eIMPACT
Assessing the Impacts of
Intelligent Vehicle Safety Systems

Contract no.: 027421

eIMPACT

Socio-economic Impact Assessment of Stand-alone and Co-operative Intelligent Vehicle Safety Systems (IVSS) in Europe

Report type	Deliverable D12
Report name	Exploitation Plan
Version number	Version 2.0
Dissemination Level	PU
Lead contractor	TNO
Due date	30.06.2008
Date of preparation	26.09.2008

eIMPACT Partners

Netherland's Organization for Applied Scientific Research (TNO)
University of Cologne (UOC)
Daimler AG (DCA/ DAI)
Centro Ricerche Fiat ScpA (CRF)
BMW Forschung und Technik GmbH (BMW)
Robert Bosch GmbH (BOS)
PTV Planung Transport Verkehr AG (PTV)
Technical Research Centre of Finland (VTT)
Federal Highway Research Institute (BAS)
Dutch Ministry of Transport (RWS)
Transport Research Centre of Czech Republic (CDV)
Movea Trafikkonsult AB (MOV)
Irion Management Consulting GmbH (IMC)

Information Society and Media

Authors

Kerry Malone (TNO)
Tom Alkim (RWS)
Roland Galbas and Michael Fausten (BOS)
Veronika Hamernikova (CDV)
Joachim Irion (IMC)
Gunnar Lind (MOV)
Gerhard Noecker (DAI)
Heiko Peters (BAS)
Pirkko Rämä (VTT)
Konrad Roßrucker (BMW)
Carlotta Vitale, (CRF)
Ulrich Westerkamp (UOC)

Project Co-ordinator

K.M. (Kerry) Malone
Mobility and Logistics
Business Unit of TNO Built Environment and Geosciences

Email: Kerry.Malone@tno.nl
Phone: +31 15 269 6912
Fax: +31 15 269 6854

Visiting Address:
Van Mourik Broekmanweg 6
2628 XE Delft
The Netherlands
Postal Address:
P.O. Box 49
2600 AA Delft
The Netherlands

http://www.tno.nl

Revision and history chart

Version	Date	Reason
0.0	01.06.2008	Draft structure by Gerhard Noecker
0.1	03.06.2008	Modified structure by Kerry Malone
0.2	16.06.2008	Contributions from partners added to document by Kerry Malone
0.3	18.06.2008	Contributions from partners added to document by Kerry Malone
1.0	18.06.2008	Contributions from partners added to document by Kerry Malone, formatted by Marina Taal
1.1	24.06.2008	Revisions to D12 based on reviewers' comments
2.0	26.09.2008	Final Revisions to D12 based on consultations with partners and project officer

Table of contents

Table of figures

Executive summary

Introduction to eIMPACT

The eIMPACT project, "Socio-economic Impact Assessment of Stand-alone and Co-operative Intelligent Vehicle Safety Systems (IVSS) in Europe", assesses the socio-economic effects of Intelligent Vehicle Safety Systems (IVSS) and their impact on traffic, safety and efficiency. It addresses policy options and the views and roles of the different stakeholders involved. eIMPACT is part of the EU's Sixth Framework Programme for Information Society Technologies and Media.

eIMPACT supports the three pillars of the EC's Intelligent Car Initiative (ICI), addressing stakeholders, research, and awareness-raising. eIMPACT provides quantitative impacts of twelve IVSS in terms of safety, traffic and cost-benefit effects, making use of an integrated assessment method. These quantitative results provide important building blocks for the potential contribution of Intelligent Transport Systems (ITS) to reduce road fatalities, as described in the EU White Paper on Transport.

eIMPACT also provides perspectives on the market introduction of IVSS. The results of eIMPACT can be used to provide guidance in the deployment of IVSS. The results support decision making processes for research programmes in terms of focus and funding, as well as awareness, promotion and deployment activities, mainly at the EU, but also on national and regional levels. These results can also be used by policymakers, road operators and driver clubs in terms of strategic orientation, investment, promotion and deployment decisions. Finally, automotive and insurance industries can take the results as needed to develop product and innovation strategies.

Note: The assumptions on which the penetration rates and impact assessments were based were obtained from state-of-the-art sources, whether that be literature or discussion with experts. The results presented in the eIMPACT deliverables reflect the knowledge of the partners in the eIMPACT consortium.

1 Background and purpose of eIMPACT

Intelligent Vehicle Safety Systems (IVSS) are seen as having tremendous potential for reducing road fatalities, which were over 40,000 in 2005 in the EU. ICT systems such as ABS, cruise control, adaptive cruise control and electronic stability control (ESC) have been on the market for years, in some cases decades. The uptake of these systems varies; ESC has had a relatively quick uptake and now is present in approximately 40% of vehicles on the road. ACC on the other hand is installed on less than 1% of vehicles. To achieve safety goals, more vehicles need to be equipped. The deployment of the systems should be accelerated. To accelerate deployment, stakeholders such as road authorities, policy makers and industry want to know which systems should be chosen to be accelerated, and why?. What are the benefits? Who do they benefit? Who should promote them, and how? Different stakeholders have different emphases. The eIMPACT project, "Socio-economic Impact Assessment of Stand-alone and Co-operative Intelligent Vehicle Safety Systems (IVSS) in Europe", addresses the need to quantify the effects of the systems in order to support decisionmaking about research, investments, deployment incentives, etc. eIMPACT is part of the EU's Sixth Framework Programme for Information Society Technologies and Media.

The project carried out impact assessments of twelve stand-alone and cooperative systems at the EU level, for 2010 and 2020. For each of these two future years, a scenario with a low penetration rate, reflecting no incentives to accelerate deployment, and a high penetration rate, including policy incentives for system deployment, was analysed. Outputs include safety impacts in terms of reductions in fatalities, injuries and accidents, traffic effects in terms of direct (traffic flow) and indirect (reduction in congestion) effects, and the cost-benefit analysis (CBA) for the twelve systems. The CBA was extended by a stakeholder analysis, examining the costs and benefits incurred by users, industry and public authorities. Finally, policy options and strategies were explored for deployment strategies of IVSS.

eIMPACT produced an integrated set of quantitative impacts that can inform decision making on strategic orientation, innovation, investment, awareness, promotion and deployment activities by stakeholders. The exploration of possible policy options and strategies provides insight into what elements form a successful deployment strategy. Thus, eIMPACT supports the three pillars of the EC’s Intelligent Car Initiative (ICI), addressing stakeholders, research, and awareness-raising.

The guiding principles of the eIMPACT analyses reflect the information available to the partners at the time. Most of the systems analysed were not yet on the market, therefore little or no empirical information was available. The ex-ante analyses are based on the most recent empirical results, literature review and expert judgment available. The bases of findings are made as transparent as possible.

Most importantly, the results can be improved when new findings from Field Operational Tests (FOTs), driving simulators and test tracks are made available.

