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on the implementation of objectives 4 and 5 of the European Commission's policy orientations on road safety 2011-2020 – deployment of vehicle technologies to improve road safety

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1. INTRODUCTION

This document discusses the potential road safety improvements offered by in-vehicle safety systems and Intelligent Transport Systems (ITS) technologies. It places these technologies in the context of the current figures and trends for road accidents and explains how some in-vehicle safety systems can contribute to the target of halving the number of road accident fatalities by 2020. Their safety benefits are assessed on the basis of recent studies and research co-financed by the European Commission or carried out independently.

The aim of the document is to provide a view on the potential of these technologies to prevent accidents, or reduce their consequences, and on how to best promote the deployment of those seen to be most effective.

The document does not include automated driving systems. The safety technologies discussed assume that the driver remains responsible for controlling the vehicle.

This document will help to inform and guide the industry and other stakeholders on the on-going and future work of the Commission services involved.

Road accidents and their consequences in the form of fatalities and serious injuries remain a social problem in the European Union. Despite the encouraging improvements achieved during the decade 2001-10 when for the first time ever a numerical target was set, still much needs to be done. The most recent road accident figures published by the Commission in March 2014¹ show a decrease of 8% in the total number of road fatalities in 2013 as compared to 2012.

These statistics also show that special attention needs to be given to vulnerable road users, particularly in urban areas, where they make up for more than two thirds of the fatalities. It is therefore necessary to put more effort on crash avoidance measures now available in addition to crash mitigation, with a particular focus on vulnerable road users.

The Policy Orientations for Road Safety 2011-2020², adopted by the Commission in July 2010 provide a governance framework and strategic objectives for action aimed at further improving road safety at all levels. Developing safer vehicles and promoting modern technology, in particular Advanced Driver Assistance Systems (ADAS), to increase road safety are part of the strategic objectives of these policy orientations.

The European Parliament also insists that the potential of technology should be exploited to the full. In its report on road safety concerning the Policy Orientations³, it called on the Commission to take steps to deploy various ITS technologies to improve road safety and to come up, where appropriate, with legislative proposals in certain areas.

¹ http://europa.eu/rapid/press-release_IP-14-341_en.htm

² COM(2010) 389 final

³ Report on European road safety 2011-2020 (A7-0264/2011). Committee on Transport and Tourism. Rapporteur: Dieter-Lebrecht Koch

More recently the CARS 2020 Commission Communication⁴ on an action plan for the European automotive industry recalled the need for an integrated approach on road safety policy comprising the driver the infrastructure and vehicles whereas keeping the competitiveness of the EU automotive industry through its technological lead.

2. SAFETY POTENTIAL OF NEW TECHNOLOGIES

The most important cause of road accidents is human error or behaviour: this is the main factor in 80-90% of all fatal traffic accidents⁵. Excessive speed, distraction and drink-driving are some of its most common manifestations.

Great progress has been achieved in the past years, particularly in the area of passive safety, thanks to improved technology and car design minimising injuries to passengers and pedestrians in the event of a collision. Advanced technologies for active safety are also being incorporated as requirements under the EU framework for type-approval (see section 3 below).

In addition to the technologies already included as minimum safety requirements for certain categories of vehicles within the EU type-approval legal framework, various ‘intelligent technologies’ are now available which use sensors and information processing to advise, warn or assist the driver. These safety systems effectively help to pre-empt or compensate for human error and prevent offences and given the importance of the human factor in road safety could reduce the number of traffic accidents. Various studies have assessed that some of these systems have a high potential to increase safety. Some of the results are briefly referred to below.

Given that the terminology used for each system in the different studies is not always the same as that used in this document, the former has been maintained to avoid misinterpretation. The functionalities of the systems may vary in the details. A table describing the functionality of each system or technology has been included in Annex I.

In 2006, a study⁶ carried out at the request of the Commission evaluated some in-vehicle safety systems’ potential to reduce accidents and fatalities, and the related benefit-to-cost ratios.

In 2011, another study⁷ carried out for the Commission on the safety and comfort of vulnerable road users (action 3.4 of the ITS Action Plan⁸) included a qualitative analysis of the ITS in-vehicle safety systems that should be prioritised on the basis of their potential to improve the safety and comfort of vulnerable road users.

