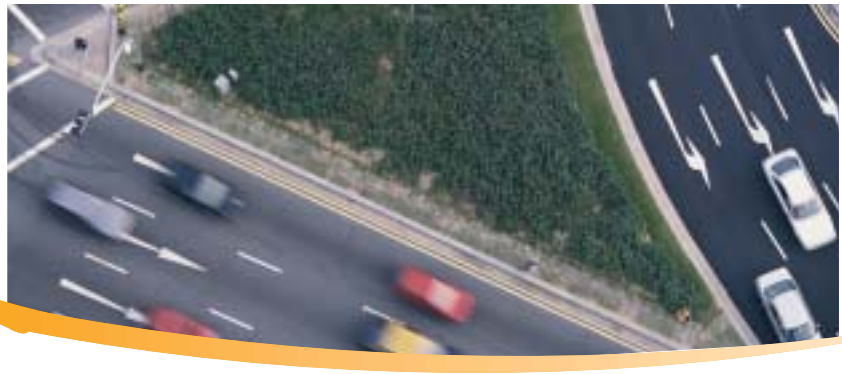

eSafety

Final Report of the eSafety Working Group on Road Safety

Final Report
November 2002

Information Society Technologies

European Commission

Final Report
of the *e*Safety Working Group
on Road Safety

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PREFACE

About eSafety

*e*Safety is a joint industry – public sector initiative for improving road safety by using new Information and Communications technologies[1]. The overall objective is to join forces and to build up a European strategy to accelerate the research and development, deployment and use of Intelligent Integrated Road Safety Systems including Advanced Driver Assistance Systems (ADAS) for increasing road safety in Europe.

About this report

This is the final report of the eSafety Working Group. The eSafety High-Level meeting on 25 April 2002 called for establishing of such a Working Group, to be tasked to further elaborate the above-mentioned European strategy, to recommend actions and to prepare for the next High-Level Meeting. The Commission services established this Working Group, which has met four times on 7 June, 8 July, 9 September and 8 November. This report represents the result of the work in the Working Group.

[1] For more information, refer to www.eu.int/information_society/programmes/esafety/index_en.htm

1. INTRODUCTION

1.1. Towards a safe and efficient transport system for the enlarging European Union

Mobility: a key factor in the enlarging European Union

Transport is a key factor in modern economies: the sector corresponds to more than 10% of gross domestic product and employs more than 10 million people. Motor vehicles are the biggest contributor to mobility, we estimate that some 80% of travel calculated in passenger – km is currently by car.

The enlarging European Union with increasing demand for transport services needs an efficient transport system, and has to tackle the problems caused by transport: congestion, harmful effects to the environment and public health, and the heavy toll of road accidents.

Reaping the benefits of Information and Communications technologies for safer and more efficient mobility

More and more of the added value – and also manufacturing cost - of vehicles comes from more sophisticated electronic systems which can replace entire mechanical and hydraulic subsystems. An increasing number of vehicle control, safety and comfort functions are controlled by processors and software.

In Europe, we have invested heavily in research and technological development (RTD) for the use of Information and Communications Technologies (ICT) in transport. The EU's Research Programmes have contributed in realising leading edge technologies, systems and applications for safer, cleaner and more efficient transport. The development of appropriate sensors, actuators and processors has already permitted wide spread implementation of autonomous in-vehicle systems with potential safety effect, such as Anti-lock Braking Systems (ABS) and Electronic Stability Programme (ESP).

It is time now to reap the industrial, economic and societal benefits of these new systems which we call **Intelligent Integrated Road Safety Systems.** European industry should be able to position itself as a leader the in the world, and at the same time contribute to the reduction of road accidents.

The number of road victims is still unacceptably high

During the last decade, the European Union, Member States and the automotive industry have been actively involved in improving road safety through both accident prevention and injury reduction. Most of the accident prevention measures have focused on the driver, while the measures to reduce the consequences of an accident have primarily focused on the vehicle, through improved passive safety such as crashworthiness, seatbelts, airbags and conventional active safety systems such as braking and lighting.

These combined actions have contributed to the continuous reduction of the number of fatalities on European roads[2]. Nevertheless, the number of road

[2] http://europa.eu.int/comm/transport/home/care/index_en.htm

accidents and the number of road victims are still unacceptably high in the European Union. And even though the number of fatalities on EU roads is decreasing, the number of accidents with injuries is still increasing. Moreover, the contribution of some conventional safety measures is reaching its limits. Further improvements in safety by these measures are becoming more and more difficult to achieve at a reasonable cost.

The goal of the White Paper: 50% reduction of road fatalities

The price paid for mobility in Europe is too high. In 2000, road accidents killed over 40 000 people in the European Union and injured more than 1.7 million. The directly measurable cost of road accidents is of the order of 45 billion €. Indirect costs are three to four times higher. The annual figure is put at 160 billion €, equivalent to 2% of the EU's GNP.

In September 2001 the European Commission presented the White Paper on European Transport policy for 2010[3]. In this paper the Commission set a very ambitious target for road safety: a 50% reduction of road fatalities by 2010, which should bring the number of deaths per year down to 20 000, and simultaneously bring down the number of accidents and injuries.

The use of new technologies cannot achieve this target alone, although it can make an important contribution. Other measures such as infrastructure improvements and enforcement of compliance with current safety measures make an extremely important contribution to overall road safety and must be implemented without delay. The penetration of new technologies to all vehicles will also take a long time, and even in the best of cases will be incomplete by 2010.

Acting at EU, national and local level

The EU has a broad scope to act on road safety and has been active in the following ways since the late 1980s:

- Legislating where it has exclusive and shared responsibilities
- Promoting the use of financial instruments and support to create a market for safety
- Encouraging best practice and information exchange
- Accident and injury data gathering and analysis
- Research and development towards future solutions

In the light of subsidiarity and the responsibilities for different aspects of road safety, achieving the targets set in the White Paper cannot be the sole responsibility of the European Union. Shared action encompassing all types of safety measures and all players at the EU, national and regional level is needed. The European Strategy for a partnership approach and proposed

[3] White Paper European Transport Policy for 2010: time to decide, COM(2001) 370, 12.9.2001

measures for improving road safety are brought forward in the Road Safety Action Plan 2002-2010[4].

Increasing co-operation between the public and private sectors

The road authorities and the industries have to work closely together on strategic, tactic and operational levels. The WERD[5] Subgroup on Telematics is generating strategic recommendations on ITS Deployment for Road Authorities, based on practical experience and analysis. For advancing the deployment of Intelligent Integrated Safety Systems, the public and private sectors should collaborate on fitting together their

- Strategy goals: Policy objectives and network performance requirements with business goals translated to marketing strategies
- Tactical goals: Network functions and facilitating services with product portfolios
- Operational goals: Network operations with services and products

Creating demand for safety

The public perception, expectancy and understanding of in-vehicle safety systems and interaction with infrastructure does not completely align with reality. Nevertheless, a policy to introduce such systems can be based only on a public demand for safety. If public demand for such systems is to be generated and satisfied, there needs to be a co-ordinated effort by the EU, Member States, automotive industry, Car Clubs, standardisation bodies, insurance industry, and trade associations, and more involvement of police and law enforcement agencies to promote public demand, understanding and acceptance of safety systems. Incentives need to be discussed by industry and presented to e.g. the EU Council of Ministers of Transport and other bodies.

1.2. Using Information and Communications technologies for safer and more efficient mobility

Vision for the Intelligent Vehicle

The driver is sitting behind the steering wheel and is driving at 70 km/h. He steers the vehicle into a corner. To do so he uses information acquired by looking at the total road picture, the surroundings and his in-car instruments. The in-car applications continuously receive information from cameras (visible light and infrared), in-vehicle radar systems, digital maps, GNSS satellites for location information, vehicle-infrastructure communication, information from other vehicles and the like. The information collected by these sensors is verified by the in-vehicle control unit, integrated, analysed and processed, and presented to the driver.

[4] Currently under preparation (DG Transport and Energy)
[5] WERD is the association of managing directors of West European Road Administrations

In this case, there has been an accident on the road, around the corner and not visible to the driver. The Advanced Driver Assistance Systems (ADAS), part of the on-board intelligent integrated safety system intervenes by giving an audible warning (a spoken message), based on information received from vehicles ahead. The driver knows that he remains in control of the vehicle and can always ignore signals or override active assistance. He reduces speed, and is able to stop safely before the accident site. His car starts immediately to broadcast warnings to the vehicles following behind.

The driver is also aware that his car is equipped with a sophisticated safety system which can do even more in hazardous situations. Depending on the degree and timing of the danger the system would inform him, warn him, actively assist him or ultimately actively intervene to avoid the danger. If the intervention cannot avoid the crash completely, intelligent passive safety applications will be deployed in an optimal way to protect the vehicle occupants and possibly other parties involved in the accident (vulnerable road users). The system will also automatically contact the emergency services indicating the severity and location of the accident.

Improved road safety through the use of new technologies

New systems which use advanced information and communication technologies in new intelligent solutions for improved road safety can reduce the number of accidents on our roads, in particular when the accident can still be avoided or at least its severity significantly reduced. We know that almost 95% of the accidents are partly due to the human factor. In almost three-quarters of the cases the human behaviour is solely to blame. This apparent mismatch between driver skills and situation complexity can be addressed by improvements in three factors: the driver (education and training); the environment (intelligent infrastructure) and the vehicle (vehicle safety systems). This is the area where ***Intelligent Integrated Road Safety Systems***, including Advanced Driver Assistance Systems, offer their greatest potential.

The development of appropriate sensors, actuators and processors, has already permitted wide spread implementation of ABS and stability systems, which help the driver to maintain control of the vehicle even when he has exceeded its 'normal' limits of handling. We are now looking towards a new generation of active safety systems and Advanced Driver-Assistance Systems. These systems will take into account not just the driver and the vehicle, but also the environment around the vehicle. Co-operative systems will enable essential safety information to be exchanged between the vehicle and other vehicles, and the infrastructure.

By receiving information from outside of the vehicle, the systems will be able to assess the risk of an accident happening. They can then warn the driver so that he can take appropriate action, or they can even initiate appropriate action. If an accident becomes unavoidable the systems could use that same information to optimise the passive safety systems. Other safety systems can also automatically summon assistance following an accident.

In this approach to safety using new technologies, the European Commission, Member States, public authorities and industry all have an important role to play.

The necessary actions, which include investments in safety-related information and road infrastructure, have to be clearly identified at an early stage. A European and integrating strategy is required for increasing road safety in Europe.

Community Research: Foundation for safety technologies and applications systems

In the transport sector, the EU has played a leading role in research in Road Transport Telematics and Intelligent Transport Systems (ITS) since 1988. Under the EU's Fourth Framework Programme for Research, Technological Development and Demonstration (1994 -1998), the Telematics Applications Programme, administered by Directorate-General for Information Society of the European Commission, has realised leading-edge systems and applications.