The consortium consists of 13 partners, representing Original Equipment Manufacturers (OEM's) and suppliers, public authorities, research institutes and universities, covering both the older and newer EU states, and bringing the required perspectives into the project.

1.1 Structure of the report

Chapter 2 provides a general description of the exploitable results of eIMPACT. Chapter 0 presents the exploitation patterns of the partners. Chapter 4 provides a roadmap linking the results of eIMPACT to existing IVSS roadmaps, and different stakeholder perspectives. The report concludes with Chapter 5 in which an overview of the exploitable knowledge and results for each organisation are provided.

2 General description of exploitable results

eIMPACT produced two types of results. Firstly, eIMPACT developed and applied a complete, exhaustive and integrated methodology for impact assessment, CBA, stakeholder analysis, and policy deployment strategies. Secondly, eIMPACT produced quantitative results for impact assessment, benefit-cost ratios and stakeholder analyses.

2.1 Results

Safety

The information about the safety impacts can be used as an indicator to compare IVSS and define the sequence of introduction of IVSS.

Outputs of eIMPACT project provide the opportunity to help the EU national governments to improve the traffic safety also by deploying intelligent systems. Safety analysis also supports the attitude that is needed to spur innovation in the area of constructing vehicles and using them on roads. Knowledge of intelligent systems in the area of traffic safety gives us also the opportunity to inform the users in EU countries about advantages of these systems.

Traffic

Analyses of direct and indirect traffic impacts provided new insights into the types of effects that can be expected from IVSS. These insights can support the choice of IVSS according to the conditions in a particular region or country.

Systems affecting the longitudinal direction, e.g. which affect speed choice, and which work on all different road types under all conditions show direct traffic effects. The travel time effects are quite small, but emission impacts can be considerable when choice of speed is affected. Much higher penetration rates are needed to show direct traffic effects.

Indirect effects of IVSS are significant, due to the direct link between reduction in accidents and reduction in accident-related conditions. The systems which work on all different road types under all conditions during peak traffic conditions show the greatest indirect traffic effects.

CBA / BCR

Benefit-cost ratios can be used as an indicator to compare IVSS benefits and costs and so to define the sequence of introduction.

This analysis brought the possibility to say that intelligent systems are good for the traffic safety improvement. This analysis showed that intelligent systems can decrease the social costs which are related to traffic accidents. So, this analysis is a convenient and useful tool to argue that the market penetration of intelligent systems is necessary and economically profitable.

Due to CBA / BCR we can inform the public sector, especially Ministry of Transport about the results of CBA and persuade the public bodies about advantages and disadvantages of these systems.

It should be one of the first steps in implementing intelligent systems into market in EU countries.

The results of this analysis can also motivate car industry, public bodies, insurance companies, automobile clubs, fleet managers and all users about the positive role of intelligent systems in the field of traffic safety. This analysis gives the opportunity to say that intelligent systems are much cheaper than the economics impacts of traffic accidents which would have happened if there were no intelligent systems on the market. This analysis said that using intelligent systems with the view of decrease economics costs is a good idea.

Policy options

Policy options can also be integrated into the development process. When technicians propose the development of specific IVSS to be introduced in the market an OEM, they can use not only technical information and information about IVSS benefits, but they can also suggest policy options for the IVSS introduction. This will complete and enrich the technical proposal.

Policy options go hand-in-hand with the results of CBA / BCR. When eIMPACT says that using intelligent systems and promoting them to users is an economically good step, the public bodies and other stakeholders can look for the tools to support the market introduction and improved penetration of this systems.

The eIMPACT project found identified strategies how to support the market penetration of intelligent transport systems in European countries. It helps the public bodies to start thinking about how to implement these support activities in particular country.

Stakeholder analysis

The analysis of possible risks for OEM's and suppliers can be used to give a wide overview of risks and possible recovery actions.

Stakeholder analysis provided much information about different stakeholder roles in the area of supporting market penetration of IVSS. This information should become available to the public sector, insurance companies, the car industry, users and other stakeholder groups. Information about stakeholder roles and tools which they can use can help especially public bodies in developing their own strategy in supporting market penetration of IVSS.

2.2 Methodologies

Safety

The safety methodology demonstrated its completeness in estimating the safety effects of systems for which there is little or no empirical evidence. This methodology can be applied to in the future to stand-alone, cooperative and nomadic systems. As new evidence becomes available , the safety impact methodology can be used to improve impact assessments.

Traffic

Investigating the traffic effects of IVSS provided valuable new knowledge about the implications of changed driver/vehicle behaviour in traffic flow. It was found that such changes require a deeper look at the fundamentals of traffic; e.g. the effects of an earlier braking

reaction. The classic methodology, usually of a more macroscopic approach, may not disclose real effects and even obscure them. It was found that such effects require an evaluation of simulation results at a microscopic level. Therefore, a new methodology was defined, implemented is now readily available for future application.

CBA / BCR

The cost-benefit methodology applied to the IVSS in eIMPACT can be applied to other systems.

Policy options

The methodology developed in eIMPACT can be used for development of deployment strategies at the regional, national and European levels.

Stakeholder analysis

The stakeholder analysis methodology is an important part of building business models and deployment strategies. The stakeholder analysis methodology can be applied to systems in the future. Conducting break-even analyses for the involved industries (automotive industry, insurance industry) requires information which is not publicly available. The forthcoming Field Operational Tests provide a unique opportunity to collect information also on user perception, willingness-to-pay (specifically for the tested systems but also for safer road transport in general), the value of higher comfort etc. The quality of input data for stakeholder analyses would largely benefit from these accompanying research activities.

3 Exploitation patterns of the partners

3.1 Industry

The results will influence the research and development strategies of OEMs and suppliers. The tools developed in eIMPACT will help to improve the evaluation of further IVSS. There is no dedicated time horizon, because eIMPACT experience, results and evaluation tools will influence the current development of IVSS and components.

The results will be applied to make strategies to develop and deploy future advanced driver assistance systems, cooperative systems for safety and related marketing concepts

Industry will exploit the methodology of impact assessment and the methodology to calculate benefit-cost ratios. The break-even analyses will be adapted to support the a priori evaluation of future safety systems and the estimation of the impact of the related business cases. In particular these methodologies are expected to be applied both to ADAS systems and to cooperative systems for road safety that will be based on the communication among vehicles and the infrastructure.

Finally, the exploitation patterns of industry have to consider the maturation of the used technologies and the options to bundle systems for the deployment of future IVSS.

3.2 Public Authorities

Public authorities plan to disseminate the results from eIMPACT. CDV published three papers about the eIMPACT project and its results. The papers inform public bodies, researchers, professionals and users about eIMPACT project and about intelligent systems. The papers extend the awareness of intelligent systems and their impacts to driving and safety.

Some of eIMPACT results will form a knowledge base which can help in other projects focussing on IVSS and their role in driving habits, drivers behaviour, traffic safety and new trends in this area.