⁴ COM(2012) 636 final

⁵ No comprehensive data causation analysis is available for the EU. The estimate comes from various accident causation sources (Member States, NHTSA, studies). More information on accident causation can be found in www.trace-project.org

⁶ *Cost-benefit assessment and prioritisation of vehicle safety technologies*. Framework Contract TREN/A1/56-2004. Final report January 2006.

⁷ Report on Action 3.4 — *Safety and comfort of the Vulnerable Road Users*. Final report May 2011.

⁸ COM(2008) 886 final

In 2008, the eSafety Forum identified eleven ‘eSafety’ systems, five in-vehicle systems and six cooperative systems as priority systems whose deployment should be promoted⁹.

The eIMPACT¹⁰ project, co-financed by the Commission under the 6th Framework Programme, carried out an impact assessment of twelve Intelligent Vehicle Safety Systems.¹¹ A list of the most promising non-cooperative and cooperative in-vehicle safety systems was prepared on the basis of this assessment.

Under the iMobility Support project¹² a database¹³ of safety effects has been set-up, which compiles various impact analyses for different safety systems.

Furthermore, some of these in-vehicle safety technologies are already fitted by manufacturers to their vehicles as an option or even series equipment in high end models. However the deployment rates appear to remain low for the time being. An overview of the market penetration in 2010 and 2011 for some of them has been produced under the iCar Support project and its successor, the iMobility Support project and is summarised in the table below. However, no comprehensive and recent data is available on the market uptake of these technologies.

Deployment rate for newly registered cars EU27*		
System assessed	2010	2011
Blind Spot Monitoring	0,57%	0,97%
Adaptive Headlights	9,70%	11,91%
Obstacle & Collision Warning	1,77%	2,78%
Lane Keeping Support	0,55%	0,90%
Emergency Braking	0,34%	1,06%
Eco Driving Support	4,48%	16,20%
*iCar - implementation status survey by use of OEM data 2012. Deployment state in EU member states. Executive Summary		

Given these systems' potential to tackle human error and the level of technical maturity that some of them have reached, it is worth to assess the benefit-to-cost ratios of their widespread

⁹ eSafety Forum. *Final Report and Recommendations of the Implementation Road Map Working Group*, 30 March 2008.

¹⁰ eIMPACT: www.eimpact.info.

¹¹ *Stand-alone and cooperative Intelligent Vehicle Safety Systems — Inventory and recommendations for in-depth socio-economic impact assessment* (Deliverable 2 of eIMPACT [Vollmer et al., 2006]).

¹² www.imobilitysupport.eu

¹³ www.esafety-effects-database.org

deployment. The arguments in favour of measures to promote a widespread deployment of these systems include the following:

- (1) The unit cost of the new systems would be reduced with wider deployment for some vehicle categories;
- (2) When several systems are fitted to one vehicle, they may be based on common basic systems or technologies therefore creating synergies between them that result in more efficient design and lower costs;
- (3) Deployment of cooperative safety systems requires a critical mass for them to be effective
- (4) Raising minimum safety requirements would help maintaining the European car industry's technological lead in this area;
- (5) In-vehicle safety systems complement action taken in the context of ITS policy.

Considerations regarding cost-benefit evaluation

Technical improvements and economies of scale will drive down the cost of new in-vehicle safety systems. Some savings may result from synergies between various systems that share hardware components. The assessment of in-vehicle safety systems should take reasonable account of societal benefits that are not quantifiable in economic terms. Also, the assessment of economic costs should be comprehensive and include

- (1) the cost of fatalities and serious injuries, particularly those resulting in permanent disabilities;
- (2) the cost of non-serious injuries;
- (3) the cost of accidents without injury; and
- (4) the cost of infrastructure repair and maintenance.

Cost evaluation will benefit from the Commission's injury strategy; on the basis of a precise definition of serious injuries and improved data collection it will be possible to better assess the cost of injuries in a more accurate way.

Some of the most relevant in-vehicle safety systems whose deployment could be promoted are briefly discussed below. This list is indicative and will be reviewed by the in-depth research study launched by the Commission services at the beginning of 2014 for a report to the legislator at the beginning of 2015 as requested by the General Safety and Pedestrian Safety Regulations.