The current Information Society Technologies (IST) programme[6] builds on the success and results of the Telematics programme, continuing research in technologies and applications systems aiming at safer, cleaner and more efficient transport, with research focused on intelligent safety and Advanced Driver Assistance Systems and supporting technologies[7]. The Intelligent Vehicle cluster of the IST Programme has over 40 projects, with total budget of over 150 million € and Community contribution of over 80 million €. Research into safer vehicles and infrastructures as well as accident databases and human behaviour in road transport is also undertaken in the Sustainable Growth programme[8].

The forthcoming Sixth Framework Programme for 2002-2006[9] will offer new funding opportunities for RTD in Intelligent Integrated Safety including Advanced Driver Assistance Systems and technologies. The new instrument, ***Integrated Project,*** which is designed to generate the knowledge required to address major societal challenges, will be especially suitable for research in this area. Integrated Projects are intended to build a critical mass of activities and resources needed for achieving ambitious, clearly defined scientific and technological objectives. They are co-financed up to several tens of millions €, with the duration of typically three to five years.

Towards large-scale deployment of Intelligent Integrated Road Safety Systems

The potential contribution of the introduction of Intelligent Integrated Road Safety Systems including Advanced Driver-Assistance Systems for enhancing road safety and security has already been demonstrated by the industry in a

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[6] The Information Society Technologies Programme is part of the European Union's Fifth Framework Programme for research and technological development (RTD), covering the period 1998-2002

[7] See www.europa.eu.int/information_society/programmes/esafety/index_en.htm

[8] See www.europa.eu.int/comm/research/growth/gcc/menu-researchthemes.html

[9] Council decision 3 June 2002 concerning the specific programmes implementing the Sixth Framework Programme 2002-2006 of the European Community for research, technological development and demonstration activities (2002-2006)

number of European RTD projects. However, to realise the potential benefits, the new systems have to be widely deployed in the marketplace.

The technology is in some cases already fully developed. Unfortunately in most cases there is still an important gap between technology development and its deployment at a reasonable cost and in sufficient quantity. These technologies have to be assessed in co-operation with the industry in terms of their impact on accident reduction and their cost, so that priorities can be set for their introduction. Liability, standardisation, certification, and financial incentives need to be considered.

New technologies for more sustainable transport

The environment has become a major influencing factor on the motor industry. Environmental legislation affects both the design and performance of motor vehicles and the ways in which they are manufactured. In addition, environmental considerations have also become an argument for sales of vehicles.

For both cars and commercial vehicles, great progress has been made in reducing the levels of pollutant emissions from the tailpipe and by evaporation. Emissions of noise have also been reduced. Further actions, though, might be necessary to ensure sustainable mobility.

These actions include measures to make the road transport less energy consuming and polluting; to address the full life cycle of vehicles, including recycling; to improve safety and reduce accidents, injuries and fatalities, and measures to make the transport system more efficient. The best tools available for us today for achieving sustainable mobility are those offered by new technologies. The way forward is the approach of the intelligent vehicles and intelligent transport systems. The technologies improving safety have the potential to contribute also towards more sustainable transport.

2. INTELLIGENT INTEGRATED ROAD SAFETY SYSTEMS

2.1. The problem: Human errors in road traffic

Research has shown that 90-95% of road accidents are partly caused by human errors. In order to identify relevant errors a behavioural study/model is necessary. In the most quoted models distinction is normally made between the strategic level, tactical level and operational level.

Literature shows that the probability of human errors depends on certain error shaping conditions:

- External conditions e.g., limitations of vision by obstruction or blinding
- Errors caused by distraction (e.g., phone, conversation)
- Overload
- Underload, caused by extended absence of sufficient stimuli (highway hypnosis)
- Physical condition of the driver: fatigue, alcohol and drug abuse.
- Insufficient interaction time (high speed differences)
- Unfamiliarity with location and/or local driving behaviour
- Ignorance
- Lack of adequate skills or training

Furthermore, an important general error shaping condition is the available time (hurry). Aside from this list, errors in judgement of own capabilities, vehicle capabilities and assessing the state of the environment are of importance. It is obvious that active safety systems and applications which support the driver's perception can help the driver to perform his or her complex driving task, if the design of the system is according to the important human-machine interaction principles.

2.2. Taking an integrated approach to road safety

Integrated Intelligent Road Safety Systems will use information society technologies and intelligent transport systems in vehicles and the infrastructure for improving the safety of the vehicle, taking an *integrated and global approach to safety,* where **the involvement of and interaction between the driver, the vehicle and the road environment are addressed together.** Integrated Safety Systems will help the driver in vehicle control and use new sensors for collision warning and mitigation, lane keeping, vulnerable road user detection, driver condition monitoring and improved vision. Other technologies will provide for automatic emergency calls, adaptive speed limitation, traffic management and parking aids.

All safety systems which are introduced into the vehicles should be designed to meet certain basic requirements: reliability over time and with regard to external influences, robustness in case of a system malfunction or misuse, perceptibility of the human machine interface, comprehensibility and predictability of system functionality, controllability in every situation and consideration of foreseeable misuse.

As the life-time of the in-vehicle telematics products is substantially shorter than that of the automobile, open systems architecture, standards and inter-changeability are key issues, offering also the industry the possibility to develop components and software for use in a variety of in-vehicle and portable platforms, with multiple types and multi-sensorial interfaces (visible, audible, tactile etc.). For the industry at large, the challenge is to develop new, dependable open software and applications, aiming at offering the consumers a wide choice of competitive, interchangeable, upgradeable, personalised, and seamlessly networked products and applications. The vehicles have to remain safe and in compliance with the legal requirements, also if these new systems are fitted in the after-market.

2.3. Extending autonomous on-board functions with interactive and co-operative systems

Most of the existing safety systems and those under development operate autonomously on-board the vehicles.

Autonomous systems have their limitations. Enabling the vehicle to communicate with other vehicles or with an intelligent infrastructure could bring further benefits, including the extension of the functionality for preventive safety. Today, initial or experimental implementation of these systems already exists, e.g. e-Call, speed warning systems on specific stretches of road; traffic information and hazard-warning. In the longer term, co-operative traffic control and management will become a possibility when vehicle on-board systems can interpret data from sensors embedded in infrastructure, supplementing or replacing conventional visual signals and enhancing safety. Infrastructure-to-vehicle communication can be used to realise traffic sign recognition and to transmit speed limit information. Furthermore, information about critical road conditions (e.g. stationary vehicle or icy road ahead) can be transmitted, if suitable sensors are located at the road side.

It can be expected that in the near future, many of the onboard safety functions will be complemented by co-operative technologies, while further advances in road safety are brought by co-operative functions. **Therefore, in this report the safety systems are addressed by safety function.** Some of these functions are based completely on autonomous in-vehicle technologies while some others use also complementary, interactive technologies.

2.4. The most effective safety function

Most of the accident databases relate the accident to a small set of accident manoeuvres. However, the distribution of the registered accident causes varies per country, and the data collection methods in the different countries vary also. Most accidents are also a consequence of multiple problems.

For these reasons, *it is not possible to determine today what might be the most effective safety function* and which function would save most lives. Therefore, the industry is engaged in the development and deployment of a relatively large number of Intelligent Integrated Road Safety Systems, like safe speed and speed warning, vehicle collision alert system, lane support, safe following, pedestrian protection, intersection safety, vehicle dynamics, driver monitoring and improved vision and perception systems. These systems, their potential impact and the complementing co-operative systems such as Emergency Call and Traffic and Travel Information are discussed in detail in the next Chapter.

3. THE BUILDING BLOCKS FOR INTEGRATED SAFETY

3.1. The need for Accident Causation Data

One of the most important building blocks in setting up a strategy for the deployment of intelligent integrated road safety systems into the vehicles is the availability of a European wide database of accident causation data. Only on the basis of clear statistics on the causes of accidents can the impact of new safety systems be evaluated and the real potential of these systems highlighted. Targeted actions can then be formulated, and the deployment accelerated.

Accident statistics for all Member States exist (e.g. the EU CARE database[10]), but consolidated data on accident causation does not. However, in some countries comprehensive data sets are available and automotive manufacturers and insurance companies have also substantial data sets (e.g. GEDAS, LAB, DEKRA and Volvo databases). A European Accident Causation Database is needed. Such a database might be built on the same foundations as the current EACS database[11]. EACS is not sufficiently large nor is its coverage enough to guarantee the kind of reliable picture of accident causation required. Nevertheless, it could form the basis of a suitable database. Another important aspect that should be taken into consideration when building this database is the homogeneity of the data collected in the different European countries. This could be ensured through the development of a European system based on an easy to use advanced IT software for homogeneous data collection and processing.

Recommendations:

(1) Consolidate analyses from the existing EU, Member State and industry road accident data which give information on the cause and circumstances of the accidents, for allowing the determination of the most efficient countermeasures, starting from the most frequent accident types.

(2) Define a common format and structure for recording accident data in the EU countries. Develop jointly an European Accident Causation Database covering all EU and enlargement countries, and provide open access to industry and public agencies.

3.2. About the impact assessment of safety systems

Before the market introduction of any safety-related new functions on the vehicles, their potential impact on road safety, and possible negative side effects have to be analysed. This is imperative from the point of view of the liability of manufacturers, estimation of socio-economic cost-benefit, and consumer awareness and protection.

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[10] CARE database: http://europa.eu.int/comm/transport/home/care/index_en.htm

[11] European Accident Causation Survey (EACS) Methodology, ACEA with the support of the European Commission and European Road Safety Federation (ERSF)

Unfortunately a systematic assessment of the impact of intelligent safety systems on road safety for Europe does not yet exist. Some preliminary data has been obtained in studies performed by individual automotive manufacturers and in EU funded RTD Projects. Additional data is available from U.S. studies, and those undertaken by some Member States. This data is not, however, sufficient due to the fact that most of the systems are at prototype level and the existing impact assessments in real environments are done on too small samples or through simulation.

In the view of European vehicle manufacturers there is no completely certain *ex ante* way of assessing the impact of the introduction of technologies or functions on accident or casualty rates, especially for active safety devices.

Nevertheless, the potential impact of safety systems including ADAS can be derived from the analysis of accident causation data. Here also a European database for accident causation data is urgently required.

Once a database of accident causation has been established, scenarios for the most common accidents can be drawn up. By studying the most frequent accident scenarios and their associated causes, it is possible to determine *a priori* which technologies/functions might have avoided the accidents or mitigated their severity, and to assess the relevance/potential of given technologies in these scenarios. Also, the evaluation of the possible side-effects has to be performed.

Recommendations:

(3) Develop methodology to assess the potential impact of intelligent integrated safety technologies in Europe based on the accident causation data. This work should carry out analysis of combined systems (fusion of sensors, integration and use of multiple active safety systems together).

