian DL 24/01/2012 was passed to legislate for the use of EDR devices in Italy, yet the enforcement of its EDR-related provisions needed three complementary implementation decrees for them to take effect:

- A Joint Decree to be issued by the Ministry of Infrastructure and Transport and the Ministry of Economic Development, which must identify which electronic devices can record the activity of a vehicle (cf. Art. 32, subsection 1).
- A Regulation to be issued by IVASS (the Insurance Supervisory Authority), in conjunction with the Minister of Economic Development and the Privacy Regulator, which must define the methods of collection, management and use of the data collected by the electronic devices, as well as the means of ensuring their interoperability, in the event that an insurance contract is signed with a company other than that which has installed the device (cf. Art. 32, subsection 1-bis).
- A decree of the Minister of Economic Development, to be issued after consulting the Authority for the protection of personal data, that must define a common technological (hardware and software) standard for the collection, management and use of the data collected by the electronic devices (cf. Art. 32, subsection 1-ter).

At the end of 2013 only the first of these three implementation decrees had been issued. In addition, a dispute had arisen between ANIA (the Insurance Association), on one side, and IVASS together with the Ministry of Economic Development, on the other side, on whether the insurance companies are obliged to supply EDR-based insurance contracts. These uncertainties resulted in legislative impasse.

The Italian legislator has tried to break the deadlock by proposing a new legislative provision in Article 8 of the Decree Law No. 145 of 23/12/2013, which would have replaced the contents of Decree Law 24/01/2012. However, Article 8 was removed due to strong opposition from professional and consumer associations relating, for example, to the definition of a minimum level of premium discount for EDR-based contracts, the revision of the reimbursement levels for material and physical damages, the scope for insurance companies to tie customers to affiliated body shops for repairs, and the institution of a centralised ministerial service for the collection and management of the data gathered from EDRs).

To date, no resolution has been found, and the industry is still waiting for a specific law to be discussed and enacted.

In Italy, EDR devices offered by insurance companies have also been combined with emergency call functionality, although in most cases the approach is different from that adopted in the eCall devices described in Chapter 3. In the case of a crash, the Italian insurance-based EDRs normally send a signal automatically to the EDR provider's operations centre, not to emergency services units/hospitals, which then telephones the customer and, if necessary, forwards a message to roadside and/or medical assistance.

In Sweden, insurance companies and car manufacturers have been promoting the installation of EDRs in vehicles since 1992 although, unlike in other Member States, EDRs are not used to set premia based on driver behaviour. The devices have been installed mainly for research purposes, focusing on assessing driver behaviour and road safety.

In Switzerland, one of the largest insurance companies began a pilot project using EDRs, testing their impact on 300 young drivers in Switzerland in 2007. Following this successful trial, from 2008 the company offered EDR insurance contracts to young drivers between 18 and 25, and from 2010 extended this scheme to all drivers. Other insurance companies then followed suit. The share of EDR-based contracts in Switzerland offered by the largest insurers now accounts for 3-4% of the total market, although in the target group of young drivers, about 70% of contracts sold by one insurer are reported to be EDR-based.

While no EDR-based contracts are currently available in Germany³⁰, several press articles³¹ suggest that at least one insurer is planning to offer reduced EDR-based premia in the German market from 2014. These devices will include the normal EDR recording functions and the data will automatically be transferred to, and stored at, a third party location. While the data collected will be treated confidentially, the system operator will provide a driving style index to the insurer, which can then set the insurance premia on this basis.

In the US, while EDRs devices have been in use from many years, their data has only recently been used by insurance companies to vary premia. As an example, one company has a programme called "MyRate", available in certain States, that uses an aftermarket EDR device to track its customers' driving habits. Within this programme, customers may elect to participate and install an EDR in their vehicles to track information such as mileage and hard braking frequency, in exchange for a variable premium based on their driving behaviour. Insurers are using EDR information not only to adjust premia but also to enforce their contracts effectively.

4.2.4 Emergency, police vehicles, school and work transport

In Switzerland, as of August 2002, with the entry into force of the Ordinance on the Technical Requirements of Road Vehicles, all emergency vehicles must be fitted with EDRs. In accordance with the provisions of this ordinance, EDRs are also mandatory for vehicles weighing up to 3.5t which are used as school buses, for the transport of workers, or for the transport of disabled persons.

In Germany, the Berlin police was one of the first public bodies to implement EDRs in its vehicle fleet on a large scale, with 381 police vehicles fitted with EDR devices in 1998. A number of other local police authorities across Germany subsequently fitted their vehicle fleets with EDRs. Within the scope of a trial, in 1998 the German Federal Police installed EDRs on all 370 vehicles based in its branch in Frankfurt (Oder), responsible for the policing of the German-Polish border region.

Following this installation on police vehicles, many German rescue organisations in also fitted their vehicle fleets with EDRs. Since 2002, the Federal State of Bavaria requires all emergency vehicles to be fitted with EDRs (and refunds the cost of repair of any emergency vehicle involved in an accident).

In Austria, EDRs are part of the standard equipment of emergency vehicles of a number of regional branches of the Austrian Red Cross. Federal Police vehicles in Vienna and Salzburg have been equipped with EDRs since 1995, although in 2003 the Ministry of the Interior stopped fitting new Federal Police vehicles with EDRs due to budgetary constraints.³²

³⁰ According to the Association of German Insurers (GDV).

³¹ <http://www.spiegel.de/auto/aktuell/autoversicherer-fuehrt-telematik-tarife-mit-blackbox-ein-a-933247.html>.

³² Austrian Court of Audit (2005) Wahrnehmungsbericht des Rechnungshofes 2005/6.

4.2.5 Public transport vehicles

In Germany, Federal States such as Baden-Württemberg and Sachsen-Anhalt have recently included EDRs in the technical specifications for new public transport vehicles financed through their budget.

EDRs were first implemented in Austrian public transport vehicles, and in particular in Vienna's trams, in the 1960s, and trams and buses in Linz and Vienna are now fitted with EDRs.

In recent years in Italy EDRs, and specifically windscreen VEDRs to record images and data both before and after an accident, have been installed by both public transport companies and taxi operators. This acts as a form of tutelage for the drivers, who can use the recorded video images to defend themselves from prosecution in the event of an accident.

4.2.6 Commercial car fleets

Private companies and public authorities see telematics as an effective means of improving their vehicle management, and as a result have driven the introduction of EDRs and other telematics devices in the UK. Examples include the London Borough of Hackney and FirstGroup, a major transport operator.

EDR devices are being installed in an increasing number of commercial car fleets in Germany and Switzerland. One Swiss insurance company introduced a car fleet management system, in cooperation with car fleet operators, to increase awareness of the importance of vehicle damage and wear and tear on the total costs for the insurer.

4.2.7 Driver rehabilitation programs for alcohol and drug-using drivers and other EDR uses

EDRs have also been employed for other reasons. In Switzerland, for example, EDRs have been used in the "Via Sicura" road safety programme. This makes installation of an EDR device mandatory for drivers whose licence has been revoked for a period of at least 12 months. Approximately 800 drivers' cars have now been fitted with EDR devices following a conviction for speeding or driving under the influence of alcohol.

In the US EDRs are now being used in conjunction with automatic crash notification systems, such as General Motors' OnStar, common on newer models, to facilitate emergency response. OnStar uses cellular services to convey EDR data and other information to emergency personnel after an accident. The OnStar motoring-assistance service taps directly into EDRs and, if the airbags are deployed, automatically alerts emergency services and provides the location of the crash and its potential severity. General Motors is also working with the University of Michigan to develop algorithms to predict the types of injuries sustained.

This service relies on CDMA³³ mobile phone voice and data communication, and location information using GPS technology. Drivers and passengers can use its audio interface to contact OnStar representatives for emergency services, vehicle diagnostics and directions.

³³ Code Division Multiple Access.

The OnStar service includes “Stolen Vehicle Tracking”, which can provide the police with the vehicle’s exact location, speed and direction of movement, and “Stolen Vehicle Slowdown” that allows OnStar to slow a stolen vehicle remotely. The service is expected to help reduce the risk of property damage, serious injuries or fatalities resulting from high-speed pursuits of stolen vehicles.

OnStar subscribers may be eligible for anti-theft and low mileage insurance discounts. Some insurance companies offer a discount because OnStar can help with the recovery of a stolen vehicle.

Another prominent use of EDRs in the US is in accident reconstruction for traffic enforcement or criminal prosecution purposes. Several law enforcement agencies send one or more of their staff to EDR training facilities to learn how to retrieve EDR data and analyse the information. Florida law enforcement agencies, for example, receive EDR training from the Collision Safety Institute (CSI) or the Institute of Police Technology and Management (IPTM).