Information about the IVSS studied in the eIMPACT project, the impact on safety, the results of the CBA and stakeholder analysis will be disseminated to students of psychology, professional drivers (drivers of emergency cars, army drivers, and public transport drivers) and others in many presentations.

Information about IVSS, their safety impacts and results of CBA and stakeholder analysis will be also sent to Ministry of Transport and will be used as knowledge base in their actions in the field of traffic safety and the support of IVSS market penetration.

3.3 Academia

The methodological framework – consisting of social cost-benefit analysis and stakeholder analysis – can be reused and improved in further research projects. The results provide also guidance on further research directions, involving assessment of system bundles,

assessment of deployment programmes, improving robustness of BCR (Monte-Carlo simulation). These lines of development will be taken up in project proposals to further research calls on European and national level.

The Stakeholder analysis in the area of IVSS is a relatively new area of research. It provides many opportunities for further expansion and application of the methods developed in eIMPACT. Furthermore, it is a crucial area of research in conjunction with deployment strategy development.

3.4 Research Organizations

MOVEA is a company working with R&D and consultation, mainly supporting the Public sector. The enhanced knowledge of IVSS applications and their behavioural aspects can be used to support strategies in R&D efforts and improve forecasts concerning the use of IVSS within the traffic system. Experience concerning the traffic and safety impacts of IVSS can be used to enhance and focus European and national R&D programs. Experience concerning the costs and benefits of IVSS can be used to improve decision-making concerning IVSS (policies, strategies and funding) in the Public sector.

PTV finds that the ways to exploit the knowledge gained from the project are manifold. The two most important ones are to strengthen the micro-simulation product VISSIM and to apply this knowledge in other evaluation tasks.

The product VISSIM is enhanced by being prepared to predict future traffic with IVSS-equipped vehicles. This is essential because a micro-simulation must be able to create a realistic traffic flow. Through the application here valuable knowledge was gained how to treat such equipped vehicles.

On the consulting side, the knowledge gained here lies mostly in the types of effects the IVSS investigated revealed. From a macroscopic view, they can hardly be found. The experiences made here by researching the effects are valuable for further studies in both ITS-related and also “conventional” applications.

A comprehensive methodology for safety impact assessments including method for fleet penetration estimates was developed by eIMPACT. The method and the tools included were and will be applied in other projects focusing on impact assessment of stand alone, cooperative and nomadic systems both on EU level (PReVAL, CODIA) and in national projects (The Finnish Vehicle Administration AKE). Furthermore, the methodology will be submitted to a scientific article, and further developed. In addition, the competence has been and will be utilized in several projects where safety impact methods are needed (e.g. FESTA, iCars, TELEFOT)

The results will be presented in national seminars and workshops to contribute and support decision making of national road authorities concerning transport policy and ITS’s role in it. The results will be utilized in eSafety Forum’s working groups.

4 Exploitation roadmap

eIMPACT produced an integrated set of quantitative impacts that can inform decision making on strategic orientation, innovation, investment, awareness, promotion and deployment activities by stakeholders. The exploration of possible policy options and strategies provides insight into what elements form a successful deployment strategy. This chapter takes the results a step farther by presenting the perspectives of industry (OEMs and suppliers), public authorities, and the possible user perspectives. It also names "factors in the landscape," or exogenous developments, that may have an effect on the exploitation of IVSS.

4.1 Roadmaps for IVSS with respect to the State-of-the-Art

The EC-funded ADASE project, which ran from 2001 – 2007, developed a road map showing first forecasts for the deployment of Advanced Driver Assistance Systems including Intelligent Vehicle Safety Systems (IVSS) in Europe. The complexity and contribution of the systems were the primary drivers in determining the sequence of the roadmap. Figure 1 shows the ADASE roadmap, onto which the twelve eIMPACT systems have been mapped. Simple systems appear lower in the ADASE roadmap, indicating that they should reach the market earlier. More complex and autonomous systems appear at the top. No timeline is given in the ADASE roadmap.

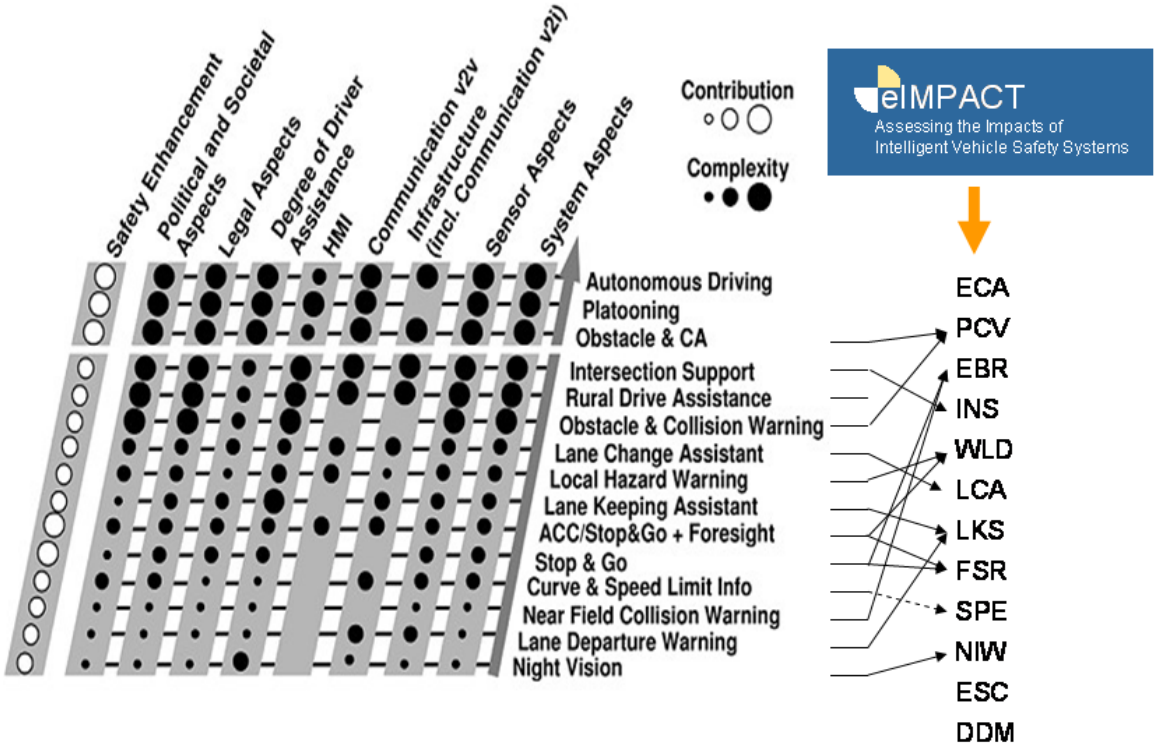

Figure 1: Match of ADASE roadmap and IVSS investigated in eIMPACT

A reference between ADAS and IVSS is given on the right side of the sketch. The systems selected and assessed in eIMPACT match well with the ADASE roadmap. Only eCALL (ECA), ESC, and Driver

Drowsiness Monitoring and Warning (DDM) are not considered in the ADASE roadmap.