Develop validation methodology and procedures for vehicles equipped with Intelligent Integrated Road Safety Systems.

(4) Set up a coordinated validation framework for operational tests for active safety systems in the Member States.

3.3. Human-Machine Interaction

Information transmitted to the driver might distract him or her from the current task. This might be dangerous if the driver is performing a difficult manoeuvre. Systems of prioritisation and management of information can be implemented.

Human-Machine Interaction with increasingly more complex in-vehicle systems is a major concern. To tackle this other important issue, the Commission published in 2000 a Recommendation on Safe and Efficient In-vehicle

Information and Communication Systems[12]. This Recommendation requests the industry to take account of guidelines contained in the recommendation, and the Member States to follow-up their implementation and to report to the European Commission within a period of one year. Some Member States have answered, but the picture is still incomplete.

Recommendations:

(5) Assess the reports by the Member States on the Commission Recommendation "Statement of Principles on safe and efficient in-vehicle information and communications systems", and decide on further actions as necessary taking into account the rapid development in this area.

The use of portable (nomadic) devices requires urgent assessment of risks.

(6) Develop workload assessment, testing and certification methodology and procedures for complex in-vehicle working environments involving interfacing with in-vehicle devices for vehicle control, driver assistance, intelligent integrated safety, including Multi-Media systems.

3.4. Road Map for Intelligent Integrated Safety

Why a Road Map?

The Intelligent Integrated Road Safety Systems hold a huge promise of a safer future for all road users. Some of these systems are already on the market, and more will follow. Gradually, these systems will assist the driver in maintaining safe speed, following other vehicles safely, avoiding un-intentional lane departure and accidents at intersections, detecting in time the vulnerable road users, and help him in all emergency situations.

Their market introduction is, however, a highly complex issue, involving policy, technological, societal, business, legal and consumer aspects. In the market introductions, we have to carefully balance the following perspectives:

- The automotive industry has to be allowed to undertake market introductions freely, based on their own assessment of the technological readiness and safety (functionality, reliability, robustness), the market situation and competition, availability of supporting infrastructure and incentives, etc.

- The consumer demand, and willingness to pay for Intelligent Integrated Road Safety Systems depends on public perception of potential usefulness and benefits. It is clear that public perception cannot be based on individual safety technologies, because this is far too complex. The use of relatively simple, universal concepts for vehicles equipped with (the same) set of safety features would be clearly beneficial.

[12] Commission Recommendation of 21 December 1999 on safe and efficient in-vehicle information and communication systems: A European statement of principles on human machine interface Text with EEA relevance (notified under document number C(1999) 4786) , published in the OJ 25 01 2000 L19

- The safety functions should be standardised at functional and operational level, so that they operate in a similar, predictable way in all vehicles.

- From the societal point of view, it has to be possible to estimate the potential impact of the Intelligent Integrated Road Safety Systems on road accidents and fatalities, and to use this information to determine if further measures are required. For example, financial or tax incentives, directives and regulation can be used for harmonising the market and enabling take-up.

- The industry is mainly targeting the introduction of the new systems in new vehicles. However, considering the replenishment rate of the existing vehicle fleet, additional measures may be required for removing older vehicles from the fleet, and/or equipping vehicles in circulation with more efficient safety systems.

A Road Map that balances the above-mentioned views, and introduces clear milestones for Intelligent Integrated Road Safety Systems is therefore seen as a key element for their successful take-up. This Road Map should indicate the technical and economic capability of the automotive industry to deploy intelligent integrated safety solutions, and, for the public sector, the time-table for infrastructure investments and other support measures.

Intelligent Integrated Safety: Technical maturity

The following is a summary of the potential maturity of the various Intelligent Integrated Road Safety Systems, based on the analysis later in this Chapter and the results from EU supported RTD:

Safe speed

Systems that warn the driver of excessive speed or assist him or her to keep to the speed limit could be put in vehicles using on-board digital maps (EU RTD Projects ACTMAP and NEXTMAP), using infrastructure-based systems, or their combination. These systems are not yet fully mature for the market introduction, mainly because of unavailability of speed data attributes for the digital maps.

The work done by National governments such as the Netherlands, the UK, Sweden and Belgium should be followed closely and a benchmark or best practice exercise could be launched.

Lane support

Lane keeping, lane departure warning and blind spot detection could have a large impact on road safety. A system performing these functions is commercially available for trucks. These systems were also developed and tested in FP4 projects (IN-ARTE and LACOS) they exist as prototypes for cars.

Safe following

ACC is already in the market, although only in top-of-the-range cars. It is expected that ACC will be made available in more and more of the new cars, when the manufacturing costs, especially the sensor technology gets cheaper.

Pedestrian protection

Technologies for pedestrian protection, like PROTECTOR or SAVE-U are not mature yet. Follow-up of the progress in developing and deploying measures to

improve pedestrian protection included in the indicative list in the industry commitment on pedestrian protection[13] is required.

Improved vision

Systems for artificial vision or improved vision already exist but they are expensive. Implementation of intelligent lighting systems should be supported, although they are anyway coming into the market little by little (always in the top-of-the-range vehicles first).

Driver monitoring

RTD projects are working on it and first results are promising but technologies and systems are not mature for the moment.

Intersection safety

Very little exists for in-vehicle systems, the problem could be better and faster solved with systems based on the infrastructure. A great deal could be done by improving infrastructure: intersection design and construction. These improvements are essential for achieving benefits from intelligent integrated road safety systems.

Vehicle dynamics

Electronic Stability Programme (ESP) is in the market and has a significant impact on better vehicle stability especially in avoiding skidding and while braking. The implementation of ESP in all cars could be promoted.

Work on vehicle dynamics through the x-by-wire is very interesting and looks very promising but solutions are not yet available for full drive-by-wire.

Vehicle-to-vehicle and vehicle-to-infrastructure communication

Ongoing activities aimed at providing drivers with on-line information e.g. by road operators using DSRC link show promising developments. However, in the specific case of co-operative safety systems, these by definition pre-suppose that other vehicles and/or infrastructure are also be equipped with the system, in order to become effective. However, in the market introduction phase this pre-condition cannot be expected to be easily met. Thus, an early buyer of the inter-vehicle or infrastructure-based hazard warning system is unlikely to perceive immediate benefits and consequently, he/she may not be willing to pay for the system before a significant percentage of other equipped vehicles are already on the roads and the infrastructure are equipped.

Short and medium-to-long term time to market

The analysis above indicates that there are a number of systems that still need to complete the basic RTD phase and are therefore not yet ready to be considered for commercialisation.

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[13] COM(2001) 389 final, 11.07.2001 – Communication from the Commission to the Council and European Parliament – Pedestrian protection: Commitment by the European automobile industry

Other systems are being considered for commercialisation but are still dependent on market demand and a valid set of business conditions. These could be considered for early launch but only when all supporting factors are in place.

Recommendations:

(7) a) Develop regularly reviewed Road Maps with technical steps and economic implications for the introduction of Intelligent Integrated Road Safety Systems.

These Road Maps should indicate the technical and economic capability of the stakeholder industries to deploy intelligent integrated safety solutions.

b) The public sector Road Maps should indicate the investments required for improvements in the road networks and information infrastructure based on the industrial Road Maps, and identify the steps needed for removing regulatory barriers.

3.5. Intelligent Passive Safety Systems

Intelligent passive safety technologies encompass the sensing technologies that enhance the passive safety systems and reduce the seriousness of unavoidable crashes. Examples of the technologies include pre-crash sensing, activation of passive safety systems adapted to optimise protection (including systems for the protection of vulnerable road users) and anticipated alerting.

The passive safety systems will keep on contributing to the reduction of the number of road fatalities. Intelligent passive safety systems, which use information from active safety systems for adapting to the parameters of the unavoidable collision, are expected, to be more efficient.

3.6. Intelligent Integrated Road Safety Systems including ADAS

Safe Architecture

Vehicle Electronics Safe Architecture is the basic building block on the way towards the development of cost-effective in-vehicle safety technologies, starting from active chassis control. Significant effort has to be put into the development of fail-safe technologies, on-board communications, sensors and actuators with a particular emphasis on sensor fusion.

Safe speed and speed warning

These systems relate to keeping a safe speed for instance related to the road and environment or when approaching curves, congestion or adverse road conditions. Examples of these systems include curve speed prediction, traffic sign recognition, speed advice, road status, and intersection support using vehicle - infrastructure communication. It is possible to develop systems linked to intelligent speed adaptation, based on GNSS positioning or vehicle-to-infrastructure communications e.g. using DSRC or a combination of the two, that

will alert drivers to the speed limit according to the current traffic situation. A link with traffic models could allow better short term forecast of traffic conditions.

Excessive speed is one of the major causes of accidents on European roads. Speed is intimately related to the risk and severity of a crash. The UK Department of Transport[14] states that research has shown that speed is a factor in about one-third of all road accidents. The report says that excessive and inappropriate speed is a contributing factor to the death of around 1200 people each year and to injure 100,000 more. The German Federal Statistic Office[15] identifies 88,770 accidents, or 25%, in 2001 in which "unadapted speed" is a factor. An ADAS function for safe speed, safe following and improved vision and stability could be beneficial in reducing frontal and rear end collisions. Speed warnings could reduce the seriousness of perhaps 500,000 accidents and reduce fatalities by 10-12,000 per annum.

The safe speed systems have a potential for both increasing safety and improving traffic flow. On motorways, for example, vehicles moving much slower or much faster than the median speed are over-involved in accidents. In 30 km/h zones it is shown that traffic-calming measures have good potential to reduce accidents. It is widely recognised by the stakeholders (industry, road authority) that these applications should be *assisting* the driver in keeping a safe speed , i.e. that the driver should remain attentive to the driving task and responsible for the vehicle's actions (driver in the loop).

Vehicle Collision Alert System

On European roads, many accidents occur due to poor visibility. Especially in the case of fog, the number of severe traffic accidents is significantly above-average. Rear fog-lights and hazard flashing lights as well as the vehicle´s optical warning devices, are in many cases not sufficient for timely and effective alerting of drivers of following vehicles. Hazard warning systems based on sensors as well as direct vehicle-to-vehicle communication link can improve traffic safety significantly in such situations.

Possible technical options are currently being investigated, e.g., in the German-French research project DEUFRAKO-IVHW, a low cost system for inter-vehicle hazard warning on roads has been specified and has been demonstrated. The system is designed to create perceivable benefits at an expected penetration rate of 10-15 %.

Lane support

These systems decrease unintentional lane departure, leading to a decrease of collisions with other vehicles and single vehicle accidents usually associated with road departure. Lane support currently exists as an autonomous in-vehicle system. The possibility exists to extend this by vehicle-to-vehicle communication to a system which alerts road users to unexpected changes of lane. Examples of these systems include Lane keeping, Blind spot warning, Lane Change

[14] Tomorrow's Roads: Safer for Everyone, http://www.roads.dft.gov.uk/roadsafety/strategy/tomorrow/

[15] See website www.destatis.de/basis/e/verk/trafttab9 (also time series data available from the same source)

Assistant, Driver Drowsiness Detection and warning. Lane support systems may require complementary/support infrastructure investments (e.g. better lane markings).