A number of prosecutions based on evidence extracted from EDRs, mostly to establish a vehicle’s speed at the time of an accident, have also already been brought against drivers in the US. Data from EDRs were also used by the US Department of Transportation to investigate the possibility of electronic interference causing unintended acceleration of Toyota cars.

4.3 Technical features of EDRs

4.3.1 Examples of technical characteristics of existing EDRs

EDR devices in use in Europe and the US share some features but also have different technical specifications, reflecting their diverse applications and dates of introduction.

The EDR most commonly used in Germany is the accident data recorder, an aftermarket device which records acceleration data through its integrated sensor system. It can register vehicle speed, transverse and longitudinal acceleration, and changes in direction, 500 times per second. It also registers status data from up to ten input channels, such as indicators, brake lights, and, for emergency vehicles, emergency lights and sirens.

In the event of an accident (identified by acceleration beyond a set threshold), the system automatically stores 45 seconds of data: the last 30 seconds prior to the event, and 15 seconds after the event. It also registers further data for up to 30 minutes after the event, but at a substantially lower frequency, to identify vehicle movements after the event. The device remains active at lower speeds, where the trigger acceleration threshold is substantially lowered to allow it to register less intense impacts. First generation devices could store 2 events but second generation ones can store up to 12.

In Sweden, EDRs have evolved from providing passive safety information, such as crash pulse and airbag deployment times with limited pre-crash data, to the most recent models with a higher frequency (1000Hz) which have the ability to record data 30 milliseconds (ms) before pulse start ($t=0$) and a total recording time of up to 500ms. These can also record both longitudinal and lateral acceleration.

Similar developments can also be seen with the main car manufacturers in the US. General Motors' earlier EDRs did not record any pre-crash information such as vehicle speed, engine speed, percent throttle, and brake status, but did record longitudinal change in velocity every 10ms (100Hz) for up to 300ms. Later modules added pre-crash information but could only record 150ms of longitudinal change in velocity because of limitations in storage capacity.

Older and newer Ford EDRs record for different time periods. Newer modules record crash information for longitudinal change in velocity and longitudinal acceleration for up to 142ms every 10ms (100Hz), while older modules record only up to 80ms every 20 ms (50Hz).

Not that the recording time, for both Ford and General Motors' EDR modules, does not necessarily start at the time of crash. Older modules store information at the time of the crash, when the airbag firing algorithm activates, but newer modules can store information up to 142ms before the event.

One application in Italy is based on the use of VEDRs which can also record video images. VEDRs on the windscreen of the vehicle are able to record images and data both before and after an accident, allowing for a better understanding of the event. Drivers can also activate the device in case of emergency. VEDRs are installed on thousands of public transport vehicles in Italy and, as discussed earlier, are an extra safeguard for the driver, allowing better evidence to be available in court. These devices are able to connect to GPS systems, allowing the vehicle to be tracked using map-based software, and record audio and video. They also work when the vehicle's engine is off. One type of VEDR unit also incorporates Wi-Fi technology, facilitating the retrieval of data.

These examples show that existing EDR devices have the potential to record a wide range of parameters and incorporate a range of different functionalities, including activation of emergency support in the case of a crash, or ability to track the vehicle's position.

However, none of the devices studied collects all 20 parameters identified by the VERONICA project (see Table 1 in Chapter 3) to support the reconstruction of accident causation, though many of them, such as the German example, have the potential to do so. This is because many EDRs have been developed to meet the private needs of car manufacturers, insurance companies, fleet managers or drivers, and not to pursue the general interest of improving knowledge of accident causation factors.

In a number of countries, however, national legislators have defined or are in the process of defining some basic features of EDR devices to be used in their territory, with the aim of improving the quality and reliability of data available for accident investigation, while keeping to privacy requirements. This is the case in the US, Italy and the UK as illustrated below.

4.3.2 Examples of national regulation on EDRs technical standards

In August 2006, the US NHTSA established regulation "49 CFR Part 563" (Part 563)³⁴, which required that all vehicle manufacturers voluntarily installing EDRs complied with certain EDR standards by September 2012. The NHTSA rules required each vehicle equipped with an EDR to record at least 15 data elements within a certain interval/time and at a specified sample rate. The NHTSA stated that these 15 data elements are necessary as

³⁴ Department Of Transportation: National Highway Traffic Safety Administration: 49 CFR Part 563.

they are “critical to crash reconstruction, advanced restraint operation, and enabling automatic crash notification”.

Box 4: Mandatory installation of EDRs for light vehicles

In a notice published in December 2012, the NHTSA proposed to mandate installation of EDRs in most light vehicles manufactured on or after 1st September 2014.

This notice would create a new safety standard, mandating the installation of EDRs for all light vehicles that are required to have frontal air bags and are manufactured on or after the above date. The EDRs in those vehicles would need to meet all the requirements included in Part 563 discussed in the main text.

The aim of the NHTSA is to cover the estimated 8% of the current light vehicle fleet that do not have an EDR. It believes that requiring all light vehicles to be equipped with EDRs would help improve vehicle safety, while imposing relatively limited costs on the automobile industry. While the NHTSA understands that the current and expected levels of voluntary installation of EDRs may be sufficient to generate data for assessing performance of the general vehicle population to support future rulemaking, the agency notes that many of the vehicles without EDRs are high end vehicles and have advanced safety technologies, including advanced collision avoidance technologies. Thus, it is particularly important to be able to obtain EDR data generated by the accident event of these particular vehicles so that the agency has as much information as possible about emerging technologies.

The NHTSA says that field studies have shown that the devices can increase driver safety by helping to modify driver behaviour, and the agency cites studies showing commercial fleets which have seen accident reductions of as much as 30% where the vehicles are equipped with these systems.

The NHTSA believes that the costs of installing EDRs would be minimal because the devices involve the saving of data that is already being processed by the vehicle with little additional cost for the installation of new sensors. The cost for an EDR is estimated to be \$20 per vehicle.

The estimated total incremental costs associated with this proposal would be \$26.4 million, which is measured from a baseline of 91.6% EDR installation to 100% installation, assuming the sale of 15.5 million light vehicles per year.

The NHTSA also recognises the existence of significant privacy issues with the collection of this data but states that the proposed rules do not provide any specific violation of the NHTSA data collection mandate already in place.

NHTSA Part 563 standardises the type of data recorded and collected from EDRs nationally and obliges manufacturers to provide notice to consumers of the existence of EDRs in their vehicles. It also requires certain standards for the “survivability” and “retrievability” of EDR data to ensure that it can withstand most accidents and be retrieved by persons authorised to use the data. This has been introduced with the aim of ensuring that experts can access significant, relevant and “good quality” data to support the federal government in the development of more effective occupant protection and motor vehicle safety programmes. In 2012 NHTSA proposed to mandate installation of EDRs in most light vehicles for the same purpose (see Box 4).

In Italy the new legislative provision³⁵ mentioned in Box 3 above seeks to provide some form of standardisation of the emerging devices in light of their progressive penetration of the Italian insurance market. According to this decree, these devices must be sealed, powered and solidly anchored to fixed and rigid elements of the vehicle and:

- Allow continuous determination of the position and speed of the vehicle
- Allow continuous determination of the acceleration profile of the vehicle
- Enable remote diagnostics of the functional integrity of the device
- Ensure the incorruptibility of the data collected with a confidence level greater than 99%
- Allow the timely detection of malfunctions or unauthorised tampering at both hardware and software levels
- Allow two-way wireless communication with other devices installed on the vehicle
- Allow for periodic and secure transmission of the stored information

The device must also communicate with the new Galileo system and with mobile telecommunication infrastructure (GPRS).

In conjunction with this decree, the Italian national insurance monitoring body (IVASS) proposed a parallel regulation³⁶ (the second of the acts mentioned in Box 3 above) that would set out the type of data recorded by these devices and the limitations on their use. According to this proposed regulation, EDRs should record both distance data (total number of kilometres travelled, type of road travelled, time bands of vehicle use, days of the week of vehicle use) and data needed to reconstruct the dynamics of an accident which the insurance companies could access only in the event of an accident. However, as the legislative process is at an impasse in Italy, it is not clear whether and when any ruling on EDRs technical standards will emerge or whether it will be based on the IVASS draft regulation.

An initiative to improve the standardisation of the devices and the type of data collected is also taking place in the UK, where eight major insurers and brokers, registered under the Association of British Insurers (ABI), have established the Industry Data Initiative Board. The goal is to help establish “a stable and competitive telematics market that improves outcomes for consumers, and maximises the potential that is offered by the new technology, regardless of the eventual size of the telematics market”.

