A CODE OF PRACTICE FOR DEVELOPING ADVANCED DRIVER ASSISTANCE SYSTEMS:
FINAL REPORT ON WORK IN THE RESPONSE 3 PROJECT

Version: 1

by S Cotter, J Hopkin and K Wood (TRL Limited)

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(A Burrows)

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Executive summary

The European Commission funded project ‘RESPONSE 3’ was established with the main aim to develop a Code of Practice for the design and evaluation of ADAS. Before RESPONSE 3 the industry had no formal guidelines or legislation to help in the design and development of ADAS systems. From the manufacturer’s perspective it is clear (or reasonably clear) what technological performance has to be achieved, and internal quality assurance procedures are in place to ensure the required standards are achieved. The manufacturers had no equivalent clear targets to aim for concerning driver interaction behaviour and ergonomic/traffic safety. The RESPONSE Code of Practice can be used by industry through self-commitment to fill this position and to help ensure safe systems.

The European eSafety initiative aims to speed up the introduction of new technologies for improving road safety, and in this context, the European Commission has funded research to support the development and introduction of ADAS. The RESPONSE Code of Practice (CoP) helps to meet that objective through a robust development process to avoid liability recall issues with systems when they reach market.

This report, whilst written for the UK Department for Transport (DfT), is also designed to help encourage manufacturers and suppliers to adopt the Code of Practice and understand the purpose, scope and potential future use of the Code of Practice.

Advanced Driver Assistance Systems (ADAS) are active safety systems fitted in vehicles which support the driver, making the driving task safer and more comfortable. They help the driver in normal driving and critical situations to prevent accidents or mitigate their consequences.

ADAS systems present new challenges for system safety. The RESPONSE Code of Practice helps with these challenges and is designed to guide industry in developing, testing, assessing and introducing ADAS systems to market. The CoP provides a tool for engineers to use when developing and assessing ADAS. ADAS do not operate in isolation so there is a focus within the Code of Practice on controllability of the vehicle and the human machine interactions involved. The Code endeavours to help in the development of systems that allow full driver controllability and as such are acceptable to both drivers and Authorities. The Code of practice covers all of the stages in the development and testing of ADAS systems. It includes procedures which can be integrated into manufacturers’ own processes.

While developing the Code of Practice, the RESPONSE 3 project has achieved broad consensus among the manufacturers and suppliers involved in the project on the rationale for and content of, the Code of Practice. Also during the RESPONSE 3 project industry involved in sub-projects conducted trials of the CoP before the Code was finalised.

A preliminary informal consultation has been conducted by TRL with European Member States to obtain their first opinion on the Code of Practice. The results indicate that Public Authorities will support a self commitment to the CoP from industry and they agree that the CoP is sufficient to demonstrate adequate safety and fulfil the needs of their country in terms of ADAS approval but would be in favour of regulations or legislation stemming from the CoP in the future. It appears that Member States would find it useful to receive recommendations from the EC regarding implementation of the CoP and would be in favour of endorsement of the CoP at a European level. Member States have identified no serious barriers to implementation of the CoP.

A Public Workshop took place at the end of the RESPONSE project. During discussions it was suggested that voluntary adoption of the Code of Practice would not be sufficient and that legislation would be needed. The Code of Practice offers significant help in avoiding the problems feared by manufacturers such as litigation and product recall. The industry partners of the RESPONSE project have already started to implement the Code of Practice as an industry “self commitment”. For example VW, PSA and Bosch are all implementing the CoP in their organisations. On initial review it has been positively received. It is thought to be particularly useful for junior engineers although one organisation commented that the checklist appears complicated to use initially but does offer real benefits in practice. During the Workshop it was agreed that the RESPONSE CoP will be presented to
the eSafety Forum for its adoption. There is also a proposal to ACEA (European Automobile Manufacturers Association / Association des Constructeurs Européens d’Automobiles) to monitor the CoP and discuss the need for modifications.

The Code of Practice (European Commission, 2006) has been issued as a final draft and the project deliverable is waiting for European Commission Approval. The CoP has already been disseminated through a paper and presentation at the 13th ITS World Congress in London and an article in TEC magazine. In addition a presentation has been given by TRL to the International Harmonisation Research Agenda ITS Group.