The German Federal Statistical Office[16] estimates that of 466,863 road accidents in 2001, 54,908 were attributable to overtaking errors, or mistakes while turning off. Unfortunately the number of fatalities is not reported.

Preventing steering errors in heavy traffic will lead to fewer serious accidents and associated consequences for infrastructure use. Active heading control systems will also strongly contribute to the user comfort. Deployment is slowly taking up, but only in the freight sector (trucks). Nevertheless in Japan some cars equipped with lane keeping and lane departure warning systems are already in the market.

Safe following

These systems will automatically maintain distance and optionally adapt the speed. This function could be implemented through a class of collision mitigation systems, building on today's cruise control systems, with added sensors, warning systems and communications. Most of the proposed systems require a well-controlled traffic situation, such as found on motorways. Examples of these systems include Collision warning, Collision mitigation, ACC, Platooning, Stop & Go, and Vehicle-vehicle communication.

The avoidance of the primary instance of collision can be successfully repeated by passing warning data, and possibly causing a partial activation of braking systems, through a chain of following vehicles. This should lead to a reduction of multiple vehicle crashes.

The German Federal Statistic Office estimates that 55,740 accidents, or 15%, involved insufficient distance between vehicles. In a study done at Volkswagen, an analysis of the pre-crash braking behavior shows that in severe accidents about 85% of drivers either did not brake at all or not to the full possible deceleration. While the human factors behind this are still not perfectly understood, this finding is the rationale for Assistant systems that maintain a safe distance between vehicles (ACC, Stop&Go) or that assist the driver in emergency breaking maneuvers.

Pedestrian protection

The voluntary commitment by the European automotive manufacturers covers a set of measures for the protection of pedestrians. This commitment covers testing of the fronts of the vehicles, support for ICT in improving active safety (as suggested in Annex IV of the Commitment) and the progressive installation of additional active safety measures.

Active pedestrian protection systems can warn when the risk of an accident with a pedestrian or a vulnerable road user is high, and significant safety improvements can be expected in urban and rural areas. There is a strong link

[16] http://www.destatis.de/e_home.htm

to (intelligent) passive safety systems. Examples of these systems include: Vulnerable road user protection, Pedestrian awareness.

15% of the total number of people killed on European roads are pedestrians, and 28% are vulnerable road users[17]. Although the relevant technologies are not mature today, it is important to continue research into ADAS functions for the protection of vulnerable road users.

Intersection safety

Evidence suggests that intersections are particularly dangerous. They are also a particularly challenging problem for collision mitigation systems. Alongside the conventional vehicle-related collision warning systems, there are also systems in development (particularly in Japan and the USA) that monitor dangerous intersections and warn or inform drivers of vehicles entering or approaching the hazardous zone. These systems employ detection functions and road-side-vehicle or even vehicle-vehicle communication. Due to the high complexity of these situations, the requirements for reliability and accuracy are high. Strong potential is expected in complex urban and rural intersections.

UK statistics[18] indicate that 61% of personal injury accidents happen within 20 meters of a junction. NHTSA[19] claims that 30% of all crashes occur at intersections, causing 6700 fatalities per year. The German Federal Statistical Office identifies 86,497 accidents involving failure to observe priority or on entering the road (overall 34% of the accidents happens at intersections, with failure to observe priority 19%, turning off mistakes 10%, entering or starting off the road 5%). This suggests that feasible technical solutions reducing this type of accident by 50% would save 6000 - 7000 lives per year in Europe.

Vehicle dynamics

These systems combine vehicle dynamics and speed assistance and support in managing the vehicle when for example to reduce the braking distance or to prevent it from skidding or rolling over. These systems may lead to a decrease in serious accidents, especially in freight transport, as these systems are especially attractive for heavy road users. Examples of these systems include roll-over warning systems and roll stability control, road surface monitoring (loss of traction alarms)

Most promising for the mitigation of lateral impacts is a system that maintains stability (i.e., reduces side-slip angle). It will be beneficial even under the most pessimistic assumption that it does not avoid any accidents but simply transforms them from lateral to frontal, which are generally more survivable. This change alone would already reduce the fatality rate in this type of accidents from about 18% to less than 7%[20]. Such a system, known as ESP, is now optional or even standard on many current passenger cars. Preliminary findings on accident

[17] See the CARE database, http://europa.eu.int/comm/transport/home/care/index_en.htm

[18] Department of the Environment, Transport and the Regions. Personal Injury Road Accidents: Great Britain 1998.

[19] National Highway Traffic Safety Organisation (U.S. Department of Transport), http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/index.html

[20] Based on data in the GIDAS Database.

causation analysis seem to confirm a very high efficiency of today's ESP systems in terms of reducing skidding. This observation is also in line with an *a priori* estimation of ESP efficiency published by the German Insurance Association. Future automobiles may provide an even better platform for stability control. Steer-by-wire systems will enable ESP not only to apply the brake on selected wheels but also directly to influence steer angle. Precision navigation systems and digital maps will provide accurate information on the vehicle's position with respect to the environment. Thus ESP will no longer solely depend on steer angle information to determine the desired vehicle trajectory.

Driver monitoring

Driver monitoring systems which are currently in the research phase can non-intrusively detect driver drowsiness and/or degraded driver performance, and provide in-vehicle warnings. In the future it will be possible for such warnings to be sent to a traffic control centre to enable appropriate measures to be taken. Warnings could also be sent to adjacent vehicles.

The previously cited UK report states that between 10 pm and 4 am 672 people were killed with a further 5363 seriously injured in 2000. NHTSA claims that drowsiness was a factor in crashes in which over 1400 fatalities occurred. Overall in the UK, 1926 deaths occurred at night or in wet conditions on roads in 2000, or some 56% of total deaths. A UK Department of Transport publication states that over 16,000 accidents in 1998, including 460 deaths were caused by accidents where at least one driver was over the legal alcohol limit. The same source states that fatigue may be the principal factor in around 10% of all road accidents.

Although it is difficult to draw a firm conclusion, systems to warn of fatigue and reduced driver performance, especially if integrated with enhanced vision and road-state data, might save a large number of lives.

Improved vision systems

Improved vision systems help the driver in his task to perceive the environment, especially when in difficult conditions, like night and bad weather. Examples of these systems include improved infra-red vision systems and adaptive lighting systems for different driving conditions.

Need for further RTD in technologies for safety systems

The future development of the above-mentioned safety functions requires RTD in a number of technologies. This RTD should cover, as relevant, improvements in sensors and sensor data fusion, situation capture in complex environments, improvement of vision during night or detrimental meteorological conditions, fail-safe systems, advanced adaptive restraint and safety systems, vehicle electronic safety architecture, vehicle-to-vehicle and vehicle-to-infrastructure communications technologies, accurate and reliable location technologies, safety uses of DSRC and pedestrian detection and protection technologies.

Recommendations:

(8) Analyse existing accident causation data and possible countermeasures, and determine clear goals and priorities for further RTD in Intelligent Integrated Road

Safety Systems in industrial research, Community Research (Integrated Projects in the 6th FP) and national research programmes.

(9) Identify existing specifications, and where necessary develop new specifications for pan-European, standardised interoperable interfaces and communications protocols for vehicle-vehicle and vehicle-infrastructure communications which will support interactive, co-operative safety systems and services, including Traffic and Travel Information.

(10) Pursue international co-operation in the development of intelligent integrated safety technologies.

The co-operation should cover especially Human-Machine Interaction, certification and testing methodology and procedures, harmonisation and standardisation, legal issues, impact and socio-economic benefit analysis, and benchmarking/best practice.

3.7. The European Safety Map database

General principles

Navigation systems are increasingly becoming standard equipment in European cars. Based on the positioning capability of the vehicle, location-aware driver information systems can be built, that increase road safety by informing the driver in advance of safety issues related to the road section ahead.

Implementing map based safety systems that provide on-the-spot as well as predictive road information e.g. speed alert, curve warning, slope warning, require an appropriate digital map which contains the respective road safety related data attributes.

It is evident, that these safety related data must be of particularly high quality and reliability and that a permanent up-date process will be required to ensure the data quality also over the life time of the vehicle.

Market forces that drive the navigation market push currently for additional trip/travel related content (e.g. points of interest, tour information, service related data), and not for safety relevant road network data (e.g. speed limits, road bend shapes, slope gradients, road danger warnings).

Considering these current market signals, it is evident that due to commercial constraints a European Road Safety (ADAS) Map Data base, a key enabler for autonomous applications, is not likely to appear on the market as a sufficiently low-cost product which would enable large scale take-up of safety applications. This finding is in line with the experiences of traffic information services, which have shown that the citizen is not willing to pay additionally for traffic congestion or traffic safety related information, as it is clearly seen as one of the tasks of public authorities in ensuring safe and efficient mobility.

Actions required

Thus, the lack of a digital map containing safety related road data of high quality, turns out to be a major barrier for the introduction of autonomous and interactive safety systems.

European road map data bases containing additional agreed attributes for driver-support and advisory purposes should be produced, maintained and certified under the responsibility of a public-private partnership and made available at acceptable prices for end users (possibly free of charge) and in an open format to all parties interested in implementing Intelligent Integrated Road Safety Systems and services. This partnership should among other tasks, define which data, attributes, functions and services will be required from both the mapping industry and the public sector road authorities, and determine how they will be compiled and certified. An important additional application will be the production of a specific database for commercial vehicles including data on weight, height and width restrictions on the road network.

The mapping suppliers already have an extensive road map data base to which must be added agreed road safety attributes. These should be provided in digital form to industry standards by the public sector authorities.

As a consequence, suitable business models need first to be established by all parties concerned, with the goal of ensuring delivery of digital road safety map data bases by the mapping industry, ensuring appropriate revenue generation for the private mapping suppliers involved.

Recommendations:

(11) Based on existing research results, define requirements for a European digital road map database. This database should contain in addition to road map data agreed road safety attributes for driver-support for information and warning purposes, such as speed information and road configuration data.

Create a public-private partnership to produce, maintain certify and distribute this digital road map data base. It should be made available for all users at affordable prices (possibly free of charge). National, local and regional authorities and operators should provide safety-related data on road configurations within their networks, with target dates for implementation.

3.8. Emergency Calls (e-Calls) and E-112

<u>E-112 regulation and implementation in the EU</u>

The response time of emergency services attending the scene of accidents varies greatly across different regions of the Union. Infrastructure operators and authorities currently depend on notification of accidents and incidents through telephone calls (fixed, and increasingly mobile), or through data provided by video, radar or other sensing equipment. Especially in the case of mobile calls, the location of the accident or incident cannot be accurately determined in 40% of the cases.