Intelligent speed adaptation (ISA)

Intelligent speed adaptation, also known as speed alert, is a cooperative system which, based on information concerning the speed limitations applicable on the spot, warns the driver if the car is traveling at a speed higher than the limit. In some versions of the system the driver could be required to supersede a haptic signal if he wants to exceed the speed limit. Systems

preventing the driver from altogether accelerating beyond the speed limit are technically possible but are not considered here. Technically advanced versions of ISA could also inform the driver about the recommended speed taking into account real time information from various sources on aspects like weather conditions or the state of the infrastructure, e.g. works, congestion, incidents.

Various studies have assessed Intelligent Speed Adaptation (ISA) as being potentially very effective in reducing the number or seriousness of road accidents¹⁴. This is consistent with the accident causation analyses which have identified excessive or inadequate speed as one of the most common accident factors.

Its deployment relies on updated information on speed limits in the network, ideally including real-time communication between vehicles and the infrastructure to provide real time information on variable speed limits. Additionally some vehicles may be equipped with on-board cameras capable of reading speed limits on traffic signs. The European Parliament's Report on Road Safety called on the Commission to 'draw up a proposal to fit vehicles with "intelligent speed assistance systems" which incorporates a timetable, details of an approval procedure and a description of the requisite road infrastructure'.

Recently, an ex-post evaluation study¹⁵ was carried out, providing an independent evaluation of the road safety, environmental and economic effects attributed to speed limitation devices¹⁶ for heavy commercial vehicles, including possible application of speed limitation devices and ISA to light commercial vehicles. The study concluded that there is no need to modify the speed limits for heavy commercial vehicles set out in the Directive. Nevertheless, possible introduction of ISA in combination with existing speed limitation devices in these vehicles could significantly improve road safety. As regards light commercial vehicles, ISA would have a stronger road safety potential than speed limitation devices. Taking into account technological evolutions, mandatory ISA¹⁷ could in the future be further considered as an alternative to speed limiters in heavy goods vehicles and buses.

Advanced emergency braking

Advanced emergency braking systems (AEBS), also referred to as autonomous emergency braking systems, detect a potential collision and activate the vehicle brakes in order to avoid it or mitigate it. These systems generally provide a warning for the driver before acting on the brakes. Their operation and performance depends on the vehicle's speed (absolute and relative to the obstacle) and often full braking is only applied below a certain speed threshold. Commercial systems are available as an option for many car models although with very different functionalities and performance levels.

¹⁴ Lai, F., Carsten, O., Tate, F., 2011. *How much benefit does Intelligent Speed Adaptation deliver: An analysis of its potential contribution to safety and environment.*

¹⁵ Evaluation of the application of speed limitation devices and intelligent speed adaptation systems (ISA) to commercial vehicles
http://ec.europa.eu/transport/road_safety/pdf/vehicles/speed_limitation_evaluation_en.pdf

¹⁶ Directive 92/6/EEC as amended by Directive 2002/85/EC

¹⁷ i.e. a version of Intelligent Speed Adaptation that prevents the driver from exceeding a certain speed limit.

Advanced emergency braking systems are mandatory for new types of trucks and buses in the relevant categories since 1 November 2013 and will be mandatory for all new vehicles registered as of 1 November 2015. Their effectiveness was evaluated as part of the impact assessment¹⁸ accompanying the proposal for the General Safety Regulation¹⁹. Despite their potential to reduce accidents, low benefit-to-cost ratios mainly due to the cost of the devices did not justify mandatory deployment for cars in 2008; lower prices and improved performance could yield a different result today. A recent study²⁰ evaluated the overall benefit (in casualty cost-reduction terms) of AEBS to be between 6% and 40%.

Lane departure warning systems

Lane departure warning systems (LDWS) monitor the vehicle's trajectory and warn the driver, by an audible or haptic signal, of an unintentional drift of the vehicle out of its travel lane. This technology relies on the presence of lane markings or road edges that can be clearly distinguished by means of a camera and its image processing system. If the system is unable to assist the driver it will warn him of that circumstance.

Lane departure warning systems are mandatory for new types of trucks and buses in the relevant categories since 1 November 2013 and will be mandatory for all new vehicles registered as of 1 November 2015. As in the case of AEBS, the safety impact was assessed under the impact assessment for the General Safety Regulation and the result at that time did not justify a mandatory deployment for other vehicle categories. However technological and market developments could result today in a different outcome. According to a more recent assessment²¹ estimated the overall benefit of LDWS (in casualty cost-reduction terms) to vary between 12 and 31% depending on the lead time for deployment.