When deciding the next steps for the RESPONSE CoP it is important to consider not only the results of the initial consultation but also lessons learned from writing similar guidelines and to learn from the work of the EC eSafety Implementation Road Map group. These factors have been fully considered and used to draw up a list of the next steps towards implementation, which are summarised below:

- Over the next two years TRL recommends that it would be beneficial for industry to record the use of the Code and provide a review of the use of the document.
- All industry organisations should be encouraged to use the RESPONSE CoP and, in the UK, the Department for Transport should encourage industry to implement and review the Code of Practice. In order to help industry it would be advisable to develop training materials to help industry implement the CoP.
- An industry self-commitment is only the first stage and it is recommended that the Code of Practice should be developed into a European Code of Practice or an EC Recommendation (as with the European Statement of Principles, ESoP). This process should start through the eSafety Forum.
- A European agreement is easier to achieve than a global agreement. However it was reported during the final RESPONSE workshop, that the USA have stated that the RESPONSE CoP would be useful for their needs in the USA and would assist with legislative issues.
- Community acceptance is vital, therefore an important recommended next step is to conduct a full consultation over an 18 month time frame. The eSafety forum may be a good place for this activity to take place utilising a wide range of experts.
- Consideration should be given to the further development of specific assessment criteria within the CoP before it is implemented as European Guidance or an EC Recommendation.
- It is likely to take some time before a European Code of Practice is established; therefore, it is strongly recommended that the UK should consider developing a UK Code of Practice.

A summary of the next steps are shown in the flow diagram below:
PART 1 – DEVELOPMENT OF THE CODE OF PRACTICE

1 Introduction

The European eSafety initiative aims to speed up the introduction of new technologies for improving road safety, and in this context, the European Commission has funded research to support the development and introduction of ADAS. The Code of Practice helps to meet that objective through a robust development process to avoid liability recall issues with systems when they reach market.

This report whilst written for DfT, is also designed to help encourage manufacturers and suppliers to adopt the Code of Practice and understand the purpose, scope and potential future use of the Code of Practice.

1.1 Background

Advanced Driver Assistance Systems (ADAS) are active safety systems fitted in vehicles which support the driver, making the driving task safer and more comfortable. They help the driver in normal driving and critical situations to prevent accidents or mitigate their consequences. Examples include: electronic stability program, intelligent speed advisory, lane departure warning, speed alert, adaptive headlights, blind spot monitoring and collision warning systems. In future, some ADAS could potentially take control from the driver in extreme situations.

Currently, practical experience of ADAS in use is limited, and they provide new challenges for system safety for two reasons. In modifying the control of the vehicle, they involve interactions between the driver and the system, and at the same time there are complex interactions between the system and the road environment which alter the interactions between the driver and the vehicle.

Although industry has done a considerable amount of development work on prototypes for ADAS, few systems have reached the stage of mass production. Those which have entered the mass vehicle market have been slow to reach that stage. Slow and curtailed development can be explained partly by risks not being fully taken into account or not being overcome during the early stages of the development process; there are risks for manufacturers if systems do not match users expectations, develop faults or are operated beyond defined limits (in other words, they are misused). There have also been technical issues affecting progress, while some of the systems which have been developed do not fully meet users’ needs and expectations.

This report presents a Code of Practice for developing, testing, assessing and introducing Advanced Driver Assistance Systems (ADAS), which has been developed by the RESPONSE 3 project (European Commission, 2006). This project has been funded partly by the European Commission and partly by industry and Member States, and has been carried out by a European consortium consisting of vehicle manufacturers, equipment manufacturers, research organisations and ERTICO (ITS Europe). The project is a sub-project within the PReVENT Integrated Project which covers a broad range of research activities on the topic of preventative safety (PReVENT project website: http://www.prevent-ip.org/).

While developing the Code of Practice, the RESPONSE 3 project has achieved broad consensus among the manufacturers and suppliers involved in the project, on the rationale for and content of, the Code of Practice. The project has also carried out preliminary consultations with Member States to elicit the views of public authorities on support for the Code of Practice and ways to encourage its implementation.