The ABI is partly funding one of the newly-established workstreams at the Thatcham Research Centre. The Centre is a leading, not-for-profit research institution tasked with improving the safety and security of the automotive industry. In particular, Thatcham is involved in providing the system intended to give insurers data on the relative risk of private cars and light commercial vehicles. In recent years, Thatcham Research has promoted further research in the definition of technical standards for EDRs. Given its experience, the Centre intends to present a set of minimum standards (reflecting those

³⁵ Italian Transport Ministry Decree (2013), *Meccanismi elettronici che registrano l'attività del veicolo*.

³⁶ IVASS (2013), “Schema di regolamento per la definizione delle modalità di raccolta, gestione e utilizzo dei dati raccolti dai dispositivi elettronici che registrano l'attività del veicolo e di interoperabilità di tali dispositivi” (implementing decree of Law No. 27 of 24/03/2012).

listed in “Part 563” of the Code of Federal Regulations in the USA) for adoption by the UK automotive industry.

Finally, Switzerland has also introduced legislation aimed at specifying the technical features of EDRs, set out in the Ordinance on Technical Requirements for Road Vehicles. In accordance with Article 102 of this ordinance, EDRs must record the following data for at least 30 seconds, or 250 metres driving distance, before the triggering event:

- Speed
- Status of the brake lights and indicators
- Status of the flashing blue light and the two-tone horn (for emergency services)
- Status of the dipped-beam headlamp

In addition, the recorded data may not be either deleted nor manipulated.

4.4 EDRs data ownership, use and privacy

As discussed in Chapter 3, the collection and processing of data from EDR devices raises concerns regarding the protection of driver and passenger privacy. This section provides some examples of how this is addressed in single Member States of the EU and in the US.

4.4.1 Examples from the US

In the US, EDRs and the data they store belong to vehicle owners, though in some cases the exact identification of the ultimate ownership is subject to different legal interpretations, as pointed out in the box below.

Box 5: EDR ownership in the US

US law states that any information stored on an EDR belongs to the “owner” of the EDR. Owners are defined in different ways in each statute.

The NHTSA considers the owner of the vehicle to be the owner of the data collected from an EDR. The NHTSA definition may be problematic under some circumstances. For example, when there is an accident and a car is severely damaged, sometimes the insurance company will only pay for the damages once they retain the title of the car. Once an insurance company retains title of the car, it can be argued that the insurance company then owns the EDR data and can defend itself against additional claims.

Originally only the OEMs were able to download and analyse the information stored in EDR modules. After 2000, a crash data retrieval toolkit was made publicly available, allowing police, crash inspectors, researchers, and the public to connect to an EDR via the vehicles’ Diagnostic Link Connector (DLC) or directly to the airbag module.

Law enforcement agencies, insurers, researchers, vehicle manufacturers and others may gain access to the data only after the owner has given his/her consent. Without consent, access may be obtained through a court order. For accidents that do not involve criminal proceedings, especially when the law enforcement agencies or insurers are only interested in assessing fault, insurers may be able to access the EDRs through provisions in the insurance contract requiring policyholders to cooperate with the insurer. However, 13 US States prohibit insurance contracts from requiring policyholders to consent to access.

Virginia, for example, prohibits insurance companies from reducing coverage, increasing premia, applying surcharges, or denying discounts solely because a vehicle operator or owner refuses to grant the insurance company access to EDR data. Arkansas prohibits insurance companies from requiring access to EDR data as a condition of an insurance policy. Connecticut law requires law enforcement agencies to obtain search warrants before accessing EDR data without owner consent. Oregon limits EDR data disclosure “to facilitate medical research of the human body’s reaction to motor vehicle crashes” by requiring that the last four digits of the vehicle’s identification number and the details of the owner remain confidential. In the State of Washington, any person that accesses EDR data without the vehicle owner’s consent, and who does not otherwise have authority granted by exceptional permission, can be prosecuted in court.

The following table summarises the main provisions in a number of States.

Table 2: Provisions on EDRs for selected US States

State	Ownership provision	Access to Data restrictions	Notice or Disclosure provision	Insurer Use provision
Arkansas	√	√	√	√
California		√	√	
Colorado	√	√	√	
Connecticut		√		
Maine	√	√	√	
Nevada	√	√	√	
New Hampshire	√	√	√	
New York	√	√	√	
North Dakota	√	√	√	√
Oregon	√	√		√
Texas	√	√	√	
Virginia	√	√		√

Source: Senate Commerce Committee Staff.

The use of EDR data for research purposes in the US

The NHTSA is one of the bodies entitled to access EDR data for research purposes. The agency has tried to quell fears regarding data use by assuring that it only uses the information to assess safety devices, always seeks consent to use the data, and carefully protects any identifying information associated with the data collected. Furthermore, before releasing information from databases containing EDR data (usually aggregated reports), the agency strips out the last six characters of the Vehicle Identification Number, the portion that would allow identification of a specific vehicle and, potentially by indirect means, the identity of the vehicle's current owner. The NHTSA therefore states that it has taken adequate steps to protect individual privacy.

The Part 563 regulation illustrated above also intended to clarify the scope of use of EDR data and to reassure vehicle owners regarding the protection of their personal data. However, there are still some concerns in the US about the NHTSA agency failing to address driver and car-owner privacy in a meaningful manner, particularly with reference to the new proposal to make EDR installation mandatory on certain categories of vehicles by 2014.

While the NHTSA states that new proposal involves no changes to the approach to privacy, this is not the view of a joint Committee of consumer associations (EPIC³⁷) who reviewed the new proposed rule and its privacy issues. The main question that EPIC raises regards the volume of data that EDRs can collect. Thanks to new technologies, EDRs can now collect data significantly more information, including vehicle location, safety belt use, data services accessed (such as phone use, GPS location, and Vehicle Mobile Services), and even audio recordings. Moreover there is evidence that the NHTSA will require expanded EDR capabilities and data use in the future³⁸.

The growing use in cars of computing components and telecommunication technology such as OnStar is increasing the amount of data collected. Many of these technologies provide useful services to owners and operators, but consumers are concerned that reuse of data for unrelated purposes could have negative consequences for car owners and operators.

The US EPIC Committee suggested that five main points should be addressed to protect individual privacy better. These include:

- Limiting the type of EDR information to which the agency can request access.
- Conducting a comprehensive privacy impact assessment before mandating EDR installation.
- Upholding the Privacy Act protections and grant vehicle owners and operators control over their data.
- Requiring security standards to maintain the integrity of EDR data.
- Establishing best practice to protect the privacy of vehicle owners and operators.

³⁷ Electronic Privacy Information Center <http://epic.org/>.

³⁸ January 2013 Significant Rulemaking Report, US Department of Transportation, <http://www.dot.gov/regulations/january-2013-significant-rulemaking-report> (last visited February 7, 2013).

4.4.2 Examples from the EU

Due to the fact that EDR devices are less common in Europe, the introduction of EDRs has not been accompanied by specific legislation on data use and privacy, with more comprehensive national and EU legislation on data protection usually ruling this aspect.

In Sweden the Personal Data Act (PUL 1998), enacted in 1998 to implement the requirements of the Data Protection Directive 1995/46/EC, regulates the use and accessibility of data collected by telematics. Data collected by EDRs is owned by the company promoting the use of these devices, the car manufacturer or insurance provider, but car owners must consent to the submission of the data.

Third parties do not have access to the data, as it is not publicly available. Stakeholders in the research sector explained that they have been granted access to some data collected, but the information that is made available must be anonymous as required by the PUL Act.

Similarly in Germany, any data processing activity must be in accordance with the Federal Data Protection Act (BDSG, First promulgation January 1977, last amended August 2009) and the underlying Basic Human Right of “informational self-determination” as set out in the German Constitution³⁹. The Federal Highway Research Institute (BAST) states that, to date, data collection from EDR devices has been exclusively by car owners who install such devices on a voluntary basis. It therefore remains unclear how far data collection is limited by privacy, and the legal relationship between car owners and drivers or other passengers has not been addressed. In German law, data collection and storage is possible on a voluntary basis. Moreover, if kept “anonymous”, data processing (“data transfer” or “sharing”) is not limited by any data protection provisions.

The UK does not have any specific legislation covering EDRs. However, the Association of British Insurers actively advocates self-regulation and considers compliance with the Data Protection Act 1998 paramount to regulate data storage and accessibility. The ABI wishes to maintain consumer confidence in telematics products as this will be “a key determinant of the long-term viability and success of the telematics market. That is, consumers need to trust insurers to treat them fairly and protect their personal information⁴⁰”.