Providing accurate positioning information will reduce response time, reduce trauma in victims, increase survivability and provides the opportunity for enhancing the complete incident and road emergency management chain. A study conducted by the European Commission indicates that a 10% reduction of fatalities can be achieved by improvements in the response time, due to better location information[21].

Therefore, the Commission launched an initiative for making it mandatory for telephone network operators to provide the best possible caller location information available to emergency authorities. This provision is contained on the new electronic communications package[22] (Universal Service Directive, Data Protection and User Rights Directive, which regulates access to location data and privacy), and will become mandatory in all Member States from July 2003.

Privacy is a major concern in the provision of location information. The majority of the users agree that in case of a life-threatening emergency, privacy and the authorities should overrule data protection rights. 64% of the users even go so far to accept recording of the call, in order to be able to reconstruct the process later if needed.

Besides the provisions mentioned above, implementation guidelines are required. These will be published by the European Commission by the end of 2002 in a Commission Recommendation on the processing of caller location information for the purpose of location-enhanced emergency call services. These implementation guidelines are based on the deliberations of the CGALIES[23] group and a recent study on caller location in telecommunications networks[24].

Commercial in-vehicle e-Call systems

In cases where a vehicle is involved in an accident, an emergency call with location information can be initiated automatically. This basic function which should be implemented immediately can be in the future complemented with additional safety-related information, which can be passed to the call center via a commercial Service Center.

From project surveys carried out by the EC-funded project E-MERGE in the partner countries, users clearly preferred an automatic call (in the case of Airbag

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[21] IST-1999-14093 LOCUS Location of Cellular Users for Emergency Services, http://www.telematica.de/locus

[22] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive)
Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive)
Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)

[23] Final Report of CGALIES (Co-ordination Group for Access to Location Information by Emergency Services), http://www.telematica.de/cgalies/

[24] Caller Location in Telecommunication Networks in View of Enhancing 112 Emergency Services, 30 April 2002 by Helios Technology Ltd

release) and manual call (via SOS button) system. Exact location information is seen as the most important feature of an in-vehicle emergency-call system. The majority of people have no objections to their telephone number being displayed at the call centre to facilitate a call back if needed.

The Public Service Answering Points (PSAPs) are normally not yet equipped to handle the location information or the above-mentioned additional information for the provision of location-enhanced emergency services. The automotive industry together with service providers is currently developing data requirements and interface specifications for vehicle-originated emergency calls, or the so called e-Calls[25]. The aim is to establish specifications and call routing and handling procedures which would allow for pan-European inter-operability. To reach economies of scale and to drive adoption rates that allow for Community-wide benefits to be realised, an integrated strategy for pan-European emergency services needs to be driven from the European institutions. The successful co-existence of commercial Service Centers and publicly operated PSAPs requires defining the interface between them and solving the related liability and responsibility issues.

Public sector involvement

The infrastructure will have to handle manual and in the future also automatic emergency calls from vehicles and mobile devices. The actual location information is either generated by the on-board system (normally based on GNSS), or determined by the public telephone network operator using either handset-based or network-based methods. This location information is then passed to the PSAP.

The PSAPs, as well as the emergency response vehicles, must be equipped with equivalent map databases with Graphical User Interfaces to handle the emergency call location. This requires large-scale investments by especially the civil protection authorities (PSAPs, ambulances, fire trucks etc). Standards are required for the location information (vehicle or mobile to infrastructure) and for the interface between the communication network and PSAPs, and for the additional information between PSAPs and commercial Service Centers.

The Commission is proposing, for the follow-up of the implementation of E-112; to establish an European Emergency Communications Forum (EECF).

Recommendations:

(12) After consultations (telecommunications authorities, civil protection authorities, industry through CGALIES) adopt a Commission Recommendation on the introduction and implementation of E-112 in Europe.

(13) Establish a European Emergency Communications Forum to continue the CGALIES work and to monitor the implementation of E-112 in the Member States.

[25] IST-2001-34061 E-MERGE Pan-European harmonisation of vehicle eMERGEncy call service chain http://www.ertico.com/activiti/projects/e_merge/e_merge.htm

Establish national liaison groups to co-ordinate the implementation and building up of the E-112 service chain.

(14) For in-vehicle emergency calls (e-calls), establish data requirements and data transfer protocol for e-Calls originating from vehicles. Establish an interface specification and routing and handling procedures for e-Calls with location and other accident-related information.

3.9. Traffic and Travel Information

Real-time TTI for road safety

Accurate, reliable and on-time Traffic and Travel Information has the potential to increase the safety and efficiency of the transport system in many ways. With real-time traffic information, the road users can avoid congestion and bottlenecks, select alternative routes and avoid secondary accidents and incidents in urban areas and the motorway network.

Multiple services are in use in Europe, with various technologies. RDS-TMC is the only available pan-European service, supported by the TMC Forum. The co-operation between the car industry and service providers has produced many commercial services for multiple platforms (in-vehicle platform, internet and mobile phones). On the side of data collection, so called Floating-Vehicle Data (FVD) is emerging as a new method for real-time traffic information.

Essential requirements for the establishment of TTI services are access to the public sector data, and capability of the private and public sectors to co-operate in service provision at local, regional, national and EU levels. In order to facilitate this, the Commission published in 2001 a Recommendation on the deployment of Traffic and Travel services in Europe[26]. This recommendations asks the Member States to report in 2002. Also, a Commission proposal for a Directive on "Exploitation of Public Sector Information" has been recently published[27], and is expected to become mandatory in 2005.

The commercial sector appears to be well placed to provide services in large conglomerations like London, Paris and Berlin. However, the realisation of pan-European TTI services and especially services providing all the necessary safety-related information cannot be expected from the private sector only. Public-private partnerships would be required for supporting European level services, and for supporting the business case for safety-related information.

Standardisation

Standardisation is guided by the Telematics Forum work program, which is being migrated to GST (Global Standard for Telematics)

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[26] Commission Recommendation on the development of a legal and business framework for participation of the private sector in deploying telematics-based Traffic and Travel Information (TTI) services in Europe, OJ L 199/20 24.7.2001

[27] COM (2002) 207 final dated 5.6.2002. "Proposal for a Directive of the European Parliament and of the Council on the re-use and commercial exploitation of public sector documents"

CEN and ISO have produced protocols and message sets standards RDS-TMC. They are in the process of developing a standard for RTTI via Digital Broadcast. CEN has also developed a standard for DATEX, (DATa EXchange between Traffic Control Centres), which is already in use.

Recommendations:

(15) Analyse the Member States' responses to the TTI Recommendation, draw up further actions if necessary, and make a progress report to the Council and the European Parliament.

(16) Create public-private partnerships to capture, process and provide real-time traffic, travel and road condition data from a variety of sources, including Floating Vehicle Data.

(17) Support the wider use of the pan-European RDS/TMC network for safety-related traffic information.

Provide a report with required actions to the European Commission on the status of RDS/TMC implementation and the remaining bottlenecks.

4. ADAPTING REGULATIONS AND STANDARDIZATION

4.1. Motor vehicle type-approval legislation

Within Europe there is an established type approval regime for motor vehicles and their components/systems. Under this regime, once a vehicle or component has been type approved against a set of technical provisions, it must be permitted to be marketed in every country that applies those provisions, without any further testing being required. In the EU, those technical provisions are contained in Directives, which are applicable to every Member State.

Before new passenger cars and motorcycles can be placed on the market within the European Union they must have obtained whole vehicle type approval against a specified set of directives. Those directives cover both safety and environmental aspects of the vehicle (e.g. braking systems, emissions, etc.).

The EU legislation is regularly up-dated to take account of technical progress, and wherever possible to remove requirements that would prevent new technologies being applied in vehicles. For example, steps are now being taken to amend the relevant legislative acts to enable the use of "steering-by-wire" and new types of adaptive headlamps that can direct the light into a corner.

Generally new solutions are coming forward in all areas of motor vehicle design based on new technologies including information and communication technology (ICT), and the electronic content in motor vehicles is increasing dramatically. It has been possible to integrate these new technologies without major legislative obstacles.

There is also the forum of the United Nations Economic Commission for Europe (UN/ECE), which prepares regulations which contracting parties to either the 1958[28] or 1998[29] agreements may apply. The European Community is a Contracting Party to these agreements and many of the regulations prepared under the 1958 agreement are accepted as alternatives to the directives prescribed for WVTA.

The European Commission also acknowledges that non-legislative market initiatives must be pursued in order to bring forward improvements in vehicles. As a supplement to the EU legislative acts the European, Japanese and Korean car manufacturers have, for example, committed themselves to further reduce the level of CO_2 emissions from vehicles and to introduce measures to reduce the fatalities and injuries of pedestrians. It can be foreseen that similar approaches could be used in the case of Intelligent Integrated Road Safety Systems.

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[28] E/ECE/324-E/ECE/TRANS/505 Rev.2 Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions.

[29] ECE/TRANS/132 - Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles.

Recommendations:

(18) Determine what actions may be required for rapidly bringing forward road safety improvements obtainable with Intelligent Integrated Road Safety Systems in vehicles.

4.2. Standardisation

An increasing number of vehicle control, safety and comfort functions are controlled by processors and software and sophisticated telematics services are becoming available on embedded in-vehicle platforms or portable terminals. The need for responsive standardisation process becomes extremely important. Standardised solutions guarantee wide market acceptance, higher volumes and lower costs, benefiting all consumers.

Within Europe there are three formal European Standards Organisation, CEN, CENELEC and ETSI.

CEN and CENELEC are the European Standardisation Committee and the European Committee for Electrotechnical Standardisation, respectively. They have the responsibility of promoting voluntary technical harmonisation in Europe in conjunction with world-wide bodies, and other standardisation partners in Europe. They have technical committees (TC) and working groups (WG) covering the full range of standards work. CEN is primarily responsible for the work on road transport, and within the ITS sector the relevant technical committee is TC 278 – 'Road Transport and Traffic Telematics'. Under TC 278 there are currently 13 WGs. Voting on draft standards within CEN is weighted according to the GDP- of the countries.

The global equivalent of CEN is the International Organisation for Standardisation (ISO) which promotes the development of voluntary standards to facilitate the international exchange of goods and services. Within the field of ITS, the lead technical committee is TC 204 (Intelligent Transport Systems), which has 7 active WGs and 23 sub-committees. TC 204 liases closely with TC 22 (Road Vehicles) and with CEN TC 278. ISO voting is vote per country.

ETSI, the European Telecommunications Standards Institute, develops standards for the needs of the telecommunication/electronic communication community. The telecommunications as well as radar standards are under the responsibility of ETSI ERM (EMC and Radio Spectrum matters). While ETSI develops radio standards, the allocation of frequencies are under the responsibility of the CEPT/ECC. Its global equivalent is the International Telecommunications Union (ITU-R). Both CEPT/ECC and ITU-R deal with radio frequency Spectrum allocation issues. ETSI co-operates with CEPT/ECC under a MoU.