Detection of vulnerable road users

Pedestrians and cyclists detection systems, possibly combined with automatic emergency braking (PDS/EBR), have been assessed to have high potential for improving vulnerable road users safety by preventing or mitigating accidents involving them, particularly in urban areas.

Various technologies that can reliably identify a pedestrian or a cyclist and the potential collision with them are starting to be commercially available. Cyclists or pedestrians, and to a lesser degree also motorcyclists, are more difficult to detect and identify by automatic systems in comparison with the detection of a relatively big and solid object such as car, bus or goods vehicle.

More specifically, blind spot detection for trucks (BSD-T) has been identified as having potential for improving the safety, particularly cycling safety in urban areas. Blind spots are areas around a vehicle which cannot be seen (directly or indirectly) by the driver. BSD

¹⁸ COM(2008) 316 and SEC(2008) 1909.

¹⁹ Regulation (EC) No 661/2009 of the European Parliament and of the Council of 13 July 2009 concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor.

²⁰ *Cost benefit evaluation of advance primary safety systems, Final Report, 2011 TRL*

²¹ See 20

systems rely on sensors to detect the presence of a pedestrian or a cyclist in a 'blind spot' and warn the driver so he can avert a potential collision. Heavy goods vehicles have larger blind spots which can result in very serious or even fatal accidents when these vehicles interact with cyclists or pedestrian which occurs often in urban environments.

Some BSD technologies are available commercially, although they are not as mature as pedestrian detection systems.

Alcohol interlocks

Alcohol is one of the most common factors of road accidents and several studies have concluded that alcohol interlock devices have the potential to reduce the number of accidents related to drink-driving. The European Parliament's Report on Road Safety recommends that alcohol interlocks be fitted to the vehicles of road users who already have more than one drink-driving conviction and to all new types of commercial passenger and goods transport vehicles. Some Member States already regulate the use of alcohol interlocks for certain drivers or vehicle types.

The benefit-to-cost ratio of the mandatory installation of alcohol interlock for drivers who have been caught with high levels of alcohol in their blood was evaluated for four countries in the framework of the IMMORTAL project²² and assessed as yielding a benefit in three of them. The cost-effectiveness of such programs is confirmed by a study commissioned by the Commission which has been finalised recently²³. The study concludes that in order to facilitate the implementation of such programmes, the standardisation of the vehicle interface for the connection of alcohol interlock could be one of the priority actions. According to this study the cost-effectiveness of fitting alcohol interlocks to certain vehicles categories under the type-approval framework is not confirmed.

Event Data Recorders

Event Data Recorders (EDR) are devices which continuously register and store the values taken by a series of vehicle parameters so that a sequence of those records covering some seconds can be retrieved by the authorities in case of a collision.

Many of the data which would be collected by EDRs are already available in various vehicle systems and it is technically simple to store them and make them available through the EDR.

Event Data Recorders (EDRs) do not prevent road accidents, but can help accident investigators to established objectively the accident's circumstances and determine the responsibilities of the users involved; in addition, based on a statistically significant sample of accidents, researchers can draw conclusions on the relationship between accident factors and accident occurrence and severity. It has also been argued that Event Data Recorders could

²² W.P., Wesemann, P., Devillers, E., Elvik, R. & Veisten, K. (2005). *Detailed Cost-Benefit Analysis of Potential Impairment Countermeasures*. Deliverable P.2 of IMMORTAL project.

²³ Study on the prevention of drink-driving by the use of alcohol interlock devices:
http://ec.europa.eu/transport/road_safety/pdf/behavior/study_alcohol_interlock.pdf

contribute to change the driver's behaviour, since the data recorded can be used to objectively determine accident liability or to calculate insurance premiums depending on the driving behaviour.

The implementation of EDR should carefully consider who and for what will the data be used and ensure appropriate data protection. Concerning the technical solutions manufacturers could produce multifunctional devices by linking EDRs to e.g., digital tachographs.

A study on the road safety benefits of EDR is on-going whose results will be available by the end of 2014.

Tyre pressure monitoring systems

Tyre pressure monitoring systems (TPMSs) continuously monitor the inflating pressure of the vehicle tyres and produce a warning signal if one of them is under-inflated. They do this by either directly measuring the pressure inside the tyre or by calculating it on the basis of the tyres characteristics and speed.