The industry produced a Good Practice Guide in April 2013, which represents an attempt by the industry to self-regulate and pre-empt data privacy and handling issues.

³⁹ Article 2, paragraph 1 and Article 1, paragraph 1 of the German Constitution.

⁴⁰ ABI - Selling Telematics Motor Insurance Policies, A good practice guide, April 2013.

Box 6: The UK Insurance Good Practice Guide

The UK ABI Good Practice Guide has been developed in consultation with the Financial Conduct Authority and the Information Commissioner's Office (the body in charge of overseeing the treatment of personal data under the Data Protection Act (DPA) 1998). The actions in this guidance relate to:

- actions aimed at managing and handling Personal Telematics Data to ensure compliance with the DPA and maintain consumer confidence in the industry's use of Personal Telematics Data;
- actions for managing Telematics Policies so as to ensure customers are treated fairly and to minimise instances where customers lose out.

For example, one of the recommendations in the Guidance states that "[Insurance] Policy Documents should clearly state that a Premium might fluctuate over time at the behest of the insurer as a result of telematics data that indicates the policyholder is a greater or lesser risk than previously thought, and at what points during the policy fluctuations might occur". The insurance industry confirmed that any data received from the EDR is stored securely in the company's server, and that only the employees listed on their internal DPA Register can access the data. All stakeholders from the insurance industry have referred to the Telematics Good Practice Guide which sets out the procedure by which policyholders can review their data.

In France, privacy concerns and data ownership issues have delayed the market development of EDR tools. Despite this, the French Minister of Interior, Manuel Valls committed, during the general meeting of the National Council for Road Safety (Conseil national de la sécurité routière - CNSR) on 21st May 2013, to begin the political process aiming at the introduction of EDRs in private vehicles.

The use of EDRs data for court proceedings in the EU

The private right to protect personal data in specific circumstances is overcome by the need to use private information for purposes of public interest, such as the reconstruction of accident causation following severe accidents where drivers can face criminal prosecution.

For example, in Germany, the use of EDR data by the courts in the event of criminal proceedings for severe accidents is not limited by data protection law, and this is an important exception to privacy protection. However, de facto control of data collected by EDRs lies with the owner of the equipment, and access to this data depends on whether they are considered personal or not. This might not be an issue for severe accidents that take place in public, but could be a matter of concern in other circumstances.

Access and use of EDR data as evidence for court proceedings in Germany can also be based on a "private agreement" included in insurance contracts. More specifically, if insurance companies can access EDR data if this have been agreed with drivers in signed contractual obligations. However, according to paragraph 34 of the German Insurance Contract Act, an insured person may only be obliged to hand over EDR data where there is adequate contractual compensation, which could be a discount on the insurance premium, or a contribution by the insurer to the costs of the EDR.

4.5 Overview and key findings

The data collected suggests that there is as yet an unbalanced penetration of EDR devices in the EU, resulting in different levels of development of rules for technical standards, data ownership and use.

In the UK the introduction of EDRs has been driven primarily by two aims: on the one hand, private companies and public authorities have been using telematics as a way to manage their vehicles better; on the other hand, insurance companies have been introducing EDRs to improve their screening and monitoring capacity and to develop better safety standards. EDR devices have been in use from the first half of the decade beginning in 2000, but no specific legislation has been introduced. However, the Association of British Insurers is actively advocating self-regulation and considers compliance with the Data Protection Act 1998 paramount to the regulation of data storage and accessibility.

In Italy the introduction of EDRs has been led by the insurance market, with the first EDR-based contracts offered in 2002. After slow initial penetration, the number of companies offering these policies has increased, particularly in recent years. EDRs and windscreen VEDRs, able to record images and data both before and after an accident, have recently been installed by both public transport companies and taxi operators, enabling drivers to use recorded video images to defend themselves from prosecutions for road accidents. In Italy provision of a legislative framework for EDR specifications and use was attempted in both 2012 and 2013 but no agreement has been reached and the situation seems to be at an impasse.

In Sweden several mechanisms to record crash and accident data have been progressively introduced since the early 1990s. The development of EDRs has been sustained by both insurance companies and car manufacturers directly promoting their use on light vehicles, by installing them at the time of sale to consumers for research purposes about driver behaviour and road safety. The first EDRs were fitted in around 250,000 cars by the Folksam insurance company in 1992, when manufacturers Toyota, Opel, Saab and Honda took part in the initiative. No specific legislation has been introduced and the reference legislation on this matter in the country is The Personal Data Act (PUL 1998), that regulates the use and accessibility of data collected by telematics.

In Germany EDR devices are mainly installed on emergency vehicles, car fleets and public transport vehicles. Several Federal States (Baden-Württemberg, Sachsen-Anhalt) require fitment of EDRs in public transport vehicles as a condition of state subsidies to the operators. The Federal State of Bavaria requires all emergency vehicles to be fitted with EDRs. From the legislative point of view, any data processing activity in Germany must comply with the Federal Data Protection Act (BDSG), but no EDR-specific legislation exists.

In Austria EDR devices are in use in only a small number of markets, with the most common applications being emergency vehicles and public transport vehicles. One insurance company offers a premium range contract in combination with the installation of an EDR device. No specific legislation on EDRs installation standards and data use exists.

In France EDRs have been discussed for many years, but their development is lagging relative to other European countries because of widespread concerns about data privacy. The Ministry of Transport has stated that data collected by EDRs within France may only be used for specific research projects approved by the National Council for Road Safety. No

further use of data collected by EDRs will be allowed before the introduction of a specific law defining the nature of EDRs and the data that they may collect.

The following table provides an overview of the current state and future prospects of EDRs in the EU Member States, the US and Switzerland. It summarises the type of vehicles on which EDRs are installed, their uses, technical features and data use, and current and potential future deployment.

Table 3: Overview of existing implementation of EDRs

State	Type of vehicle				Uses				Legislation		Diffusion	
	Private car	Commercial vehicles	Public Transport	Emergency and Police vehicles	Insurance	Fleet optimisation	Drivers training	Research	On technical features	On data usage	Current level of deployment	Future perspective
US	x	x	x	x	x	x	x	x	Regulation 49 CFR Part 563, issued in August 2006, requires all vehicle manufacturers to be in compliance with certain EDR standards by September 2012.	In the US, EDRs and the data they store belong to vehicle owners, though in different states the exact identification of the ultimate ownership is subject to different legal interpretations according the state law.	High	EDRs diffusion could reach a coverage of 100% of the vehicles if the proposition of EDRs mandate installation on new vehicles by the National Highway Traffic Safety Administration will be approved
UK	x	x			x	x	x	x	There is no specific regulation, but a voluntary attempt to standardize the EDRs devices in use in the country and the type of data collected is taking place under the initiative of Association of British Insurers (ABI)	There is no specific regulation. ABI considers compliance with the Data Protection Act 1998 paramount to regulate data storage and accessibility	Medium	Future development of EDR devices will depend of the decision of UK legislator to follow up to the regulation proposition done by ABI
Italy	x		x		x			x	The decree "Identification of electronic mechanisms that record the activities' of vehicles" issued on January 25, 2013, provides a definition of electronic data recorder devices and sets the standards.	Article 32 of the decree law No. 1 of January 24, 2012 sets the regulation for the usage of EDRs data by insurance company. A more comprehensive regulation has been drafted by IVASS but the document has still not been approved in its definitive version	Medium	Deployment of EDRs is expected to grow in the next future supported by the recent legislative intervention and the expected implementing regulation

State	Type of vehicle				Uses				Legislation		Diffusion	
	Private car	Commercial vehicles	Public Transport	Emergency and Police vehicles	Insurance	Fleet optimisation	Drivers training	Research	On technical features	On data usage	Current level of deployment	Future perspective
Sweden	x							x		The Personal Data Act (PUL 1998), enacted in 1998 to implement the requirements of the Data Protection Directive 1995/46/EC, regulates the use and accessibility of data collected by telematics in Sweden. Here, the ownership of the data collected through EDRs rests with the individual company promoting the use of these devices	Medium	EDRs diffusion is stable
Germany		x	x	x	x (1)	x		x		There is no specific regulation. However, any data processing activity must be in accordance with the Federal Data Protection Act (BDSG) and the underlying Basic Human Right of 'informational self-determination' as set out in the German Constitution. The Federal Highway Research Institute (BAST) states that, to date, data collection from EDR devices is performed exclusively by car owners	Low	EDRs usage is expected to grow as insurance company are entering the market
Austria			x	x	x			x			Low	No EDRs development is expected in the short term
Switzerland		x		x	x	x	x		Technical features of EDRs are specified in the Ordinance on Technical Requirements for Road Vehicles. In accordance with		Low	EDR devices diffusion is expected to grow under the influence of insurance market usage