1.2 Purpose of the Code of Practice

The RESPONSE 3 Code of Practice for the design and evaluation of ADAS is intended to help manufacturers and suppliers with the process of developing and testing safe ADAS by providing them with detailed guidance that has been widely validated for different systems, providing a quality
process and methods and tools for assessing the safety of ADAS. Using the Code will enable manufacturers to declare that their systems have been developed using state of the art techniques. With the support of this Code of Practice, it is hoped that manufacturers will be encouraged to develop safer ADAS systems. The industry partners of the RESPONSE project are already starting to implement the RESPONSE Code as an industry self commitment.

1.3 Scope of the Code of Practice

The Code of Practice provides manufacturers with guidance for use in all of the work involved in specifying, developing and assessing ADAS throughout the development process, up to the point where systems enter mass production. The Code does not deal with issues which arise after this point.

The Code includes a compilation of the diverse knowledge, experience and best practice among the various manufacturers involved in the project on risk identification, risk assessment and evaluation methodology, in the context of developing and assessing ADAS.

The Code is not intended to apply to all types of ADAS. Those which provide vehicle stabilisation (such as ABS and ESP) and systems which simply provide information, warnings and communication services (such as navigation systems and telephones) without any intervention in the driving task are not specifically covered, although the approach adopted in the Code of Practice may still provide some help in their development. While the Code of Practice may be relevant to systems which involve vehicle to vehicle communication, it does not cover all of the issues involved in developing such systems. If manufacturers wish to apply the Code of Practice to development of ADAS which are outside its scope, they will first need an expert review and will then need to adapt it to suit the different characteristics of these systems.

1.4 Structure of report

This report is split into two parts. Part One concerns the development of the Code of Practice (CoP) while Part 2 concerns its implementation. Within Part 1, Chapter 1 provides and introduction to the CoP. Chapter 2 describes the philosophy of the Code. Chapter 3 provides a brief outline of the contents of the Code of Practice. Chapter 4 aims to provide an overview of the results of a consultation that took place with Authorities to obtain their views on the role, content and implementation of the CoP across Member States. Chapter 5 gives an account of the final public workshop within the RESPONSE project where the CoP was presented to the community. Finally Chapter 6 gives a brief overview of early trials of the Code of Practice.

Within Part 2, Chapter 7 gives an account of how TRL have disseminated the Code of Practice. Chapter 8 provides a summary of lessons that can be learned from previous guidelines and codes during the implementation process for the RESPONSE Code of Practice. Chapter 9 describes how the Code of Practice fulfils the recommendations of the Implementation Road Map Working Group of the European Commission (EC) eSafety initiative and describes the recommended future actions for implementation. Finally Chapter 10 provides a summary of the next steps.

2 Philosophy of the Code of Practice

2.1 Procedures for integration into manufacturers’ processes

The Code of Practice has been developed by a group of motor manufacturers based in Europe and is intended to be used voluntarily by these companies and others across Europe. It offers an approach which can be applied to any system within its scope; it does not prescribe any specific system design.

The Code of Practice provides a tool for engineers to use when developing and assessing ADAS. It includes procedures which can be integrated into manufacturers’ own processes, along with
information which can be used to help design the tasks to be carried out during the various development phases.

The Code of Practice is intended to ensure that new ADAS systems are easy for drivers to understand and to operate at all times, that system limits are clear and that defects and errors are made obvious and are communicated to the driver in good time, hence minimising risks both to drivers and manufacturers.

ADAS operate by detecting and evaluating the road environment in which the vehicle is being driven, and using this information to support the driver in different ways. As a result, the design of these systems is extremely complex. Environmental sensing systems are currently limited in their functionality, which restricts the degree to which they can support the driver and means that there has to be an interaction between the system and the driver. Under current legislation (the Vienna Convention), this interaction has to be controllable.

The Code of Practice therefore focuses strongly on the question of ensuring that a system can be controlled by the driver. ADAS do not operate in isolation, so the focus has to be on controllability of the vehicle and the Human Machine Interactions involved. This is done in the Code of Practice by considering the likelihood that the driver can cope with the driving situation, including ADAS-assisted driving, driving at system limits and in cases where the system fails.