Adequate tyre inflation pressure plays an essential role in terms of safety and energy efficiency and TPMS help to ensure that the adequate pressure is kept at all times.

The General Safety Regulation has made tyre pressure monitoring systems mandatory for passenger vehicles. Technology has progressed rapidly and more accurate systems are now available at lower prices. Therefore it may be advisable to reconsider performance requirements for the mandatory systems and their extension to other vehicle categories.

A recent study²⁴ considered that the fitting of TPMS systems for commercial vehicles could be beneficial to fuel consumption and possibly to road safety , but further research is needed for a concrete policy recommendation.

eCall for powered two-wheelers, heavy goods vehicles and buses

eCall is an emergency system which automatically activates in case of a serious crash and dials 112 to contact the emergency services, sends details of the accident, including the time of incident, the accurate position of the crashed vehicle and the direction of travel, even if the driver is unconscious or unable to ask for help. An eCall can also be triggered manually by pushing a button in the car, for example by a witness to a serious accident.

eCall for passenger cars can cut emergency services response time by up to 50% in the countryside and 40% in built-up areas²⁵. The quicker response can save hundreds of lives in the EU every year and reduce the severity of injuries in tens of thousands of cases.

²⁴ Study from DG CLIMA on Tyre Pressure Monitoring Systems (TPMS) as a means to reduce Light-Commercial and Heavy-Duty Vehicles fuel consumption and CO2 emissions
http://ec.europa.eu/clima/policies/transport/vehicles/heavy/docs/tno_2013_final_report_en.pdf

Regarding heavy goods vehicles, standardisation work is going on for the extension of the minimum set of data for heavy goods vehicles. As for powered two-wheelers, further technical development is needed before being considered for type-approval²⁶.

Seat belt reminders for all passengers

Seat belt reminders are devices audible that detect whether seat belts are in use in various seating positions and give out warning signals, often increasingly urgent, until the corresponding occupants use the belts. Research confirms that seat belt reminders increase seat belt use²⁷. The extension of the mandatory fitting of seat belt reminders to all sitting positions could reduce mortality and injuries in case of a crash.

3. EU ACTION TO PROMOTE THE DEPLOYMENT VEHICLE SAFETY SYSTEMS

Legislative measures on vehicle technology

Type-approval and retrofitting

The EU has gradually incorporated safety technologies into the type-approval legal framework on vehicle safety. The EU type-approval is the natural framework for mandatory deployment on new vehicles. It is often not possible or cost-effective to retrofit existing vehicles with safety systems required for the new vehicle types, but this possibility should be encouraged when practical, for instance by promoting insurance premium reductions for vehicles incorporating these technologies. In particular retrofitting measures may be appropriate when the use of safety system is linked to the vehicle use rather than to the vehicle type.

The mandatory fitting and use of seat belts for passenger cars and the protection of car occupants in case of frontal and lateral collisions have greatly improved passive safety. The most well-known consequence of this legislation is the routine installation of air-bags. Recently, the EU updated its legislation on the protection of pedestrians²⁸ which includes the design of the front of cars for pedestrian protection.

The General Safety Regulation for Type-Approval also introduced in 2009 a series of new safety features, like the electronic stability control (ESC) system for all vehicles, advanced emergency braking systems (AEBS) and lane departure warning systems (LDWS) for new trucks and buses.

²⁵ SEC(2011) 1019 final. Impact assessment accompanying the document Commission Recommendation on support for an EU-wide eCall service in electronic communication networks for the transmission of in-vehicle emergency calls based on 112 ('eCalls')

²⁶ Pilot projects for powered two-wheelers and heavy goods vehicles being implemented within the project HeERO2 www.heero-pilot.eu

²⁷ Lie A, Krafft M, Kullgren A, Tingvall C. 2008, Intelligent seat belt reminders-do they change driver seat belt use in Europe?

²⁸ Regulation (EC) No 78/2009 of the European Parliament and of the Council of 14 January 2009 on the type-approval of motor vehicles with regard to the protection of pedestrians and other vulnerable road users.

Both the General Safety and Pedestrian Safety Regulations establish that the Commission has to report to the European Parliament and Council on technical developments in the field of enhanced passive safety requirements, the consideration and possible inclusion of new and enhanced safety features as well as enhanced active safety technologies.