State	Type of vehicle				Uses				Legislation		Diffusion	
	Private car	Commercial vehicles	Public Transport	Emergency and Police vehicles	Insurance	Fleet optimisation	Drivers training	Research	On technical features	On data usage	Current level of deployment	Future perspective
									Article 102 of this ordinance, EDRs have to record a specific set of data that may not be either deleted nor manipulated.			
France									Currently EDRs data can be used only for specific research project approved by the National Council for Road Safety. Any further usage of the data acquired with EDRs will not be allowed until the promulgation of a specific law that would also define the nature of ERDs and that would be allowed to collect.		Very Low	EDRs deployment in the next future is subordinated to the intervention of legislator to regulate the usage of EDRs data

Note: (1) To be introduced

KEY FINDINGS

- Event data recorders have been installed in different ways in different countries. The driving force has usually been the private sector following self-interest (manufacturers, insurance companies, fleet managers) rather than public authorities seeking to improve road safety.
- As a result, the specifications of EDRs vary considerably from country to country and from company to company. Where specifications have been defined across the industry, they do not cover the core list of parameters identified in the VERONICA project.
- The US has been able to legislate on the core requirements for EDRs and has a proposal to require the installation of EDRs on all new vehicles from September 2014; this proposal has yet to become law.
- The EU has no single law on EDRs and, where national governments have sought to legislate on the matter, they have done so to meet specific domestic requirements.
- Privacy aspects of the collection of EDR data are not consistently regulated, either within the EU or the US, with different States having different requirements. The availability of EDR data for court proceedings also varies from State to State.

5. WHERE EDR DEVICES CAN BRING THE MOST BENEFITS

5.1 Introduction

This Chapter sets out the types and uses of current EDR technology and the extent to which they can contribute to the road safety targets set in the EU agenda 2011-2020.

5.2 Types and usefulness of EDRs devices

The examples described in Chapter 4 show that Europe and the US use different types of EDR to meet the varying needs of car manufacturers, insurance companies, emergency vehicles and police, fleet managers and others.

As discussed in section 4.3.1, the technical specifications of EDRs vary considerably from country to country and from company to company, though some devices are taking the lead in specific markets: for example, a single company currently covers more than 70% of the EU telematics insurance market through the EDR products and data management services it offers⁴¹.

The varied use of these devices reflects different objectives including, inter alia, increasing vehicle safety and reducing drivers' insurance premia and/or the cost to insurers of claims and court proceedings.

5.2.1 Crash reconstruction and vehicle design

EDRs are essential to gathering information about vehicle and driver behaviour before accidents and thus determining accident causation factors. Much of the data derived from EDRs is information that even accurate eyewitnesses could not provide.

In the US, a recent experiment by a federal agency, the Volpe Center, showed that data collected by EDRs can improve the computation of key accident reconstruction parameters, such as the change in longitudinal velocity, by up to 4 times compared to techniques already in place to investigate accidents⁴².

In Sweden, stakeholders representing one of the largest insurance companies and car manufacturers have stated that the data collected through widespread installation of EDRs have been useful in enhancing their knowledge of injury causation in motor vehicle accidents. For example, the data has helped to identify injury risk factors such as crash speed and the influence of the change in speed after the impact (Δv ⁴³), vehicle stiffness and seat design. The data also clarified the influence of mean acceleration on injury outcomes and identified injury risk curves for male and female occupants. This research could have a consequential effect on the reduction of road accidents.

⁴¹ PTOLEMUS (2013), Usage-based insurance Global Study - Executive Summary, October 2013.

⁴² Report available at: reference available at <http://www.harristechnical.com/downloads/810935.pdf>

⁴³ A measure of the amount of "effort" that is needed to change from one trajectory to another by making an orbital manoeuvre.

5.2.2 Accident rates and costs

EDR suppliers state that the installation of EDR devices on car or vehicle fleets can result in a 20-30% reduction in the number of accidents. A study in Germany by an EDR provider⁴⁴ reports a number of examples supporting this argument: a 20% reduction in accidents after fitting EDRs in 381 Berlin police patrol cars between 1998 and 1999, up to 36% reduction in accidents claimed after fitting EDRs on emergency vehicles, and 15-20% reduction in accidents after a trial fitment of EDRs to 123 buses in Baden-Württemberg. Anecdotal evidence in Italy indicates that installation of VEDRs on the public transport fleet can reduce road accidents by up to 40%.

From the point of view of a fleet manager or public transport operator, the reduction in accident risks generates a number of benefits: the German study mentioned above indicates that damage costs can fall by 25-35%, while the time spent by vehicles off the road and in repair could be reduced by 9%. Use of EDR devices could also lead to a reduction in liability payments to third parties and the prevention of insurance fraud. For example, the video cameras present on the VEDRs installed on Italian public transport vehicles has helped some operators reject claims by people who falsely claimed to be on a bus in an accident.

The improvements in safety result primarily from a change in driver behaviour, as shown by a recent UK study⁴⁵. According to the Royal Society for the Prevention of Accidents (ROSPA), logistics companies that fitted EDR devices to their vehicles saw a fall in accidents of 10-50% in the first year of operation. This positive result has been reinforced by the fact that some companies can monitor their drivers' behaviour more closely and both reward good driving and penalise dangerous driving, resulting in an improvement in driver behaviour as a whole.

These examples suggest that installation of EDRs on public or private fleets can lead to large gains for fleet managers, public transport operators and professional drivers. There is, however, no evidence that this has a direct impact on reducing road fatalities or injuries rates. The evidence is even more limited for private vehicles, with the only relevant experience being in Switzerland (see Chapter 4), where the sample was too small to draw any firm conclusions.

5.2.3 Insurance

As shown in Chapter 4, telematics-based insurance policies are at now common in Italy, the UK and the US. According to PTOLEMUS (2013) there were 2.1 million telematics insurance customers in the EU in July 2013⁴⁶, with EDR devices taking the lead.

For the insurance company, accurate and unbiased information gathered by EDRs can help in assessing road safety risks in more detail, and drafting more accurate risk-profiles for their clients. Insurance Europe, the association of European insurance companies, reported that total claims have grown by approximately 20% between 2002 and 2010, despite a decrease of 38% in the number of fatalities⁴⁷. This is attributed to three main factors: increase in repair costs (the price of spare parts has increased by more than 20% in the past decade), personal injury costs and fraud.

⁴⁴ VDO Kienzle (2003) Sicherer fahren, effizienter wirtschaften – der Unfalldatenspeicher.

⁴⁵ ROSPA (2013), Road safety and in-vehicle monitoring (black box) technology, Policy Paper.

⁴⁶ PTOLEMUS (2013), Usage-based insurance Global Study - Executive Summary, October 2013, p. 71.

⁴⁷ PTOLEMUS (2013), Usage-based insurance Global Study - Executive Summary, October 2013, p. 84.

The use of EDR devices can also enable careful drivers to benefit from cheaper premia. In Italy, EDR installation costs are usually borne by the insurance company, and PTOLEMUS reported that, after adopting telematics-based insurance policies, drivers benefited from a reduction in insurance premia of 10-20%⁴⁸. A recent legislative proposal in Italy proposed a discount of 7% for all policies proposing the installation of EDR devices, but this provision has been repealed from the final text approved by the Italian Parliament and to date the discount available to drivers is a commercial decision of insurance companies.

In Switzerland, an insurance company offers EDR-based contracts to private and commercial vehicle drivers. The first category receives installation at no cost (with private drivers getting a 15% discount) while for the second category, customers need to pay for the EDR and the installation.

Northern Ireland's largest independent insurance broker introduced, in conjunction with their automotive partner, an EDR tool offering insurance premia discounted by up to 55% for young people⁴⁹.

In the US, an insurance provider offers a policy in some states which uses an aftermarket EDR device to track its customers' driving habits. A customer may elect to participate and install an EDR in their vehicle to track information such as mileage and hard braking frequency, in exchange for the possibility of a lower premium. However, high mileage or hard braking may result in a 9% increase in premium.