Since the ADASE project, other projects have examined other aspects of IVSS and thus produced other roadmaps. The Integrated Safety systems roadmap from the PReVENT INSAFES project in Figure 2 shows that longitudinal and lateral support systems have already entered the market, beginning with ACC at the end of the last century. Systems have matured since then and the costs for sensors decreased. Thus nearly all car manufactures offer these systems or plan their introduction.

In the short term, longitudinal safety integration is expected. Already ACC (operational at 30 km/h or more) have been expanded to stop & go traffic, and they entered the area of safety functions like pre-fire of reversible belt pre-tensioners or emergency brake assistance and collision mitigation. The systems started as comfort systems and they entered the field of safety after proving their reliability.

The Integrated Safety systems roadmap from the PReVENT INSAFES predicts that integrated systems coupling longitudinal and lateral support can be expected in the next 5 years. Cooperative systems which are based in V2X communication will appear at the end of the next decade.

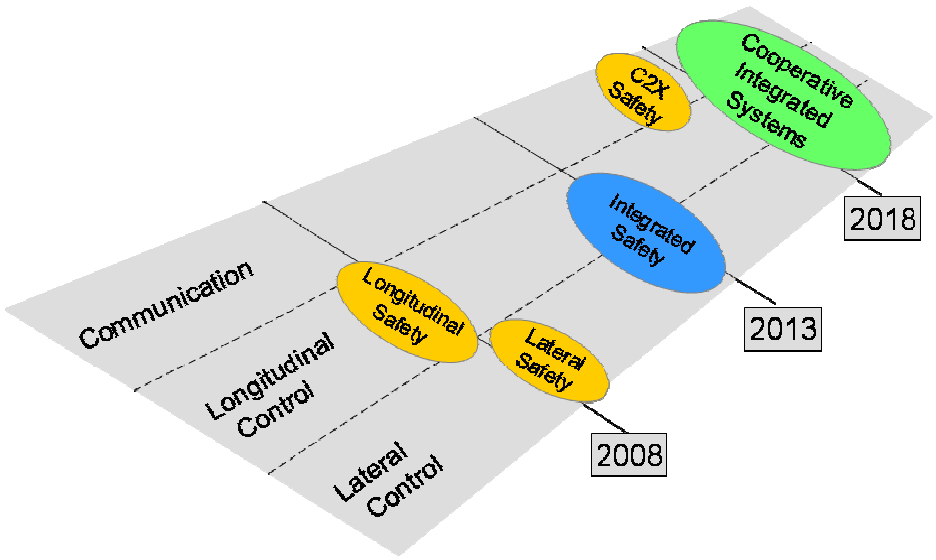

Figure 2: Integrated Safety Systems – Roadmap (PReVENT INSAFES)

4.2 Basic Conditions for IVSS Introduction

It is clear from the impact and CB analyses that the achievable reduction in fatalities (and injuries and accidents) depends on the penetration rates. The penetration rates depend on pricing, dissemination, legislation, homologation, and standardization. Legislation, homologation and standardisation need EC support.

From the demand side, the customer needs to understand the benefits of IVSS. Firstly, the customer must be aware of the existence of IVSS. Secondly, only then can the customer weigh if the price-to-benefit ratio is attractive to him or her.

The sequence of introduction has to fit into the strategies of the relevant stakeholders. In particular, this means that the car manufacturers' introduction strategies (based on their specific product philosophy) as well as the priorities like environmental and or safety and throughput objectives of the Public Sector (e.g. Road Authorities) have to be taken into account. In addition the user needs to understand the benefit of these systems; otherwise the demand for IVSS will remain on a low level.

System introduction will follow a step by step process. Firstly, information systems will come before active support depending on the maturation of the underlying technologies. Secondly, systems will be bundled because of cost reasons, if they use the same components. Figure 3 outlines the different categories of support to accelerate the deployment of different types of IVSS.

The design of detailed measures for a dedicated IVSS is explained in the eIMPACT deliverable "Policy recommendations to promote selected Intelligent Vehicle Safety Systems" (D7, [Alkim et al, 2008]). In general all relevant stakeholder groups like OEMs and their suppliers as well as user groups and the public sector have to cooperate for a successful market introduction. The main stakeholder groups are the OEMS and their suppliers, and sometimes the public sector, on the supply side, and the users on the demand side. To accelerate deployment of IVSS, it is important to bring together all relevant stakeholders in appropriate forums such as the eSafety Forum. Finally, whether there is an attractive business case for the stakeholder that bears the main financial load of a strategy plays a crucial role in the cooperation among the stakeholders. The stakeholders' specific tasks, needs and risks are outlined below in the sections 4.3 - 4.5.

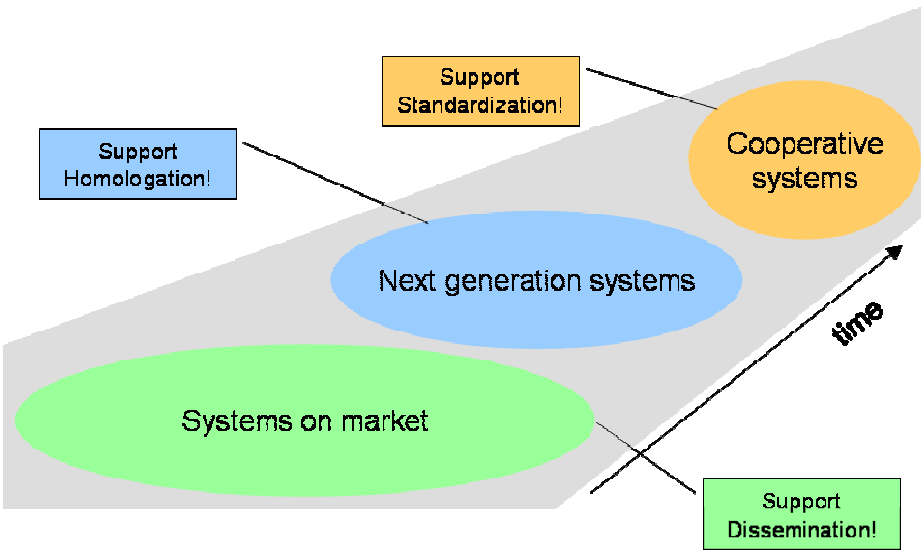

Figure 3: Appropriate support in different stages

Depending on the status and degree of market introduction, IVSS need appropriate measures to promote them. Specific measures are outlined below.

Dissemination (for systems already on the market)

- raise of public (customer) awareness
- improvements in driver education and driver safety training
- promotion in motor press
- investigation in infrastructure systems for v2i communication
- tax refunds for safety systems

Homologation on EC level (for next generation systems)

- improvement of EU-wide legislation and homologation

Standardization on EC level (for cooperative systems)

- support of protocol standardization and frequency allocation for v2x communication systems (Recommendations of the eSafety Forum Initiative - Working group Communications are already under preparation)

The safety effects (i.e. avoided fatalities and injuries) and the Benefit Cost Ratios (BCR) calculated in eIMPACT (D4 [Wimink et al., 2008] and D6 [Baum et al., 2008]) could be used to determine for which systems specific measures are effective and efficient.