In order to fulfil this obligation, an in-depth research study was launched by the Commission services at the beginning of 2014. This study will cover possible new measures on both active and passive safety in a comprehensive manner following an holistic approach (including the review of the studies listed under section 2 of this document) and with a full and updated cost/effectiveness analysis. It will look e.g. at the extension of AEBS, LDWS, TPMS to other categories, PDS/EBR, the protection of vulnerable users in cities. The results of the study will enable the Commission to prepare a Communication to the European Parliament and to the Council at the beginning of 2015.

A new EU Regulation on the type-approval of motorcycles, mopeds and quadricycles²⁹ has been recently adopted. This Regulation will make mandatory starting in 2016 the fitting of ABS on bigger motorcycles as well as the fitting of advanced braking systems (e.g. combined braking systems) on other motorcycles and of the automatic headlamp on feature on all L-vehicle³⁰ categories. This regulation improves in particular the safety of vehicles of categories L6 and L7 whose use is spreading as an alternative to M1 category vehicles.

The Commission proposed in May 2013 two pieces of legislation to help the deployment of eCall:

- A Regulation concerning type-approval requirements for the deployment of the eCall system (amending Directive 2007/46/EC) in all new types of passenger cars and light duty vehicles – making the vehicle fit for eCall; and
- A Decision on the deployment of the interoperable EU-wide eCall – making the public infrastructure fit for eCall.

The decision on the deployment of the interoperable EU-wide eCall has been adopted and published in the OJ³¹.

International harmonization on vehicle regulations

The European automotive industry acts on a global market and this should also be taken into account in proposing new measures on vehicle construction, i.e. the EU makes more and more reference to UN Regulations (United Nations) in the EU type-approval legislation for the testing of new vehicle devices. The World Forum for Harmonization of vehicle regulations of the United Nations is the appropriate forum to define such worldwide technical requirements whereas the EU legislator remains competent for political issues like the mandatory fitting of new devices.

²⁹ Regulation (EU) No 168/2013 of the of European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles

³⁰ L-category vehicle is the family name of light vehicles such as powered cycles, two- or three-wheel mopeds, motorcycles with and without sidecar, tricycles and quadricycles.

³¹ Decision No 585/2014/EU of the European Parliament and of the Council of 15 May 2014

Related legislative measures

Professional drivers

Particular attention should be paid to the use of in-vehicle safety technologies by professional drivers. Due to their intensive use – much longer distances and driving times than private vehicles – and to management based on cost-effectiveness criteria it is worth considering to prioritise fitting them to commercial vehicle fleets. They can productively lead the way in the deployment of new safety systems, by providing a test bench for the new technologies.

Driving license

Drivers may need to be aware of the safety technologies installed in their vehicles. The assessment of new in-vehicle safety systems should pay attention to training aspects and determine whether, and to what extent, the driver should understand the functionalities of the system or be exposed to its functioning in a training context.

Roadworthiness

Any system fitted to a vehicle should maintain its functionality over the entire vehicle life, and safety systems are no exception. The European Parliament and the Council have adopted the new roadworthiness³² legislation which provides a framework which will allow for the testing of electronic systems safety systems. A study on the technical aspects of this testing is underway whose results will be the basis for future implementing provisions in this crucial area.

ITS Directive

In the context of the implementation of the ITS Directive (2010/40/EU) the Commission has adopted specifications for various priority actions like the provision of road safety related minimum universal traffic information free of charge to users³³, the provision of information services for safe and secure parking places for trucks and commercial vehicles optimising parking areas and mitigating parking accidents due to unsuitable parking³⁴, and the harmonised provision for an interoperable EU-wide eCall³⁵.

Non-legislative measures

Promotion of deployment

Non-legislative measures might prove more efficient than legislation to deploy new safety technologies. Their voluntary deployment is already taking place and can be further promoted in various ways:

³² http://ec.europa.eu/transport/road_safety/events-archive/2012_07_13_press_release_en.htm

³³ OJ L 247, 18.9.2013, p. 6.

³⁴ OJ L 247, 18.9.2013, p. 1.

³⁵ OJ L 91, 3.4.2013, p. 1.