In 1999, the Commission issued a mandate to the three European standardisation organisations (CEN, CENELEC and ETSI) to prepare a draft

programme for European standardisation in the ITS area. The report and recommendations have now been published[30]. International collaboration and strengthening liaisons between CEN and ISO are required especially with respect to vehicle standards, architecture, wide-area communication systems and traveller information systems.

4.3. Safety systems standards and regulation in the EU: State of the art

In-vehicle functions

A number of systems that affect the longitudinal control of vehicles are already in production, i.e. anti-lock braking systems (ABS), traction control systems, electronic stability control systems, brake assistant systems, throttle-by-wire, and adaptive cruise control (ACC). Others are under development, i.e. brake-by-wire, ACC with stop and go, collision warning/mitigation, and speed warning/adaptation.

In addition systems are being developed that influence the lateral control of vehicles, e.g. steer-by-wire, lane support, automatic lane keeping, advanced stability control systems using automatic corrective steering.

Other safety systems are available, or under development which do not directly affect the control of the vehicle, e.g. parking aids, tyre pressure monitoring systems (TPMS), enhanced brake lamps, and adaptive headlamps.

The type approval of braking systems has been in operation for many years based on EC Directive 71/320/EC and UN/ECE Regulation No. 13. Braking standards are also addressed in ISO TC 22. Emergency Braking is being discussed in Working Party 29 of the UN/ECE and ISO TC 22. Test procedures & standards for ACC have been developed in ISO TC 204, while “Adjustable Speed Limiters” are covered in UN/ECE Regulation No. 89.

All X-by-wire standards, (including steering) are being addressed by an expert Working Party of the UN/ECE, ISO TC 204, and the FlexRay Industry Consortium. Steering equipment is regulated by UN/ECE Regulation No. 79 and EC Directive 70/311/EEC. Installation of lighting devices is regulated by UN/ECE Regulation No. 48 and EC Directive 76/756/EEC, whilst the performance of particular devices are regulated by a number of separate Regulations and Directives. Standards for tyre pressure monitoring systems are under preparation in the US.

Vehicle-to-infrastructure communications

The available and emerging technologies include RDS-TMC, DAB, DSRC, GSM, GPRS, 3G, Bluetooth and others.

Standardisation is underway in CEN concerning GNSS and 3G wireless. Continuous Air Long & Medium Range Communications (CALM) and six new work items are making progress in ISO TC204, whilst CEN 278 with ISO TC204

[30] http://www.cenorm.be/standardization/tech_bodies/cen_bp/workpro/tc278.htm

is in charge of standards for RDS-TMC and derivatives. ETSI-IEC liaison stresses EU bandwidth availability issues.

No pan-European specification or standards exist currently for applications using communication to/from vehicles. This has lead to different systems in different countries, even if they are used for the same purpose, e.g. Electronic Fee Collection.

Vehicle-to-vehicle communications

The available and emerging technologies include Broad Band High Speed and 3G.

Continuous Air Medium and Long Range Communication (CALM) standards are being rapidly developed under ISO TC204. Bandwidth and spectrum allocation are being co-developed on the European level through the CEPT/ECC with the support of ETSI and ITU. CEN TC 278 is developing Traffic and Travel Information services via Digital Broadcast bearers.

Sensors

Many different sensor technologies are already available on vehicles, ranging from simple temperature sensors, through to advanced radar systems. It is in the field of spatial sensor that the greatest road safety benefits are likely to be achieved. Ultra-sonic and infra-red sensors are in limited production for use with systems such as reversing aids or interior monitoring for security systems. The 77 GHz radar for applications that need to 'see' long way ahead is in production and used in ACC systems. These sensors, though, are very expensive. The 24 GHz ultra-wide band radar for shorter range applications is in development with a view for production in 2005. These sensors are a fraction of the cost of the 77 GHz radars, but their use is not currently permitted as this frequency is currently restricted in the EU (US released 24 GHz SRR frequency allocation April 2002). See section 4.5 for more information.

Vision-based sensors using camera technology are under development for number of application, such as road sign recognition and driver alertness monitoring (e.g. monitoring of eye movement).

77 GHz is approved for use in vehicle system. For the 24 GHz the Harmonised ETSI Standard "EN 301 091" is in process with strong support from manufacturers & suppliers, ACEA, & CLEPA, (release due 1st quarter 2003*).* Completion of the ETSI Standard work depends on the CEPT/ECC frequency regulation process. 24 GHz SRR sharing studies with other services are progressing but need support from national administrations.

Multi-Media products

The available and emerging technologies include voice recognition, 'Hands-free' use, standardised docking ports for mobile (nomad) after market accessories, and standardised in-vehicle data buses.

AMI-C (Automotive Multi-Media Interface – Consortium) is progressing on three localisation API specifications for safe use of Multi-Media and nomad products.

A MOST Databus Standard is in production, while MOST and AMI-C have put into operation an MoU on co-operation. Many Nomad devices / PDA's are in production and are being introduced in the vehicles.

Recommendations:

(19) Analyse the specific needs and priorities of the intelligent integrated road safety systems for standardisation in ISO, CEN and ETSI.

For vehicle-vehicle and vehicle-infrastructure communications, promote the accelerated standardisation of emerging communications protocols.

For CEN, based on the recently published report of the M270 mandate, choose the appropriate mechanisms (Committee Working Agreements, full EN standards), and establish the necessary working groups.

4.4. Legal issues of market introduction of Intelligent Integrated Road Safety Systems

Legal issues in the market introduction

Information/warning systems

These are systems which only provide information to the driver, for example, by warning that the vehicle is too close to another, but do not physically take over the driver's role in any way. The driver remains fully in control of the vehicle at all times, with no physical driving functions being assumed by the system. Instead, information is provided for the driver to listen to or see, in order to assist in careful and proper driving. Therefore, where an accident or collision occurs after a warning has been given, and the driver fails to take the appropriate action, he is likely to have breached his duty of care to other road-users. Accordingly, it seems that the existence of such a system means the driver may have a higher standard of care, because a reasonable driver would not only take into account the usual factors when driving, but would also take heed of any information or warning, and take the appropriate action to avoid damage. Responsibility is therefore focused on the driver's care as to his driving behaviour. However, there remains a possibility that the information provided by the system may be incorrect or inaccurate. If this is the case, the manufacturer or distributor's liability should also be taken into account.

It should be noted, however, that in most cases, it could be difficult for the concerned parties to provide evidence of the malfunctioning of the system and then to determine the correct allocation of responsibility between the driver and the manufacturer.

Overridable intervention systems

The potential liability of the driver in negligence where the system is overridable will very much depend on the facts of each case. Important factors will include whether or not the system has inherent limitations, whether the driver takes note of and acts appropriately in relation to any warnings about the consequences of

such limitations, and whether in the circumstances a reasonable person in the same situation could have overridden the system to avoid a collision. If a driver chooses to buy a vehicle with overridable functions, he may be exposing himself to a new degree of risk. By buying such an advanced feature, the driver takes on the responsibility of using the function in the appropriate manner.

Certain factors need to be considered such as the correct level of information and warnings released by the manufacturer about the functioning of the system. Indeed, the care of the driver in his driving behaviour may be classified on the basis of his capability to correctly utilise the system, taking into account the information and instructions made available to him.

Also, malfunctioning of the system may imply a manufacturer's liability, the possibility depending on whether it is possible to determine that the malfunctioning of the system caused the damaging event.

Non-overridable intervention systems

If the driver is not able to override the system, no liability for a breach of rules on behaviour in road traffic caused by the system arises, because such liability, as a pre-condition, requires that the driver is able to influence his driving. If there is no alternative conduct available to a driver, there is no fault-based liability.

If the driving support system is not overridable by the driver, the area of the manufacturer's liability in case of accident in traffic situations is likely to be broadened.

Given the importance of a driver being able to avoid accidents to the general safety of the public, a system which renders the driver powerless in certain foreseeable and likely situations should be considered as a defective and unsafe design.

Therefore, where damage ensues as a result of the intervention of a system which cannot be overridden by the driver, the manufacturer will be considered liable.

Such liability may fall under the general rules of tort law (general liability) or Defective Product Law (strict liability, which in EU countries is generally governed by the EU Directive 85/374).

However, notwithstanding that the likelihood of liability being imposed on the driver is strongly reduced in cases where damage is caused by the malfunctioning of vehicles equipped with non-overridable systems, it cannot be totally excluded.

There will always be other issues to consider, such as whether or not the driver of another vehicle has been negligent. Also, if a collision occurs where the functioning of the non-overridable system has no bearing (for example, it occurs as a result of the driver's failure to slow down, yet the system permits him to slow down), the driver of the vehicle may be liable in negligence.

Towards a European Code of Practise

The discussion above indicates the complexity of the legal side of the market introduction of Intelligent Integrated Road Safety Systems. A project supported by the IST Programme, called Response 2[31] is developing a basis for a Code of Practice by undertaking risk/benefit analysis for market introduction scenarios, and converting this to possible strategies for managing risks in the market introduction of safety systems.

The definition of a full Code of Practice for the legal considerations in the market introduction of Intelligent Integrated Safety Systems requires an overall industrial and societal consensus, especially for the "reasonably safe" products and the definition of "duty of care" process.

Recommendations:

(20) Develop a methodology for risk benefit assessment, achieve an industrial and societal consensus on a European Code of Practice, and establish guidelines for facilitating the market introduction of Intelligent Integrated Road Safety Systems.

4.5. Ultra wide-band 24 GHz short range radar

Ultra wide band (UWB) 24 GHz radar is considered by many to be a key technology to realise the introduction of many Intelligent Integrated Road Safety Systems. Such radar enhances road safety by collision warning and mitigation through active safety devices. The radar components are ready for operation in the 24 GHz band. Nevertheless, there remain regulatory barriers that will affect timely achievement of Community goals if not solved co-operatively with the pan-European Electronic Communication Committee (ECC) of CEPT. UWB short range radar technology represents a cost-effective technology by taking advantage of an existing frequency band for unlicensed low power devices in the 24 GHz range and combined with off-the-shelf radar sensor technology. In contrast, higher frequency UWB radar - as suggested by the ECC - do not offer the same advantages. For example, 77 GHz technology is not mature for volume production, and is significantly more expensive than 24 GHz technology, which would significantly delay its implementation.

ETSI and ECC have been looking at the issue of the use of 24 GHz for automotive application and is seeking to resolve concerns that UWB technology in this frequency range could cause harmful interference to other applications.

The U.S. Federal Communications Commission (FCC), in an order released on 22 April 2002, already has authorised UWB short range vehicular radar in the 24 GHz band. The FCC assessed comments from over 400 commenting parties, and concluded that the risk of interference from automotive 24 GHz UWB short range radar could be managed with technical standards consistent with ITU-R rules.