In the UK, EDR-based policies may monitor the times at which policyholders drive. Some devices activate if they are on the road between 11pm and 5am, when fatal accidents are more frequent, and impose a £100 penalty to discourage young drivers from driving at night⁵⁰. Some young drivers have voiced concern that telematics-based insurance may mean that their premia rise, rather than fall, if the EDR reveals dangerous behaviour. Deactivation fees have also been criticised, as they are not transparently priced in all policies. Finally, a recent verdict from the investigation into the death of two teenagers suggests that black box technologies imposing a curfew on drivers could incentivise dangerous driving in the period immediately before the curfew.

5.2.4 Emergency and recovery assistance

Another benefit associated with EDRs is their ability to improve emergency or recovery interventions. As discussed in Chapter 4, in some cases these functions must be activated by drivers, but in others, if the airbags are deployed, the EDRs automatically alert emergency services through the cellular network and provide the location of the crash and its potential severity. The latter approach is preferable, as the introduction of automatic emergency service call systems can significantly reduce the severity of road accidents. This was shown in the impact assessment accompanying the European Commission proposal to introduce eCall devices on all new passenger cars and light commercial vehicles by 2015⁵¹.

⁴⁸ For example : <http://www.thisismoney.co.uk/money/cars/article-2407945/I-got-car-insurance-500-How-blackbox-help-young-drivers.html>.

⁴⁹ <http://www.nicarfinder.co.uk/motoring-news-and-views/northern-ireland/vehicle-black-box-to-save-young-drivers-up-to-55-on-car-insurance/>.

⁵⁰ <http://www.roadsafetygb.org.uk/news/2940.html>.

⁵¹ COM(2013) 316 final.

Box 7: eCall Impact Assessment

The following benefits have been identified following from the introduction of eCall systems:

- Reduction of fatalities (with all vehicles eCall-equipped, between 1% and 10% depending on country population density, road and emergency response infrastructure);
- Reduction of the seriousness of injuries (between 2% and 15%);
- Reduction of congestion costs caused by traffic accidents. This is due to the improvement of accident management, as the accident is immediately notified to the PSAPs and can therefore be transferred to the appropriate Traffic Management Control, which can immediately inform other road users, and help reduce secondary accidents;
- Facilitation of rescue services and increased security of rescue teams (e.g. firefighters) when extracting trapped occupants, as the Minimum Set of Data ("MSD") in the eCall message will, among others, provide information on the fuel type;
- Reduced SOS roadside infrastructure, as each road user would be able to trigger an emergency call from their vehicle.

The IA evaluated three different policy options for the future development of eCall systems – namely (i) no EU action, (ii) industry voluntary approach and (iii) mandatory regulation – and concluded that the last one provides the highest cost/benefit ratio.

5.3 The contribution of EDRs to the EU road safety policy

The examples above show that wider implementation of EDR devices in the EU has the potential to deliver several types of benefits. These range from fleet use and insurance costs optimisation in the commercial sector to insurance premium reductions for private users, especially young drivers. EDRs can also facilitate court proceedings relating to liability for accidents and help speed up policing services.

In the context of the EU Road Transport Agenda 2011-2020, widespread introduction of EDRs could also contribute to the overarching objective of improving road safety by reducing deaths and injuries across the EU. Those favouring the introduction of EDRs argue that this could lead to improved driver behaviour, better vehicle design and safety performance, and faster and more incisive emergency intervention in the event of an accident, when EDRs are mated to eCall tools.

This study's literature review was not able to identify a clear causal relationship between the use of EDRs and an improvement in road safety, mainly due to the limited adoption of EDRs to date and hence the limited evidence of their effects. A number of stakeholders argue that the benefits of EDRs would be reinforced if a critical mass of drivers and hauliers used them, and that introduction of a regulation making EDRs compulsory for new vehicles sold in the EU would accelerate the achievement of these benefits.

The conventional means of assessing the validity of these claims is an impact assessment comparing the direct and indirect costs of a proposed policy intervention with its socioeconomic and environmental benefits. We support the view that a full impact assessment is needed to evaluate the effects of policy options requiring a wider introduction of EDRs on EU vehicles, including an option to make EDRs mandatory in new

vehicles, as recently proposed for eCall. The European Commission is currently working on such an assessment and its results should be presented by the end of 2014⁵².

We are also aware of a recent publication investigating the cost and benefits of a mandatory introduction of EDR devices on all vehicles in Germany⁵³. The study considered, for each vehicle category, a start-up year for the introduction of EDR devices on new vehicles and a year where a 90% of vehicles have been fitted with these devices, as shown in Table 4 below.

Table 4: Expected impacts of the introduction of EDRs in Germany

Vehicle type	Start-up year	Year when 90% fleet fitted	Cost considered	Benefits considered	CB at start-up	CB at end
Heavy trucks	2018	2024	Fitment Infrastructure for data readout and storage	Accident reduction (through prevention effects & research based on EDR data) Reduction in costs for expert opinion	13.2	36.2
Light trucks	2020	2028			3.2	7.0
Buses	2018	2032			38.3	85.6
Cars	2020	2032			2.4	4.6
Motorcycles	2020	2044			1.2	3.9

Note: CB= Cost-Benefit

Source: SDG analysis of E. Petersen, J. Ahlgrimm, (2014).

The study identifies a cost benefit ratio of four or more for all types of vehicles, with significantly higher results for buses, coaches and heavy trucks.

These results take into account not only EDR equipment costs and the benefits of accident reductions, but also infrastructure and dataset analysis costs and the benefits of using EDR datasets for accident evaluation and analysis.

Much of the quantified benefits rely on the assumed relationship between EDR device installation and use and road accident risks. For private cars there is no general consensus on the existence and/or magnitude of such relationship, because of the limited evidence base (see 5.2.2 above), but the evidence is somewhat clearer for bus and coaches.

In the absence of clear evidence on the relationship between EDRs and road safety goals, and in order to inform the ongoing debate, we have therefore attempted in this study to address this question by other means.

We focused our assessment on private car fleets, as the rationale for fitting EDRs on public transport fleets or coaches and trucks is already supported by existing evidence. For

⁵² See: http://ec.europa.eu/transport/road_safety/specialist/knowledge/esave/esafety_measures_known_safety_effects/black_boxes_in_vehicle_data_recorders.htm.

⁵³ E. Petersen, J. Ahlgrimm, (2014): Benefit/Cost-Analysis of mandatory Event Data Recorder Applications, Approach and Results). published in: ZVS-Zeitschrift für Verkehrssicherheit, Issue 2/2014, Kirschbaum Verlag, Bonn.

example, Italian companies that recently introduced EDRs reported an average 20-30% reduction in accident numbers. This area is also receiving increased attention from the private sector because of the potential benefits in areas such as fleet management and the reduction of insurance costs.

We therefore chose to assess the mandatory introduction of EDR devices on new cars from 2015, equivalent to the policy under discussion for the eCall system. Rather than estimating the cost benefit ratio of this policy option, we assessed the extent to which road safety would need to improve to cover the projected costs of the measure. In summary, we identified the scale of improvement needed to provide a "social pay-back" of the costs of mandatory installation of EDRs on new cars.

Our approach is similar to that used for the eCall system impact assessment. We assumed an average of 10-15 million new cars to be registered across the EU every year. We assumed an average total cost per EDR unit €100, including the cost of the device and an allowance for creating the infrastructure needed to record, process and analyse data. We then estimated the reduction in road casualties and injuries needed to recoup this costs. We translated a reduction in road deaths and injuries into monetary benefits using the value of road deaths and injuries recommended by the European Road Safety Observatory⁵⁴. As with the eCall impact assessment, we also took into account the monetary costs of congestion caused by accidents.

The eCall impact assessment also identified, but did not quantify, additional benefits through savings in emergency service operations, insurance costs, stolen vehicle tracking, and productivity. We have not included these benefits in our estimates, but note that they would be additional to those we have quantified.

We estimate that, to exceed the costs of rolling out EDRs on all new vehicles over 20 years, fatalities and injuries from road accidents would need to decline from the 2011 baseline by 0.7-1.5% per annum over the same period. The recently published German study envisages an average accident reduction of about 3% per annum, attributed to the effects on driver behaviour⁵⁵, from the mandatory introduction of EDRs across German road vehicle fleets. This suggests that there may be an economic case for installing EDR devices in cars.

A further benefit of a Europe-wide implementation of EDR devices could be in research and innovation. A larger network of EDRs across Europe would provide more data and improve accident causation investigation, a development which is strongly recommended by the VERONICA project. This could in turn contribute to better design and safety features for car manufacturers. The German study on EDRs estimates these benefits to be roughly 10% of the quantified accident reduction benefits. When carrying out a full cost-benefit analysis, it will be important to include these benefits.