4.3 Perspective of supplier and OEMs

OEMs and their suppliers need to open the market for future IVSS by providing effective systems to affordable prices, but they have to overcome significant liability and introduction risks.

IVSS will increasingly support drivers in complex situations. As a consequence, the functionality of these systems has to cover these events and this increases product liability risks dramatically.

In addition the requirements regarding system performance and availability result in increased development costs for the system components leading to high introductions risks.

Hence, from an OEM and supplier perspective two enabling instruments are crucial to overcome liability risks:

- Homologation and standardisation on EC-level
- Use of a common Code of Practice (CoP) on EC level.

A Common Code of Practice describing the methodological approach to develop a specific IVSS could help to accelerate the development and quality of an IVSS and to support the user acceptance. Such a Common Code of Practice includes

o An agreed set of terms and definitions

o A basic description of the development process (to be refined specifically for each supplier or OEM)

o A set of recommendations on how to prove controllability of the IVSS (e.g. expert panel, naïve users) and requirement gathering

The RESPONSE 3 project delivered version 3.0 of such a Common Code of Practice (Oct. 2006). This draft is currently under review of relevant stakeholder groups.

To mitigate the introduction risks OEMs and their suppliers might choose the introduction scenario given below. In addition, they could identify strategies to reduce their production and development costs by standardisation of components for different OEMs (based on common legislation for these components).

Possible introduction scenario

Step1: launch of warning functions combined with powerful brake assist

- no automatic system intervention ; this means a lower liability risk
- low system cost; this will improve the willingness-to pay of users
- mature systems already available
- pave the way for automatic systems

Step 2: launch of automatically intervening functions

- improve maturity, performance, availability and reliability
- reduce cost by new technologies
- additional accident mitigation and avoidance potential

Figure 4, an illustration of system dependencies, reveals the technical basis for the possible introduction scenario described above

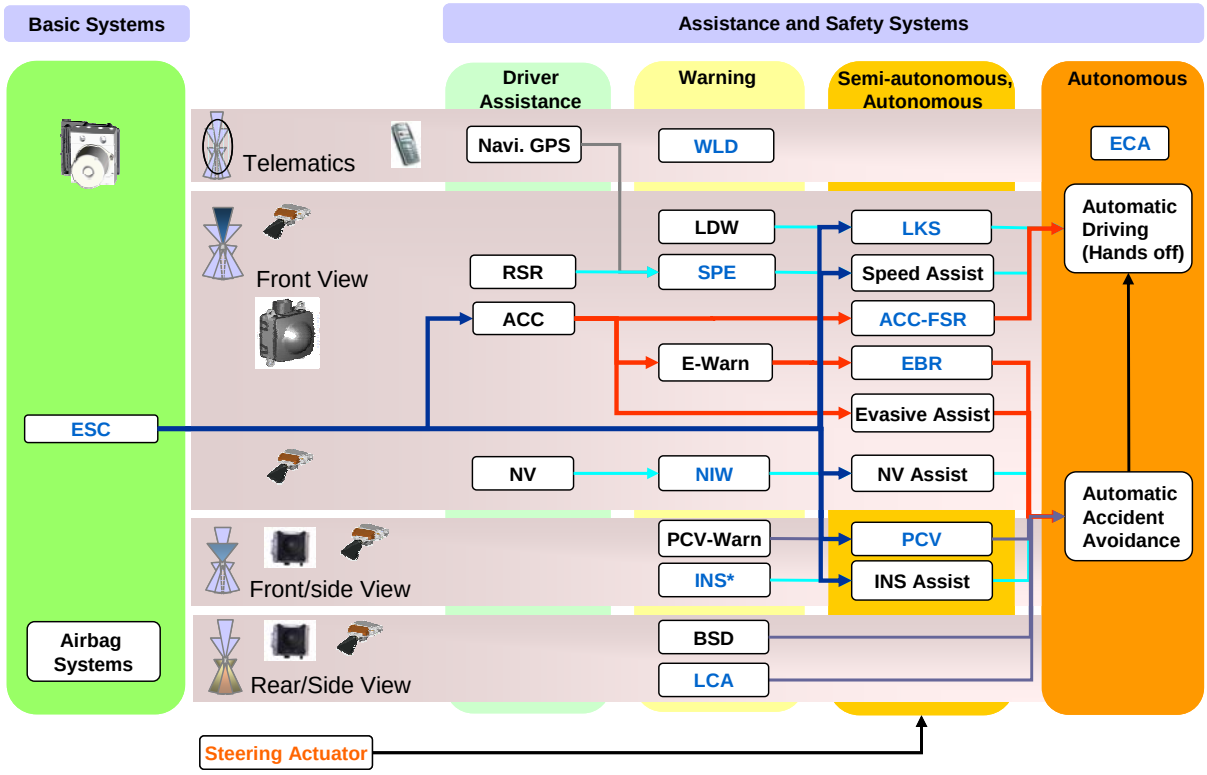

Figure 4: System dependencies

System abbreviations

eIMPACT Systems

LCA	Lane Change Assistant (Warning)
WLD	Wireless Local Danger Warning
FSR	Full Speed Range ACC
EBR	Emergency Braking
NIW	NightVisionWarn
LKS	Lane Keeping Support
SPE	SpeedAlert
PCV	Pre-Crash Protection of Vulnerable Road Users
INS	Intersection Safety
DDM	Driver Drowsiness Monitoring and Warning
ECA	eCall
ESC	Electronic Stability Control

Additional (systems not investigated in eIMPACT)

LDW	Lane Departure Warning
RSR	Road Sign Recognition
NV	Night Vision
BLD	Blind Spot Detection

The introduction risk of IVSS could also be mitigated by the specific support of already existing organisations. As an example, a possible role of EURO NCAP is briefly outlined. EURO NCAP is actively planning to enlarge its focus by assessing active safety systems (the so-called “Beyond Euro NCAP” initiative by initiating a “star rating program” for active safety systems). This could be a useful platform for industry stakeholders to be actively involved in the design of new rating schemes and rating processes. Furthermore these recommendations of “Beyond Euro NCAP” should balance systems

benefits (accident avoidance) and economical aspects and could serve as a frame to compare different IVSS.

4.4 Perspective of Users

The effective realisation of the expected benefits is going to depend on conditions of systems implementation: in particular, in which measure the system responds to drivers needs, is compatible with their functional capacities and satisfies the criteria of relevance, usability and acceptability.

The expectation of users to use a IVSS can be summarised as follows:

- Optimal safety performance in conjunction with low costs (purchase and maintenance)
- Ease to use with standard interfaces
- Comparability of systems
- Proof of evidence of the benefit of the users.