- Public procurement can be used as leverage by requiring that vehicles used within contracts with a public administration be equipped with minimum safety features.
- Member States' authorities could provide tax incentives to promote the fitting of additional safety systems, in the same way they are provided for e.g. environmentally friendly technologies.
- Insurance companies may take into account the safety systems fitted to a vehicle when determining the amount of the premia. Some insurance companies are already offering discounts to drivers who accept the fitting of an Event Data Recorder. Similar incentives could be especially relevant for crash avoidance technologies.
- The Commission and Member States authorities can financially support awareness campaigns to inform the public about the existence of these systems and their benefits for road safety.
- The European New Car Assessment Programme (EuroNCAP) is gradually incorporating in-vehicle technologies in its assessment programme. Through 'EuroNCAP Advanced', the programme rewards the fitting of advanced safety technologies and a roadmap is being drawn up for the inclusion of emerging crash-avoidance technologies in the assessment scheme by 2015.
- The European Road Assessment Programme (EuroNRAP) can also contribute by identifying risks related to the infrastructure and promoting the deployment of infrastructure based safety systems.

Research

The Commission provides financial support for the research and development in new safety technologies. The broad priority areas for research under the Horizon 2020 framework are have been defined; road safety and in particular driver assistance technologies will be amongst the areas of interest in the domain of transport, notably in relation to the potential benefits for vulnerable road users. Another area of interest is the methodology to assess cost and benefits of safety policies. The project PROS³⁶ co-financed under the 7th framework programme will identify the priorities for European road safety research. On-going projects as e.g. SafeEV³⁷ on light urban electric vehicles (categories L6, L7 and small M1) are already looking at future safety requirements.

4. NEXT STEPS AND CONCLUSIONS

Various safety technologies that are currently marketed and others that will be ready for deployment in the short term have a strong potential to increase road safety. The aim of these technologies is to tackle the human factor, which is at the origin of the great majority of road accidents. They prevent or compensate human error and distraction and in many cases illegal behaviour. Particularly important for road safety are those systems whose focus is to avoid accidents involving vulnerable road users, i.e. pedestrians, cyclists and motorcyclists, which are a growing source of concern.

³⁶ Priorities for Road Safety Research in Europe <http://www.pros-project.eu>

³⁷ Safe Small Electric Vehicles through Advanced Simulation Methodologies <http://www.project-safeev.eu/>

The present document just provides an overview of some of existing safety technologies that deserve to be considered for deployment in order to guide the industry and stakeholders, together with alternative or complementary measures concerning infrastructure and driver behaviour.

The services of the Commission have already initiated preliminary works to assess some of these technologies. A stakeholders meeting on ITS and in-vehicle safety systems was organised on 8 March 2013³⁸ which discussed the benefits of in-vehicle safety systems and underlined the importance of focusing on the main priorities for road safety policy.

The CARS 2020³⁹ Working Group for the Internal Market met on 30 April 2013 on the issue of road safety. The discussion underlined the need to apply an integrated approach (covering vehicle, infrastructure and road user) and to perform an, assessment of cost-effectiveness, giving priority to measures that address the main objectives for road safety like vulnerable road users and the main accident factors.

The possibility to include some of these safety technologies under the legislative framework for type-approval is currently being reviewed with the study mentioned under section 3. The Commission will report on the follow-up to be given to this study to the European Parliament and the Council at the beginning of 2015, as required by the General Safety Regulation and the Pedestrian regulation.

The deployment for any of the technologies listed above would in any case be subject to a detailed impact assessment and cost-benefit analysis, taking into account not only the possible benefits and costs, but also negative effects that such technology could entail (e.g. distraction, reliability/complexity of the systems, possible lack of control by the driver) and a comparison with a similar evaluation carried out for alternative measures. Data protection and systems' security should also be carefully considered in the assessment.

In any case, measures to promote the voluntary deployment of some of these safety technologies should be envisaged. Voluntary deployment can contribute to raise awareness amongst drivers about their functionalities and safety benefits, and provide knowledge concerning their performance in real traffic conditions.

Technologies based on communication between road users and with infrastructure services will in the near future enlarge the portfolio of safety systems available and enhance still more the potential for safety improvements.

³⁸ The agenda, discussion document and presentations can be found at:
http://ec.europa.eu/transport/road_safety/events-archive/2013_03_08_stakeholders_meeting_en.htm

³⁹ http://ec.europa.eu/enterprise/sectors/automotive/cars-2020/index_en.htm

ANNEX I. TERMINOLOGY

This table compiles a list of safety systems identified by their denomination and acronym, as used in this document or in the documents referred to. The list of systems is not exhaustive and intends to bring clarity upon the varied terminology that can be found in the market or in literature by describing the functionalities offered by each system.