Our indicative conclusions support the view that even a marginal positive impact on road safety (0.7-1.5% annual reduction in serious accidents) would make the widespread introduction of EDRs on new car fleets cost-effective. The case would be even stronger if technological development leads to a further fall in the cost of EDRs.

⁵⁴ Bickel, P. et al (2006) 'HEATCO deliverable 5. Proposal for harmonised guidelines.' EU-project developing harmonised European approaches for transport costing and project assessment (HEATCO). Institut für Energiewissenschaft und Rationelle Energieanwendung, Stuttgart.

Nonetheless, our approach has a number of limitations. It does not address the distributional implications of making EDRs compulsory, setting out global cost figures but not identifying who should pay for their installation. It does not take into account the maintenance and replacement costs of EDRs and related technological infrastructure. A fuller analysis is needed of the costs and benefits of creating an infrastructure, strongly recommended by the VERONICA project, to collect accident data and make this data available to experts and researchers at national and EU level. These include installation and maintenance costs of data transmission and collection infrastructure, costs to protect user privacy, and benefits from improvements in accident investigations and the installation of other functions on EDR devices, such as stolen vehicle tracking and insurance.

We recommend that these factors are examined in the impact assessment currently being undertaken by the European Commission. The German study mentioned above is a step in the right direction, but more research is needed to ensure that the costs and benefits are assessed appropriately.

We also recommend urgent investigation of whether a decision, at the EU level, to make eCall systems mandatory on all new cars and light commercial vehicles by 2015 will create an opportunity to accelerate the installation of EDRs as complementary tools to eCall. Our analysis suggests that this is already technically feasible with limited additional unit costs, though a more detailed evaluation should examine how this could be taken forward and identify the impacts of a joint introduction of the two systems.

KEY FINDINGS

- EDR devices can contribute substantially to road safety research and to reducing industry-wide costs related to accidents (as seen in relation to the installation of EDRs on emergency response and public transport vehicles).
- EDRs can also reduce uncertainty and risk in setting insurance premia, improving the manner in which customers are categorised and reducing overall premia.
- EDRs can also facilitate actions such as the recovery of stolen vehicles, and consideration should be made as to whether they would be more effective if integrated with other on-board devices such as eCall.
- There is no definitive evidence on the link between EDRs and road safety improvements. Further research will be needed as the evidence base grows.
- A recent German study shows that widespread installation of EDR devices on new vehicles had a very high cost/benefit ratio for buses and heavy trucks and a positive outcome for other vehicles.
- Our indicative estimates are that the cost of EU-wide installation of EDR devices on new cars would be justified if it led to a decline in fatalities and injuries from road accidents by 0.7-1.5% per annum for 20 years. The European Commission's Impact Assessment is likely to be able to refine this estimate.

⁵⁵ In addition, the German CBA study assumes a further 2% reduction in accident costs from 2022 from improvements in traffic and vehicle technology based on the use of EDR data in accident research. The total accident cost reduction rate assumed in the German study therefore totals around 5%.

6. CONCLUSIONS

6.1 Lessons learned

Between 2000 and 2010, road safety improved significantly across the EU. Against the 3rd European Road Safety Action Programme (RSAP) target of halving road fatalities between 2001 by 2010, a 43% reduction was achieved, despite a general growth of road traffic over the same period. The European Commission has renewed its objective of halving road fatalities by 2020 through increased focus on the enforcement of road rules.

Many studies have shown that driver error is the main cause of road accidents. Weather, the condition of the infrastructure and technical failures have a marginal impact on road safety. The use of ITS tools, in particular Driver Assistance Systems, Event Data Recorders (EDRs) and eCall can all contribute to reducing driver error and improve the identification and targeting of the causes of driver error.

EDRs are an important tool for monitoring and researching road safety data and are particularly efficient at reporting accurate data after an accident, providing information that can be used to analyse accident causation and to improve the road system as a whole.

The usefulness of EDRs in these areas was demonstrated by the VERONICA project, which recommended a number of actions to ensure that EDR adoption was effective, including identifying basic technical specifications and a gradual deployment focused a number of target groups.

This study shows how the drive to install EDRs comes from both the EU and the private sector, with the latter benefitting from improved legal certainty in litigation, more transparent insurance procedures and the improved monitoring of public transport and fleet operations. Analysis shows that the driving force behind EDR installation to date has been the private sector (manufacturers, insurance companies, fleet managers) following self-interest, rather than by public authorities seeking to improve road safety.

As a result, the specifications of EDRs vary considerably from country to country and from company to company. Where specifications have been defined across the industry, they do not cover the core list of key data, to be collected for safety purposes, identified in the VERONICA project.

Privacy of data processed from EDRs remains a concern, as different national legislative provisions account for it in different ways. The VERONICA project sought to categorise which parties should be able to access which data, although national legislators need discretion to strike the correct balance between data privacy and public well-being.

Privacy relating to the collection of EDR data is not regulated consistently in either the EU or the US, with different States having different requirements. The availability of EDR data for use in court proceedings also varies from State to State.

6.2 Key findings and recommendations

6.2.1 Scope and scale of deployment of EDRs

Wider deployment of EDRs in the EU could deliver benefits ranging from fleet use and insurance costs optimisation, in the commercial sectors, to insurance premium reductions for private users, especially young drivers. EDRs could also speed court proceedings relating to accidents and help to improve policing and accident investigation.

Evidence suggests that the installation of EDRs or similar devices (such as VEDRs) on buses, coaches and HGVs can return high positive benefits through reductions in costs and in accident rates and risks.

The installation of EDRs in private cars as part of insurance policy contracts has often led to a reduction in the insurance premium paid by drivers, but this study found no evidence of a clear causal relationship between the use of EDRs and an improvement in road safety. Nevertheless, this study suggests that, given the low unit cost of installing EDR devices, even a marginal positive impact on road safety from their introduction in private car would be cost-effective. However, our estimates have a number of limitations and we recommend a full impact assessment of the effects of policy options requiring a wider introduction of EDRs on EU vehicles. We recommend examination of a policy of mandatory installation.

Any implementation strategy may need to consider the distribution of costs and benefits to different parties, although if EDRs were made compulsory it is likely that some costs would be borne by the consumer.

6.2.2 The privacy issue in light of the revision of Directive 95/46/EC

Privacy issues remain a concern for a number of parties. At present, national privacy legislation often exceeds the requirements of Directive 95/46/EC, but in different ways.

Directive 95/46/EC is currently being reviewed to make it consistent with developments in information and telecommunication technologies. In 2012 the Commission proposed to replace Directive 95/46/EC with a Regulation⁵⁶ with the intent to overcome the existing fragmentation in the way personal data protection is implemented across the EU and make legislative provisions adopted at European level directly applicable in the MS.

On 12th March 2014 - following a Report issued by the Committee on Civil Liberties, Justice and Home Affairs⁵⁷ - the European Parliament adopted a legislative resolution on the proposal advanced by the Commission⁵⁸. Overall the EP agrees with the proposal of the Commission to replace the existing Directive with a new Regulation, pointing out though that the new legislation has to implement the fundamental right to personal data protection

⁵⁶ COM(2012) 11 final, Proposal for a Regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation), Bruxelles 25 January 2012.

⁵⁷ Albrecht Report (2013), Report of the Committee on Civil Liberties, Justice and Home Affairs on the proposal for a regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation), Bruxelles, November 2013.

⁵⁸ European Parliament (2014) Legislative resolution of 12 March 2014 on the proposal for a regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation).

stated in Article 8 of the EU Charter of Fundamental Rights⁵⁹. In this respect, some of the amendments proposed by the European Parliament point out that consent should remain the cornerstone of the EU approach to data protection since this is considered the best way for individuals to control data processing activities. It is important to note however that this holds for all data processing with the exception of data that is treated as anonymous: in the proposed text for the new privacy Regulation the Commission and the Parliament agree, in line with Directive 95/46/EC, that all cases where information is anonymous (i.e. cannot be tracked back to an identified or identifiable natural person), this is to be considered out of scope for the Regulation.

Overall, the text proposed by the Parliament states that the principles behind the processing of personal data should be: (i) lawfulness, fairness and transparency; (ii) purpose limitation; (iii) data minimisation; (iv) accuracy; (v) storage minimisation; (vi) integrity, meaning protection against unauthorised or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organisational measures; and (vii) accountability.

In this context, a question to be addressed is whether a large scale deployment of EDRs would be compatible with Directive 95/46/EC and its revision. At present it is not possible to provide a simple answer as it would depend on the ultimate use and application of EDR data, as well as on the final outcome of the ongoing process regarding the revision of the Directive 95/46/EC which, in any case, is expected to provide a clearer and more homogenous legislative framework across the EU. However, it is the view of the authors that, if EDR technology is used exclusively for the purpose of collecting information on incident causation and the reconstruction of events around that incident, privacy would not be an issue, as long as the data remained anonymous.