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[31] RESPONSE II IST-2001-37528: Advanced Driver Assistance Systems: From introduction Scenarios towards a Code of Practice for Development and Testing

The Short Range Automotive Radar Frequency Allocation (SARA) group represents the international automotive industry with the goal to implement UWB radar at 24 GHz world-wide.

Recommendations:

(21) Take the necessary actions for removing regulatory barriers to the use of the 24 GHz spectrum for short-range radar in Europe. This will include issuing an EU liaison statement to ECC and to national administrations requesting international regulations through the ITU-R concerning UWB Radar Sensors.

(22) Undertake the standardisation in ETSI for the 24GHz UWB Radar by implementing the EU Mandate for ETSI and completing and publishing the relevant standard.

5. REMOVING THE SOCIETAL AND BUSINESS OBSTACLES

5.1. Societal aspects

Estimates of societal benefits and costs

The costs of accidents and fatalities in the European Union are estimated to be 160 billion € per year, or 2% of the Community's Gross National Product. The new Intelligent Integrated Road Safety Systems thus carry a promise of huge potential savings on societal costs, if the number of accidents and severe injuries decreases.

Societal benefits of specific safety applications/functions have been estimated in a number of comprehensive reviews of the potential benefits[32]. Revenues, rates of return and benefit/cost ratios of autonomous intelligent cruise control, anti-collision systems, driver and vehicle monitoring and lane keeping, were estimated for prospective deployment. However, the data on societal benefits and cost/benefit ratio are incomplete and not kept up-to-date with latest technological developments.

Therefore, the societal benefits because of reduction in fatalities and serious injuries should be estimated, followed by a cost analysis regarding reduction of medical and other expenses in Member States.

Societal Support for market take-up

Member States could stimulate road users to buy vehicles with intelligent safety functions, and to use safety-related services. Possible support could include financial incentives (tax reduction, lower insurance premium) and/or other means of preferential treatment, such as granting access to dedicated lanes, in order to facilitate market take-up and promote user acceptance.

This support should target especially the car buyers who choose to equip their vehicles with co-operative e-safety systems, thus helping also to create an initial market demand for advanced safety systems.

Recommendations:

(23) Estimate the socio-economic benefits which can be obtained through the reduction of fatalities, injuries and material damage by the introduction of Intelligent Integrated Road Safety Systems. This should include an analysis of the reduction in medical care and other expenses in the Member States and enlargement states, and benefits like improved journey times and reduced congestion and environmental impact.

(24) Stimulate and support road users and fleet owners to buy vehicles with intelligent safety functions and to use safety-related services by incentives such as tax reductions, lowering insurance premiums, and preferential treatment.

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[32] TRL Study 1996, DIATS funded by DG TREN 1999

This support should target especially the buyers who choose to equip their vehicles with co-operative safety systems, thus helping to create an initial market demand for advanced safety systems.

5.2. The business case

The different business cases

Business models for safety functions based on *autonomous technologies* correspond mainly to the automobile manufacturers' business models. Most of these applications are at or near market stage. No formal public sector co-operation is required, though a support in the form of policies, funding for RTD and awareness actions is seen as highly beneficial.

Business models for safety functions which also use *interactive and co-operative technologies* are not so clear. Many of these applications are today still at an R&D stage. Public/private sectors must co-operate to agree final solutions, and to decide on the role and responsibilities of the partners.

The automobile industry is not likely to take the lead at the present time as it is under severe pressure from market/financial conditions. Telematics and safety functions do not represent a competitive advantage for most manufacturers at the present time. Unfortunately the industry innovators are also relatively small scale manufacturers and are also able to command a premium price for so called "exotic options" (which is how the market perceives these systems right now).

Without full support from the public sector it will take a great number of years before a safety-system enabled vehicle park is realised. Industry/consumer business cases should be developed jointly with all other actors involved (motorway operators, service providers, public sector)

The “start-up” dilemma exists for all safety systems based on direct vehicle-to-vehicle communication. The minimum penetration level of equipped vehicles in the traffic system, which is required for the safety systems to become effective, and which are needed to unfold markets, is unlikely to be created by market mechanisms alone. The market forces are, however, expected to produce higher system penetration rates later-on.

Towards a positive business case

There are different business models used by automobile manufacturers. Most common are break-even models or buyer-based pricing models. These two models take into consideration development costs, part price etc. But they stem mainly from a manufacturing point of view.

New technology is usually implemented at a higher cost due to higher development cost which makes it more likely to be sold first in high end cars. Examples of these systems are ABS, ESP etc. This early entry in high end cars will most likely be the case for the near future since for the moment no considerations are made of possible cost savings from a total society perspective.

- Discussions about business/revenue models often involve considerations of issues such as:

- How to package safety services (for instance, essential information and communication functions or lane control offered together with collision mitigation systems, etc.)

- Priorities in terms of time scale for market introduction (i.e. early autonomous technologies and e-Call versus longer-term systems for impaired driver monitoring, etc.)

- Experimentation with a tailored pricing scheme dependent on the nature of application/service (for instance, 'free of charge' for safety warning information and emergency calls; increased vehicle price for active safety technologies; 'pay per use' for personalised, location-based services);

- Co-funding investments and support (automotive industry supported by service providers, and facilitated by policy makers and user associations)

- Work agreements between involved actors (automotive industry; service and content providers; motorway operators; city authorities; user associations, insurance companies).

Strategy for a public/private partnership

Public goods are characterised by non-depletion and non-excludability. Safety technologies demonstrate the characteristics of public goods to a high degree. This is true for autonomous in-vehicle functions like collision warning as well as interactive services like e-Call. This has implications for the business models through which some of these systems may be supplied. Public goods can be and are supplied by private firms. Even when supplied by private firms, public good status may justify some kind of public intervention to 'incentives' the system development and deployment of these systems.

Special case: The e-Call business model

Taking into consideration the experience of various stakeholders, there is currently no clear business case for commercial e-Call service. Furthermore, the public authorities may not be prepared to invest in the requirede-Call centre equipment or operations.

The societal benefits and savings must be looked upon first, and then balanced against the cost of hardware in every vehicle and the costs associated with running the services. An ongoing RTD Project EMERGE is developing a business model for a pan-European harmonised e-Call servivr. A clear pre-requisite for e-Call is that the public service PSAPs are equipped to handle at least the location information of the data calls, and that the interfaces are clearly specified.

Each Member State could launch a call for tender for the investment and the operation of an Emergency Centre able to manage and route to the appropriate rescue service the localised emergency call.

Recommendations:

(25) Identify best practices for positive business cases to promote the introduction of Intelligent Integrated Road Safety Systems, including analysis of the required bundling of the functions, priorities for market introduction, co-funding schemes, and public private partnership.

(26) Support the e-Call business model by implementing the full service chain and ensuring inter-operability, compatibility with E-112 systems and direct links to infrastructure operators and vehicle breakdown services. Training of personnel has to be provided for.

5.3. User Outreach

Awareness

Awareness of the new safety systems available for consumers with clear explanations of their functioning and benefits will be a key issue, determining to a large degree the rate of uptake. The EuroNCAP vehicle crash worthiness test offers an example in this respect.

The European Commission, Member States and other stakeholders should promote the awareness amongst the consumers, with campaigns that explain the benefits of safety systems and the available subsidies and other incentives, and aim to accelerate the equipping of the vehicles with the approved systems.

Information

Adequate information of the new systems introduced with new vehicle models is essential for their safe and efficient use, and for liability reasons. The drivers cannot be expected to master these new systems on the basis of conventional driving school practices and instructions received years, or decades ago.

The automotive industries, safety organisation, driving schools and other road federations should launch a pro-active information campaigns on safety concepts at the time of issuing driver licences, when selling a car and in conjunction with campaigns on code of practice, for raising awareness on the new safety systems and stimulating user acceptance.

User Perception of Costs and Benefits

It is important to assess all costs and benefits of the safety systems, for the society as well as for the individual users, and to know how they will be financed. The user acceptance and willingness of to pay must be assessed. A wide acceptance ratio requires that the perceived benefits outweigh the cost. The benefits could include issues such as smaller risk of accidents, lower insurance premiums, access to dedicated infrastructure, improved comfort, and fewer fatal accidents. Some of these benefits are also material. The willingness to pay for such benefits must be studied with specific techniques such as stated preference surveys.

Recommendations:

(27) Design and execute awareness campaigns which explain the benefits, functioning and use of the Intelligent Integrated Road Safety Systems to the consumers.

5.4. The eSafety Forum

A continuous dialogue between the safety stakeholders is required, and the partners have to define together further actions for promoting intelligent integrated safety. It is therefore proposed that an **eSafety Forum** is established.

The eSafety Forum is a partnership open for all contributing parties. Its purpose is to monitor and promote the implementation of the recommendations of this report, and to promote the development of open platforms, open system architecture and standard software, communications, service and human-machine interfaces for accelerating the development, deployment, use and user awareness of Intelligent Integrated Road Safety Systems. The Forum should take up and continue the work of the eSafety Working Group.

Recommendations:

(28) Create a eSafety Forum with the objective to monitor and promote the implementation of these recommendations, and to support the development, deployment and use of intelligent integrated road safety systems. Determine its objectives, Terms of Reference, draft a Memorandum of Understanding and organisation. Establish membership and work programme.