Safety System	Type of system	Functionality
Adaptive Head Lights (AHL)	In-vehicle Non-cooperative	Directs the lights into the bend when the vehicle begins cornering to ensure optimum illumination of the lane.
Advanced Emergency Braking System (AEBS)	In-vehicle Non-cooperative	Advanced emergency braking systems detect an emergency situation and activate the vehicle brakes in order to avoid or mitigate the collision.
Blind Spot Detection for Trucks (BSD-T)	In-vehicle Non-cooperative	Detects and warns the driver about the presence of other road users, particularly vulnerable road users, or objects in the blind spots.
Blind Spot Monitoring	In-vehicle Non-cooperative	Same as Lane Change Assist (LCA)
Driver Drowsiness Monitoring and Warning (DDM)	In-vehicle Non-cooperative	Warns drivers when they are getting drowsy.
Dynamic Traffic Management	Infrastructure Non cooperative	Manage traffic flows by influencing speeds, lane use, route choice or merging operations by employing variable message signs (VMS).
eCall	Cooperative	Automatic emergency call for help in case of an accident.
Electronic Stability Control (ESC)	In-vehicle Non-cooperative	Stabilises the vehicle within the physical limits and prevents skidding through active brake intervention and engine torque control.
Event Data Recorder	In-vehicle Non-cooperative	Collects a sequence with duration of some seconds of certain vehicle parameters which are stored in the event of an accident. The data can be used for scientific, technical and legal purposes.
Extended Environmental Information (Extended Floating Car Data)	Cooperative	Uses vehicle data (e.g. switched-on lights, windscreen wipers on, fog lights on, information from ABS, stability control systems) to create useful information about the conditions in which the vehicle is driving.
Forward Collision Warning	In-vehicle Non-cooperative	Warns the driver about the danger of collision with an obstacle or vehicle in front of the vehicle. Same as Obstacle and Collision Warning
Full Speed Range Adaptive Cruise Control (ACC)	In-vehicle Non-cooperative	Adapts the speed of the vehicle and its distance to vehicles ahead down to standstill. May restart the vehicle.
Intelligent Speed Adaptation (ISA)	In-vehicle Cooperative	Compares the actual speed of the vehicle with the local speed limit and/or the appropriate speed depending on the actual driving conditions. It advises the driver or controls the vehicle until the speed is reduced to the appropriate limit.
Intersection Safety (INS)	Cooperative	Red light warning, right of way information at signalised intersection and stop signs and left turn assistance.
Lane Change Assist (LCA)	In-vehicle Non-cooperative	Warning for vehicles next to or at the rear of the vehicle just before lane change.

Safety System	Type of system	Functionality
Lane Departure Warning (LDW)	In-vehicle Non-cooperative	Monitors the vehicle trajectory and warns the driver of an unintentional drift of the vehicle out of its travel lane.
Local Danger Warning	Infrastructure Non-cooperative	The system transmits to the vehicle spot-wise warnings via variable message signs, flashing or electronic beacons, radar-based excessive speed information.
Night Vision and Warning	In-vehicle Non-cooperative	Enhanced vision at night through near or far infrared sensors, including obstacle warning.
Obstacle & Collision Warning	In-vehicle Non-cooperative	System detects obstacles and gives warnings when collision is imminent. Same as Forward Collision Warning.
Pedestrian Detection System/Emergency Braking (PDS/EB)	In-vehicle Non-cooperative	Detection of vulnerable road users and fully automatic emergency braking.
Pre-Crash Protection of Vulnerable Road Users (PCV)	In-vehicle Non-cooperative	Same as Pedestrian Detection/Emergency Braking
Real-time Travel and Traffic Information	Cooperative	Provides information to the driver, via in-vehicle systems and nomadic devices, about the traffic (congestion) and weather conditions.
Seat belt reminders	In-vehicle Non-cooperative	Seat belt reminders alert drivers with a visual display or audible alarm if the seat belts in occupied seats are not being used.
Speed Alert	Cooperative	Same as Intelligent Speed Adaptation (ISA)
Wireless Local Danger Warning (WLD)	Cooperative	Inter-vehicle communication distributing early warnings for accidents, obstacles, reduced friction and bad visibility.