The situation is different where EDR data is either used to profile insurance customers, to enable safety devices or to allow for other applications that need to track and communicate the exact location of vehicles (and their owners). Most of these cases would require the formal consent of the vehicle owner before any data is extracted from EDRs and processed. In this respect, all insurance or similar contracts should specify crucial aspects like: the scope of EDR data processing, the type of data collected, the process followed to treat data and how long it would be retained, who will have the right to access the data, whether data will be anonymous or not and the monitoring procedures put in place to check the correct treatment of personal data.

Special attention should be given to the treatment of data that would allow profiling: in relation to data gathered and processed by insurance companies, the European Parliament clarified that all citizens have the right to object to profiling and that those subject to data collection and processing should always be clearly informed that their data is being processed and conditions under which it will be processed (including how long the data will be retained for, if the data is to be transferred to third parties or third countries, etc.). In addition to this, profiling shall not lead to any form of discrimination against individuals on the basis of race or ethnic origin, political opinions, religion or beliefs, trade union membership, sexual orientation or gender. Finally, the Parliament stated that this process should also include a human assessment in the process and should not be based solely or predominantly on automated/software processing.

⁵⁹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0389:0403:en:PDF>.

Given the increasing use of EDR-based insurance policies, and the need to ensure that they are processed to a consistent standard across the EU, we recommend the development of EU-wide guidelines on the treatment of data used by the insurance industry. This could be achieved either by the stakeholders - insurance companies and customer representatives – and EU institutions jointly, or by the stakeholders alone developing proposals leading to agreed code of conduct.

The guidelines should provide clear instructions on:

- What features and terms are permitted and not permitted in EU insurance policies
- Procedures to inform customers of how data would be collected, stored and made available to third parties
- Rules on when customer consent is required and how it should be obtained and confirmed.

The use of EDR devices as a tool to support the installation of the in-vehicle emergency call (“eCall”) system can also generate some concerns. In this case, EDRs automatically establish a 112-based audio channel between the occupants of a car and a Public Safety Answering Point (“PSAP”) in the event of an accident and, at the same time, generate a Minimum Set of Data (“MSD”) sent to the PSAP. This process allows an ambulance to be sent to the place of the accident even in the event of the interruption of the conversation with the vehicle occupants. In the European Commission’s Proposal for the eCall system (amending Directive 2007/46/EC COM(2013) 316 final) MSD is defined as “the minimum information required for the appropriate handling of emergency calls”. As recently pointed out by a Note of the European Parliament⁶⁰, this definition, as it currently stands, does not specify sufficiently the scope of MSD nor the type of data collected. Furthermore, from the ongoing debate it seems that one of the conditions the eCall system will have to fulfil is the need to avoid constant tracking. In addition to this, the specifications of MSD will have to be clearly defined in order to prevent the sharing of information about driver and passenger habits with unauthorised third parties.

6.2.3 Coordination with other policy interventions in the area of ITS

In addition to considering whether EDRs should be deployed more widely and potentially made mandatory, a consistent approach is needed to which devices are made compulsory on new vehicles and how they communicate with each other.

Current developments in policy suggest having an eCall, an EDR and an EETS device installed in vehicles. Before any are made mandatory, the EU should consider how to integrate them into a single device to maximise the benefits of increased interoperability. This could either be legislated by the EU or be developed by the industry through such processes as standards setting.

6.2.4 Summary of findings and recommendations

The following table summarises the findings of our analysis and provides recommendation for an assessment of the introduction of EDR on a larger scale.

⁶⁰ European Parliament (2014), Briefing note on Data protection aspects of eCall, February 2014, Bruxelles.

Table 5: Lesson learned, recommendations and an assessment of introduction of EDR on large scale for safety purposes

Issue	Lessons learned	Recommendations
Type of vehicle	Evidence collected shows examples of EDRs in different types of vehicles. Motorcycles are the only category of motorised vehicle on which no evidence has been found, even though these represent the highest safety risks (between 2001 and 2010 the number of road fatalities per year declined by 43% but it remained constant for motorcycles).	EDRs could potentially be installed on all types of vehicles, focusing first on vehicles where installation has highest private and social benefits.
Use	There are different uses for these devices, with car manufacturers' research activities and insurance contracts leading to highest penetration rates. In many cases EDR devices have additional functionality, such as the activation of emergency assistance, and the tracking of stolen vehicles.	There is evidence that the private sector is interested in this technology and any policy assessment to support the introduction of EDRs for safety purposes should take this into account. Policy options able to build on private interests should be considered in order to find a "WIN-WIN" solution, able to meet both public and private goals.
Technical features specification	Few countries defined technical standards through legislative intervention. None require collection of all the parameters required by the VERONICA project.	It is important to ensure that there is a coordinated development of technical standards and to assess whether it would be useful to mandate the provision of a "standardised minimum set of parameters" essential to accident investigators and the provision of technical specifications that guaranteed the reliability and integrity of data provided by the devices. There should also be maximum interoperability with other equipment, in particular eCall, which will become mandatory in September 2015 on new car fleets. VEDRs (EDRs equipped with video recording) improve basic EDRs devices and for applications on specific fleets such as public transport and taxis. VEDRs may be worth considering when proposing wider introduction of EDRs devices on this type of vehicles.

Issue	Lessons learned	Recommendations
Data protection	Few countries adopted specific legislation on data use and privacy. In many cases, EDR data management is covered by more general national laws on data privacy and use. In some countries the debate on the need for specific legislation has only begun recently. Some countries are working on voluntary agreements proposed by insurance companies.	For road safety purposes, there is the need to ensure maximum data accessibility to investigate the causes of accidents and to improve the design of vehicles or road infrastructure (identification of black spots). This should be facilitated by anonymous data provision. EDR-based insurance contracts can improve road safety, but privacy concerns may arise if EDR data are used in courts/litigation.
Market penetration level	High only in US. Medium in a few EU countries (UK, IT, SE) driven by the insurance market or car manufacturers. Low in the remainder of the EU.	No significant step change is expected in the adoption of EDRs across Europe if present trends continue. Possible drivers of faster adoption include legislation on the technical standards of EDRs and data management, and increasing use in the insurance market. The mandatory introduction of eCall on new vehicle fleets creates an opportunity to improve the installation of EDRs. We also recommended an assessment of policies that encourage the adoption of EDRs on all vehicles, not just new ones: for example, incentives to buy EDR-based insurance policies would cover both old and new vehicles.
Key actors involved and prospective use of EDR devices	Car manufacturers and insurance companies are leading the deployment of EDRs. The public sector is lagging, as technological advances and the delicate issue of privacy make it difficult to create appropriate legislation.	Even when the promotion of EDRs is in the public interest (such as for safety purposes), it will be beneficial to maintain incentives for the private sector, primarily car manufacturers and insurance companies, to deploy them. Manufacturers of EDRs, customers associations, and public and private bodies working in the field of protecting vulnerable road users should also be involved to best address issues related to technical specifications, privacy concerns and fair treatment of all stakeholders.
Potential impact of large scale introduction of EDRs	Varies by vehicle type and policy options adopted. Impacts are higher on vehicles other than cars, and when the EDR devices are accompanied by a network able to collect, process and analyse data for road safety purposes.	While the private and social benefits of the installation of EDR devices on bus, coach, HGVs and other fleets appear to exceed the costs, further analysis is needed to investigate the expected benefits from a large scale installation of EDRs on private cars. Implementation of EDR in parallel with eCall systems should also be assessed.

Issue	Lessons learned	Recommendations
<p>Policy options and timescales suggested to support a large scale deployment of EDR devices</p>	<p>It is fundamental to involve the private sector and identify policy options consistent with the public goal of improving road safety, building on growing private interest in the installation of EDRs.</p> <p>The ideal approach would be to identify a package of policy options for different vehicle types and to prioritise the installation of EDRs on vehicles where they can provide high social return.</p> <p>The installation of EDRs (or VEDRs) on buses, coaches and HGVs shows the highest potential return and should be prioritised.</p> <p>Interoperability is required between different its devices (EDR, eCall, EETS).</p> <p>The safety benefits of EDRs on private cars should be further investigated before installation is made mandatory. However, given that eCall systems may be made mandatory on new cars, there may be a benefit in mandating devices that can provide EDR and eCall (and potentially EETS) functions together.</p>	

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