Glossary of Abbreviations and Acronyms

Abbreviation	Meaning
3G Mobile	Third generation mobile phone
ABS	Anti-locking Braking System
ACC	Adaptive Cruise Control
ACEA	Association des Constructeurs Européen d'Automobiles
ADAS	Advanced Driver Assistance Systems
AMI-C	Automotive Multi-media Interface Consortium
CALM	Continuous-Air Long and Medium range
CARE	Community Road Accident Database
CEPT	Conference Européenne des Administrations des postes et des télécommunications
CGALIES	Co-ordinating Group on Access to Location information by Emergency Services
CEN	Comité Européen de Normalisation (European Standardisation Committee)
CLEPA	European Association of Automobile Suppliers
DAB	Digital Audio Broadcast
DATEX	DATa EXchange (between traffic control centres)
DSRC	Dedicated Short Range Communication
E-112	Location-enhanced emergency (112) call
EACS	European Accident Causation Survey
EC	European Commission
ECC	European Electronic Communications Committee
EECF	European Emergency Communications Forum
ERSF	European Road Safety Federation
ETSI	European Telecommunications Standards Institute
EU	European Union
EuroNCAP	European New Car Assessment Programme
FCC	Federal Communications Commission
FCD	Floating Car Data
GIDAS	German in-depth accident study
GNSS	Global Navigation Standard System
GPS	Global Positioning System
GSM	Global System for Mobile Communications

GST	Global Standard for Telematics
GNP	Gross National Product
HMI	Human Machine Interface
ICT	Information and Communications Technologies
ISO	International Organisation for Standardisation
IST	Information Society Technologies
ITS	Intelligent Transport Systems
ITU	International Telecommunications Union
IVHW	Inter-Vehicle Hazard Warning
LAB	Laboratory of Accidentology and Biomechanic, PSA Peugeot Citroën - Renault
MMM	Mobile Multi-Media
MOST	The MOST Cooperation is based on a partnership of carmakers, set makers, system architects and key component suppliers. Together they define and adopt a common multimedia network protocol and application object model.
PDA	Personal Digital Assistant
PSAP	Public Service Answering Point
RDS-TMC	Radio Data System – Traffic Message Channel
RTD	Research and Technological Development
RTTI	Real-Time Traffic Information
SRR	Short Range Radar
TC	Technical Committee
TCC	Traffic Control Centre
TMC	Traffic Message Channel
TTI	Traffic and Travel Information
UN/ECE	United Nations Economic Commission for Europe
UWB	Ultra Wide Band
WERD	Western European Road Directors
WG	Working Group
WVTA	Whole Vehicle Type Approval

Final Report of the eSafety Working Group on Road Safety

November 2002

ANNEX I: SUMMARY OF RECOMMENDATIONS

	Recommendation	Who *Timing* **Leaders in bold**
	Accident Causation Data	
1	Consolidate analyses from the existing EU, Member State and industry road accident data which give information on the cause and circumstances of the accidents, for allowing the determination of the most effective countermeasures, starting from the most frequent accident types.	**EC**, Member States, automotive industry, insurance companies, automobile clubs, motorway operators, road safety organisations, police and road authorities in Member States, local authorities *2004*
2	Define a common format and structure for recording accident data in the EU countries. Develop jointly an *European Accident Causation Database* covering all EU and enlargement countries, and provide open access to industry and public agencies.	As above *2006*
	Impact Assessment	
3	Develop methodology to assess the potential impact of intelligent integrated road safety technologies in Europe, based on the accident causation data. This work should also analyse combined systems (fusion of sensors, integration and use of multiple active safety systems together). Develop validation methodology and procedures for vehicles equipped with Intelligent Integrated Road Safety Systems.	**Automotive industry**, equipment suppliers, EuroNCAP, research organisations, EC , user organisations, road operators, Member States *2005*
4	Set up a coordinated validation framework for operational tests for active safety systems in the Member States.	**EuroNCAP**, others as above *2006*
	Human-Machine Interaction	

5	Assess the reports by the Member States on the Commission Recommendation "Statement of Principles on safe and efficient in-vehicle information" and communications systems", and decide on further actions as necessary taking into account the rapid development in this area. The use of portable (nomadic) devices requires urgent assessment of risks.	**EC ,** Member States, automotive industry *2003*
6	Develop workload assessment, testing and certification methodology and procedures for complex in-vehicle working environments involving interfacing with in-vehicle devices for vehicle control, driver assistance, intelligent integrated road safety, including Multi-Media systems.	Equipment suppliers, automotive industry, telecommunications industry, service providers, **research institutes**, EC *2006*
	Implementation Road Maps	
7	a) Develop regularly reviewed Road Maps with technical steps and economic implications for the introduction of Intelligent Integrated Road Safety Systems. These Road Maps should indicate the technical and economic capability of the stakeholder industries to deploy intelligent integrated safety solutions. b) The public sector Road Maps should indicate the investments required for improvements in the road networks and information infrastructure based on the industrial Road Maps, and identify the steps needed for removing regulatory barriers.	**a) Automotive industry**, EC, Member States, road authorities, motorway operators, telecom operators **b)** Automotive industry, EC, Member States, **road authorities**, motorway operators, telecom operators *2003 (First Road Maps)*
	Intelligent Integrated Road Safety Systems	
8	Analyse existing accident causation data and possible countermeasures, and determine clear goals and priorities for further RTD in Intelligent Integrated Road Safety Systems in industrial research, Community Research (Integrated Projects in the 6th FP) and national research programmes.	EC, **automotive industry**, equipment suppliers, research centres, motorway operators *2003*
9	Identify existing specifications, and where necessary develop new specifications for pan-European, standardised interoperable interfaces and communications protocols for vehicle-vehicle and vehicle-infrastructure communications which will support interactive, co-operative safety systems and services, including Traffic and Travel Information.	EC, **multi-sector organisation** involving automotive industry, Telematics Forum, telecommunications industry, equipment suppliers, information and content providers, with Member States, road

		authorities, motorway infrastructure operators and standardisation bodies *2004*
10	Pursue international co-operation in the development of intelligent integrated road safety technologies. The co-operation should cover especially Human-Machine Interaction, certification and testing methodology and procedures, harmonisation and standardisation, legal issues, impact and socio-economic benefit analysis, and benchmarking/best practise.	In Europe: automotive industry, equipment suppliers, **EC**, telecom operators, motorway operators, road authorities *2003 onwards*
	Digital Map Database	
11	Based on existing research results, define requirements for a European digital road map database. This database should contain in addition to road map data agreed road safety attributes for driver-support for information and warning purposes, such as speed information and road configuration data. Create a public-private partnership to produce, maintain certify and distribute this digital road map data base. It should be made available for all users at affordable prices (possibly free of charge). National, local and regional authorities and operators should provide safety-related data on road configurations within their networks, with target dates for implementation.	EC, **mapping industry**, automobile industry, and telecomm operators, service providers, motorway operators, road authorities (national, regional and local level) *2004*
	Emergency calls and E-112	
12	After consultations (telecommunications authorities, civil protection authorities, industry through CGALIES) adopt a Commission Recommendation on the introduction and implementation of E-112 service in Europe.	**EC** *2002*
13	Establish a European Emergency Communications Forum to continue the CGALIES work and to monitor the implementation of E-112 service in the Member States. Establish national liaison groups to co-ordinate the implementation and building up of the E-112 service chain.	**EC**, Member States - especially Civil Protection Authorities, emergency service organisations, telecomm operators, automotive industry, motorway operators, automobile clubs, standardisation bodies *2002*
14	For in-vehicle emergency calls (e-Calls), establish data requirements and data transfer protocol for e-Calls	**EC,** Member States - especially Civil Protection

	originating from vehicles. Establish an interface specification and routing and handling procedures for e-Calls with location and other accident-related information.	Authorities, emergency service organisations, telecomm operators, automotive industry, motorway operators, automobile clubs, insurance industry, standardisation bodies *2003*
	Real-Time Traffic and Travel Information (TTI)	
15	Analyse the Member States' responses to the TTI Recommendation, draw up further safety-related actions and make a progress report to the Council and the European Parliament	**EC,** Member States *2003*
16	Create public-private partnerships to capture, process and provide real-time traffic, traveland road condition data from a variety of sources, including Floating Vehicle Data.	EC, **multi-sector organisation** including fleet operators, automobile industry, telecomm operators, service providers, motorway operators, public authorities (national, regional and local level) *2003 onwards*
17	Support the wider use of the pan-European RDS/TMC network for safety-related traffic information. Provide a report with required actions to the European Commission on the status of RDS/TMC implementation and the remaining bottlenecks.	EC, **TMC Forum** *2003*
	Regulation	
18	Determine what actions may be required for rapidly bringing forward road safety improvements obtainable with Intelligent Integrated Road Safety Systems in vehicles.	**EC,** automotive industry *2003*
	Standardisation and certification	
19	Analyse the specific needs and priorities of the intelligent integrated road safety systems for standardisation in ISO, CEN and ETSI. For vehicle-vehicle and vehicle-infrastructure communications, promote the accelerated standardisation	EC, **standardisation bodies**

	of emerging communications protocols. For CEN, based on the recently published report of the M270 mandate, choose the appropriate mechanisms (Committee Working Agreements, full EN standards), and establish the necessary working groups.	 *2003*
	Legal issues of market introduction	
20	Develop a methodology for risk benefit assessment, achieve an industrial and societal consensus on a European Code of Practice, and establish guidelines for facilitating the market introduction of Intelligent Integrated Road Safety Systems.	EC, **automobile industry,** equipment suppliers, research organisations, insurance industry *2004*
	Ultra-wide band 24 GHz short range radar	
21	Take the necessary actions for removing regulatory barriers to the use of the 24 GHz spectrum for short-range radar in Europe. This will include issuing an EU liaison statement to ECC and to national administrations requesting international regulations through the ITU-R concerning 24GHz UWB Radar Sensors.	**EC,** automotive industry, equipment suppliers, industrial organisations, Member States *2003*
22	Undertake the standardisation in ETSI for the 24 GHz UWB Radar by implementing the EU Mandate for ETSI and completing and publishing the relevant standards.	EC, Industry, **standardisation bodies** *2003*
	Societal issues	
23	Estimate the socio-economic benefits which can be obtained through the reduction of fatalities, injuries and material damage by the introduction of Intelligent Integrated Road Safety Systems. This should include an analysis of the reduction in medical care and other expenses in the Member States and enlargement states, and benefits like improved journey times and reduced congestion and environmental impact.	**EC,** automotive industry, research centres, Member States authorities, motorway operators *2004*
24	Stimulate and support road users and fleet owners to buy vehicles with intelligent road safety functions and to use safety-related services by incentives such as tax reductions, lowering insurance premiums, and preferential treatment. This support should target especially the buyers who choose to equip their vehicles with co-operative safety systems, thus helping to create an initial market demand for advanced safety systems.	**Member states**, insurance industry, authorities *2003 onwards*
	The Business Model	

25	Identify best practices for positive business cases to promote the introduction of Intelligent Integrated Road Safety Systems, including analysis of the required bundling of the functions, priorities for market introduction, co-funding schemes, and public private partnership.	**Multi-sector organisation**, including automotive industry, automotive retailers, fleet owners, insurance companies, motorway operators, automobile clubs, emergency service organisations *2003 onwards*
26	Support the e-Call business model by implementing the full service chain and ensuring inter-operability, compatibility with E-112 systems and direct links to infrastructure operators and vehicle breakdown services. Training of personnel has to be provided for.	EC, **Member States**, Civil Protection authorities, emergency operators, road administrations, telecom operators *2004*
	User outreach	
27	Design and execute awareness campaigns which explain the benefits, functioning and use of the Intelligent Integrated Road Safety Systems to the consumers.	EC, automotive industry, Member States, road safety organisations, ITS organisations, **user organisations**, driving schools *2003 onwards*
	Creation of eSafety Forum	
28	Create a eSafety Forum with the objective to monitor and promote the implementation of these recommendations, and to support the development, deployment and use of intelligent integrated road safety systems. Determine its objectives, Terms of Reference, draft a Memorandum of Understanding and organisation. Establish membership and work programme.	**EC**, automotive and telecommunications industry and operators, equipment and service suppliers, motorway operators, road administrations, insurance companies, automobile clubs *2003*

Further information is available from:
http://www.europa.eu.int/information_society/programmes/esafety/index_en.htm

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Applications relating to transport and tourism

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