First of all, the attention of users has to be drawn to the new IVSS by raising their awareness and by provision of support to understand the “personal” benefit of these systems. For these purposes user groups should be encouraged to participate in Field Operational Tests.

This means all measures to promote and deploy a specific IVSS have to consider the user’s needs and focussed user groups should be actively involved in the implementation of these measures.

4.5 Perspective of public authorities

In general, all public (road) authorities in Europe have a policy goal in common, to improve traffic flow in terms of safety, throughput, environment and in some countries reliability. For public authorities to reach their policy goals they have several instruments to their disposal, but only one budget. That means that, unless the budget is very large, choices have to be made. The priorities per country and per public authority may differ depending on various criteria. Regarding traffic safety the following order of investments is usually followed. First invest in the basic conditions for traffic safety, than invest in additional measures to even further improve traffic safety.

Basic conditions:

- Building and maintaining the national road network, making sure that the necessary infrastructure to allow safe traffic flows is available.
- Control the quality of the vehicles on this network, making sure that only safe vehicles (mainly regarding passive safety) are allowed to travel these roads

- Provide the necessary training and licensing to make sure that only skilled drivers are allowed to drive their vehicles on the roads

These three criteria should all three be met to guarantee a solid basis for traffic safety because the “triangle” human behaviour (driver) – vehicle – infrastructure, determines the level of traffic safety. If one of these three basic conditions is not met, then there’s no reason to invest in other conditions without addressing this lack of minimum criteria first.

Once the aforementioned basic conditions are met, it pays off to invest in additional measures to even further improve traffic safety. One of these additional measures would be to invest in IVSS, either stand-alone or cooperative. The potential of these systems is to increase traffic safety, provided that the basic preconditions are met.

In addition to investing in IVSS, either stand-alone or cooperative to improve traffic safety, there are more reasons for public authorities to invest. Especially for cooperative systems there is a large potential for road operators and public authorities because these systems provide the possibility to extract information from the traffic flow that’s necessary for their primary processes such as traffic management and maintenance of the road network. For instance traffic management measures are usually taken on the basis of data collected from loop detectors. Speed, intensity and type of vehicle can be identified by these sensors, but only at specific locations. By means of communication between the vehicle and the infrastructure this type of information and much more could be extracted from the traffic flow without having such loop detectors (and the associated costs and inconvenience from installing and maintaining them). Further more the coverage of the network can be extended largely because cars drive on primary as well as secondary and urban roads whereas (loop) detectors are usually located only on the primary roads. In addition to extracting information that nowadays is provided by other sensors and is used for traffic management, other types of information could be generated and used for new (to be developed) applications. Retrieving information from the vehicle about current ABS or ESC actions could provide local information about slippery roads for instance.

Since communication is a two-way street, there’s another potential benefit next to extracting information from vehicles and that is sending information to vehicles. Public authorities and road operators could start considering the impact of being able to send information to (specific groups of) drivers in their vehicle at a certain location at a certain time instead of posting it on static or dynamic signs, and thereby possible making them obsolete. The time scale of this development however is considerably larger due to the fact that large penetration rates are necessary and supporting actions to modify traffic regulations and laws might be necessary as well.

Once public authorities are convinced to invest in IVSS, the question is what role they can play in order to promote or speed up the deployment. Possible roles for public authorities and road operators are for instance that they can create the legal framework for the production (standardisation and homologation issues) and the use of IVSS. Financial incentives like tax reductions and direct subsidies can influence either the willingness to buy on the demand side and the

development/production costs on the supply side. Public authorities and road operators can support the deployment of IVSS by setting up and bringing forward research networks on IVSS and creating awareness through campaigns.

4.6 Factors in the Landscape

In addition to the roadmaps, routes to market and necessary pre-conditions discussed above that can accelerate the deployment of IVSS, there are other factors in the landscape, or exogenous developments, that can affect the implementation of IVSS. This section briefly discusses one of these developments.

Enforcement

Enforcement affects the deployment and use of some systems, in two ways, Firstly, some systems can help the driver in the cases of increased enforcement. For example, Full-Speed Range ACC can help the driver obey maximum speed limits as well as avoid tailgating. Speed reduction is the most important issue related to enforcement among the systems investigated. Thus, enforcement has the most direct effect on SpeedAlert among the system investigated in eIMPACT. Strict speed enforcement (with 100% chance of being caught speeding) will increase use of the SpeedAlert system. SpeedAlert including Variable Speed Limits in 2020 makes the SpeedAlert system even more attractive to use under strict speed enforcement. Strict enforcement can also have an impact on the effectiveness of some systems – such as NightVisionWarn, Driver Drowsiness Monitoring and Warning, and Full-speed Range ACC – in which drivers may have increased their average speed. With enforcement, driving with higher speeds is less likely to occur while using these systems.

Secondly, a higher penetration rate of some systems, especially SpeedAlert, can be expected under strict enforcement regimes. However, eIMPACT did not explicitly take into account the effects of higher penetration rates as a result of stricter enforcement.

5 Exploitation of knowledge and results

5.1.1 TNO

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
List of most promising IVSS	*International, national and regional public bodies, automotive industry, university*	*Present -3 years*	*Useful starting point for discussions about IVSS*
Quantitative results for 12 IVSS: traffic, safety, BCR, stakeholder analysis	*International, national and regional public bodies, automotive industry, university*	*Present – 3 years*	*Quantitative results can be used as stand-alone results to examine the impacts of individual systems and to advise stakeholders which systems meet their criteria*
All methodologies developed and applied in eIMPACT	*International, national and regional public bodies, automotive industry, university*	*Present – 3 years*	*Methodologies can be applied in future projects*
Deployment strategies for IVSS	*International, national and regional public bodies, automotive industry, university*	*Present – 3 years*	*Aids TNO in developing deployment strategies for future clients, both in terms of process and instruments available.*
Roadmap for future research	*International, national public bodies; strategic partners in research*	*Present – 3 years*	*The roadmap provides guidance for where TNO can focus its research in the area of IVSS in the future.*
Insights into intended and unintended results of IVSS via the safety mechanisms	*International, national and regional public bodies, automotive industry, university*	*Present – 3 years*	*The knowledge of intended and unintended effects helps TNO in model development, impact estimation, FOT design; and evaluation of model and FOT results. It also contributes to the general body of knowledge of what kinds of effects IVSS can have, both short- and long-term.*

5.1.2 UOC

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Methodology for assessment of socio-economic	*Inter-national, national and regional public*	*n.a.*	*The methodology can be used as a reference framework in further research projects which include socio-economic impact assessment. Moreover, findings can be also*

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
impacts of IVSS	*bodies, automotive industry, university*		*integrated in university courses on transport economics. Findings can be disseminated in conference papers and journal articles.*
Cost-benefit results for IVSS	*Inter-national, national and regional public bodies, automotive industry, university*	*n.a.*	*Based on the methodology framework cost benefit results were calculated for twelve IVSS, two target years and two deployment scenarios. Results provide a benchmark for other projects / research activities. Results also fit well into existing evidence on system benefits and costs. Findings can be disseminated in conference papers and journal articles.* *Sensitivity of results was comprehensively tested. The observation that variables coming from the impact assessment react more sensitively than variables within the socio-economic assessment is important for further research activities. Findings can be disseminated in conference papers and journal articles.* *Results provided also guidance on further research directions, involving assessment of system bundles, assessment of deployment programmes, improving robustness of BCR (Monte-Carlo simulation).*
Stakeholder analysis	*Inter-national, national and regional public bodies, automotive industry, university*	*n.a.*	*The methodology can be used as a reference framework in further research projects which include socio-economic impact assessment. Moreover, findings can be also integrated in university courses on transport economics. Findings can be disseminated in conference papers and journal articles.*
Linkage between penetration rate and driven kilometres equipped with the IVSS	*Inter-national, national and regional public bodies, automotive industry, university*	*n.a.*	*The methodology can be used as a reference framework in further research projects which include socio-economic impact assessment. Moreover, findings can be also integrated in university courses on transport economics. Findings can be disseminated in conference papers and journal articles.*

5.1.3 DAI (DCA)

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
List of most promising IVSS	*Intelligent Assistant system*	*Ongoing adjustment of strategy*	*The list of most promising IVSS provide a confident base which IVSS should be developed.*
Knowledge about driver behaviour in case of early warnings	*Test of intelligent Assistant system*	*ongoing*	*Analysing the test data of 41 test persons in the DaimlerChrysler driving simulator delivered quantitative information about the driver behaviour after a local danger warning. Simulations by TNO about the WILLWARN system confirm and complete the results of the data analyses. Results affect HMI issues.*
Behaviour and functionality of different traffic simulation tools	*Test of intelligent Assistant system and traffic impact*	*ongoing*	*Cross-check analyses of different simulation tools for analysing the traffic impact of IVSS. The results deliver the state of the art of functionality and behaviour of traffic simulation tools. The comparison of the simulation tools is the basis for a realistic assessment of the traffic impact of IVSS by simulations*
Safety relevance	*Assistance*	*ongoing*	*Evaluation procedures for the development process of IVSS can be further developed. Refined system descriptions and*

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
of IVSS	*Systems*		*new functionalities will be considered.*
Evaluation of Intelligent Vehicle Safety Systems –	*Development strategy of future IVSS*	*Depending on internal IVSS development roadmap this is an ongoing process*	*Methodology of impact assessment and results can be used for early assessment of new IVSS and the deployment strategy of future safety systems. The methods have to be applied in alignment with the Code of Practice (COP)*

5.1.4 CRF

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
List of most promising IVSS	*Public bodies, automotive industry*	*Present -3 years*	*Contribution to IVSS list identification and selection of the most relevant IVSS to be evaluated in the cost-benefit analysis..*
Cost-benefit analysis	*Public bodies*	*Present -3 years*	*Analysis of the documentation for IVSS cost-benefit analysis and peer review of deliverable D3 " Methodological framework and database for socio-economic evaluation of Intelligent Vehicle Safety Systems".*
Safety impact of IVSS	*Public bodies, automotive industry, insurance companies*	*Next years*	*Elaboration of data regarding vehicle fleet composition in partner countries. Collection and analysis of road accident statistics available in partner countries in order to correlate accident causes to IVSS.*
Policy options for IVSS deployment	*Public bodies, automotive industry, insurance companies*	*Present -3 years*	*Contribution to the preparation of a questionnaire to investigate possibilities and means organisations would use to influence the penetration of IVSS on the market. First round of interviews towards public authorities, OEMs, suppliers, insurance companies and Associations.*
Policy options for IVSS deployment	*Public bodies, automotive industry, insurance companies*	*Present*	*Contribution to the definition of most effective policy implementation strategies for Lane Keeping Support and SpeedAlert in terms of main involved stakeholders and policy instruments.*
Stakeholder analysis and overall evaluation results	*Public bodies, automotive industry, insurance companies*	*Present -3 years*	*Contribution to the definition of a qualitative assessment of stakeholder roles (suppliers, OEMs, public authorities, insurance industry and users) in terms of company goals, IVSS market introduction strategies matching company goals and financial risks associated with IVSS market introduction.*
Use of project results	*Automotive industry*	*Present*	*Comparison among different IVSS in terms of benefit-cost ratio in order to define system implementation decisions..*
Use of project results	*Automotive industry*	*Present -3 years*	*Recommendations about IVSS deployment process.*

5.1.5 BMW

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Evaluation and design of future Intelligent Vehicle Safety Systems	*Strategies to develop and deploy future advanced driver assistance systems and related marketing concepts*	*Depends on internal roadmap for advanced driver assistance systems*	*Methodology of impact assessment (nine safety mechanisms) as well as methodology to calculate benefit-cost ratios and to perform break-even analyses could be used to support the appraisal of future safety systems as well as identification and assessment of business cases.*
Knowledge about driver behaviour after a local danger warning and in general the behaviour of cooperative safety systems	*Test of intelligent Assistant system and intelligent traffic systems*	*Test of IVSS in Field Operational Tests on National or EC- level (e.g. SIM-TD, a German initiative) starting in 2008*	*Analysing the test data, the safety effects as well as cost and benefit estimations of future business cases.*
Safety relevance of IVSS	*Development of Assistance Systems*	*Depends on internal roadmap; expected after 2008*	*Refined system descriptions used in eIMPACT as well as description of safety effects in terms of safety mechanisms*

5.1.6 BOS

Exploitable Knowledge (description)	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner & Other Partner(s) involved	Short description of the exploitable results
IVSS assessment criteria and prioritisation of different stakeholders	*Criteria are involved into product strategy planning*	*Safety functions*	*2013*	*n.a.*	*All partners*	*Different assessment of stakeholders give orientation in product desin and requirement process.*
Methodology aspects of safety assessment of IVSS	*Safety assessment and efficiency criteria are involved into development process*	*Safety functions*	*2013*	*n.a.*	*All partners*	*Accident analysis is a important base of safety funtion deveolpment and alreda been used to develop IVSS.* *The view of various stakeholders help to prioritise and focus the manifold sectors of accident analysis.*
Cost estimations	*Improved*	*Safety*	*2013*	*n.a.*	*All partners*	*Cost prognosis*

Exploitable Knowledge (description)	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner & Other Partner(s) involved	Short description of the exploitable results
and prognosis of IVSS	*prognosis of marketing strategy*	*functions*				*of various stakeholders improve the marketing estimations*
Analysis of Introduction barriers of IVSS	*Identification of enabling instruments for introduction of IVSS*	*Safety function suppliers development process and marketing*	*n.a.*	*n.a.*	*All partners*	*Indicators which determine the deployment of the market of IVSS*
System dependencies & stakeholder oriented cost benefit analysis of IVSS	*List of most promising IVSS*	*Safety functions and driver assistance functions*	*2013*	*n.a.*	*All partners*	*The list of most promising IVSS provide a confident base which IVSS should be developed.*

5.1.7 PTV

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Knowledge about the methodologies to evaluate driver behaviour with IVSS	*Consulting for OEMs and public bodies*	*Within 1 – 2 years*	*The methodology to introduce IVSS into traffic flow simulation is further developed and leads to a more efficient practice. This methodology can be used for further analyses.*
Knowledge about the effects of IVSS	*Consulting*	*Within 1 – 2 years*	*The experiences about effects of different IVSS in various ways, like traffic effects and deducted socio-economic effects, extend and complement the existing know-how.*

5.1.8 VTT

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Safety impact assessment methodology	*Impact assessment studies and methods*	*2008*	*The comprehensive methodology for safety impact assessments for realistic fleet penetration rates including tools for the calculations*
EU25 accident data	*Impact assessment studies and methods*	*2008*	*EU 25 accident data including the trend estimates for 2010 and 2020 organized in three clusters*
Safety impact estimates of IVSS	*EU and national transport policy and ITS's role in it*	*2008*	*Safety impact estimates of IVSS indicated in terms of percent changes, numbers of fatalities and injuries for 100% potential and estimates of realistic fleet penetrations*
Knowledge on acceptable measures to	*EU and national transport*		*Interviews of different stakeholders and results of stakeholder workshop concerning measures to promote use*

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
promote use of IVSS	*policy and ITS's role in it*		*of IVSS*
Benefit cost estimates for IVSS	*EU and national transport policy and ITS's role in it*	*2008*	*Ranking of the systems based on benefit cost ratio*

5.1.9 BAS

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Socio-economic Assessment Methodology	*Inter-national and national research projects, advice to the German Ministry of Transport, Building and Urban Affairs*	*Within 1-2 years*	*Methodology for socio-economic assessment can be used as a comprehensive evaluation framework in future research projects on the international and national level. The assessment framework may be presented and discussed in scientific articles. Findings will be included in the advisory work on the deployment of IVSS to the German Ministry of Transport, Building and Urban Affairs*

5.1.10 RWS

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Cost-benefit results for IVSS	*National and regional public bodies*	*n.a.*	*Results provide a benchmark for other projects / research activities and can help public authorities to decide whether they should invest in specific projects / research or not*
Safety and traffic impact of IVSS	*National and regional public bodies*	*n.a.*	*Results provide a guideline for public authorities to decide whether they should endorse several IVSS or not*
Methodology for stakeholder consultation	*National and regional public bodies*	*n.a.*	*The methodology developed for the stakeholder consultation during the international stakeholder workshop can be used in the (near) future to gather empirical input from stakeholders regarding either IVSS deployment strategies discussions or ITS related deployment strategies*
Key elements for deployment of IVSS	*National and regional public bodies*	*n.a.*	*The identification of key elements for the (speeding up of) deployment of IVSS are useful for public authorities to help them formulate policies regarding IVSS*

5.1.11 CDV

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Knowledge of eIMPACT project and results of stakeholder interview in Czech republic, Slovakia and Poland	*National and regional public bodies, automotive industry, research institutes*	*2008 (in print, now)*	*Paper: Possible tools for ITS support. (Strategie pronikání vybraných ITS na trh) In magazine: Horizons of Traffic (Horizonty dopravy)*
Knowledgle of ITS and HMI	*Automobile clubs, fleet managers, car industry, users*	*2008 (in print, now)*	*Paper: Intelligent systems for intelligent drivers? (Poslouží inteligentní systémy inteligentnímu řidiči?). In magazine: Fleet (Fleet).*
Knowledge of HMI, intelligent systems and	*Psychologists, users, automobile*	*2008 (in print, now)*	*Paper: ITS impact on drivers (Vliv vybraných iTS na řidiče). In magazine: Today Psychology (Psychologie Dnes).*

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
driver´s reactions	*clubs, fleet managers*		

5.1.12 MOV

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
Knowledge of IVSS applications	*Advice to strategies in R&D efforts. Forecast of use of IVSS in future traffic.*	*Within 1-2 years*	*Provision of advice on R&D efforts to understand behavioural adaptations concerning stand-alone and cooperative IVSS in FOT's and other research activities. Classification of IVSS in order to track real effects of IVSS in use.*
Impacts of IVSS	*Assessment of contribution of IVSS to objectives in the traffic sector.*	*Within 1-2 years*	*MOV have gathered input for 5 systems to safety analysis in WP3 and contributed to safety assessment methodology. Experience from this approach can be used to enhance and focus European and national R&D programs.*
Evaluation framework and results for IVSS	*Assessment of contribution of IVSS to efficiency in the traffic sector.*	*Within 1-2 years*	*MOV provided input from safety analysis and national CBA to methodology in D3. Results can be used to improve decision-making concerning IVSS.*

5.1.13 IMC

Exploitable Knowledge (description)	Sector(s) of application	Timetable for commercial use	Description of the exploitable results
n.a.	*b.a.*	*n.a.*	*n.a.*

6 Future Dissemination Activities

Table xx below contains a summary of the planned future dissemination activities by eIMPACT partners

Planned/ actual dates	Type	Type of audience	Countries addressed	Size of audience	Partner responsible /involved
	Press release(press/radio/TV)				
	None yet				
	Conferences				
16-20.11.2008	Presentation at a Special session Accident causation and impact assessment of intelligent vehicle safety systems, sponsored by DG INFSO, with the title "Results of the eIMPACT Project on impact assessment and socio-economic analysis", World conference on Intelligent Transport Systems, to be held in New York, USA	International	International	Over 1000 attendees expected	TNO
	Publications				
Future	Article in NM Magazine, "Socio-economic impacts of stand-alone and cooperative IVSS in Europe"	National (Netherlands)	International	100 experts	TNO
June 2008	Article in Road Horizon, Czech Republic, "Tool for IVSS market penetration support" presenting results of policy deployment results based on interviews in the Czech republic, Slovakia and Poland	National	International	Journal about traffic engineering addressed to professionals in traffic	CDV
June 2008	Article in I-Fleet, Czech Republic, "Intelligent systems and intelligent drivers", addressing HMI	National	International	Journal about drivers, cars and fleet addressed to fleet managers and other professionals in traffic	CDV
Future	Article accepted for publication in Today	International	International	Journal about psychology	CDV

Planned/ actual dates	Type	Type of audience	Countries addressed	Size of audience	Partner responsible /involved
	Psychology “ITS and driver safety”, addressing HMI			and transport psychology	
	Media briefings				
	None yet.				
	Exhibitions				
	None yet				
	Project web-site				
2008 - 2009	Final deliverables will be placed on Web site	General public	International	n.a.	PTV, TNO
	Posters				
	None yet				
	Flyers				
	None yet				
	Direct e-mailing				
	None yet				
	Film/video				
	None yet.				