2.2 Benefits to industry

The Code of Practice (European Commission, 2006) is designed for use by motor industry development engineers. Only an outline is given here but a hyperlink to the Code of Practice is provided in Appendix D. The Code is designed to encourage industry develop systems that are safe for market introduction. Industry is keen to develop systems that assist drivers increase safety and increase sales. However there is concern about the risks from bad publicity and liability issues if systems do not live up to users’ expectations or could be implicated as a cause of an accident. The code aims to help in the development of systems that allow full driver controllability and as such are acceptable to both drivers and Authorities.

Before RESPONSE 3 the industry had no formal guidelines or legislation to help in the design and development of ADAS systems. From the manufacturer’s perspective it is clear (or reasonably clear) what technological performance has to be achieved, and internal quality assurance procedures are in place to ensure the required standards are achieved. The manufacturer had no equivalent clear targets to aim for concerning driver interaction behaviour and ergonomic/traffic safety. The RESPONSE Code of Practice can be used by industry through a self-commitment to fulfil this position to help ensure safe systems.

Chapters 5 and 6 provide some examples of how the Code of Practice has been used by industry to date.

3 Outline of the Code of Practice

The Code of Practice covers all stages in the development and testing of ADAS including:

- Specification of ADAS
- Performing hazard and risk analyses
- Assessment methodology for ADAS.

The main part of the Code of Practice is contained in 10 pages which follow the phases of a generic development process for ADAS. For each phase it sets out the activities, the tasks involved and reference to the relevant Annex containing detailed guidance. The structure of the Code of Practice is outlined below:

1 Definition phase
1.1 Objectives
1.2 Draft HMI concept and Controllability safety concept

2 Best Concept Selection
2.1 Objective
2.2 HMI interaction concept specification
2.3 Selection of HM interaction concept

3 Proof of Concept
3.1 Objective
3.2 Preparation of preliminary sign-off
3.3 Controllability preliminary sign-off

4 Detailed Design
4.1 Objective
4.2 Detailed HMI interaction design

5 Verification
5.1 Objective
5.2 Verification of HM interaction

6 Validation and Sign-off
6.1 Objective
6.2 Controllability Confirmation and final proof
6.3 Sign-off

The Annexes contain 85 pages of detailed guidance on specific activities and tasks within the Code of Practice:

ANNEX A: RESPONSE Procedures
A.1 Checklist – System Specification
A.2 Checklist – Evaluation concepts for system specification
A.3 Hazard analysis and risk assessment procedure

ANNEX B: Recommendation for controllability evaluation

ANNEX C: General methods for safety analysis
C.1 Risk Assessment by HAZOP
C.2: Failure Modes and Effects Analysis (FMEA)
C.3: Fault Tree Analysis (FTA)
C.4: Hardware in the Loop (HIL) Testing

ANNEX D: General methods of assessment
D.1: Expert Panel
D.2: HMI Concept Simulation
D.3: Driving Simulation
D.4: Driving Tests with Professional Test Drivers
D.5: Car Clinic with Naive Subjects
4 Consultation with European Member States

4.1 Coverage

TRL conducted a consultation among Member States to both raise awareness of the RESPONSE CoP and to obtain opinions on the role, contents and implementation of the CoP. Government officials from eleven Member States were contacted informally and asked to provide their personal opinions. In addition to Member States, ERTICO and eSafety were also given an opportunity to comment. The opinions given were not necessarily the official Member State policy but provided a useful first indication of opinions. The contacts were provided with an explanation of the RESPONSE project and a short summary of the Code of Practice. They were offered the opportunity to review a complete draft of the Code if required.

Of the government contacts, seven Member States responded (Austria, Czech Republic, Finland, France, Germany, The Netherlands and the UK). One Member State official (France) did not answer the questionnaire as they felt that a CoP would have no meaning in their country until it was integrated into legislation. Greece, Italy, Sweden, Spain, ERTICO and eSafety did not respond.

The contacts were asked the following questions:

Role of CoP

1. From a Public Authority’s point of view, do you agree that the best way to introduce ADAS into the market in a safe and rapid way would be for industry to commit themselves to meeting the Code of Practice (i.e. ‘self commitment’)?
2. From a Public Authority’s point of view, is the CoP sufficient to prove the safety of a new ADAS?
3. From a Public Authority’s point of view, is the CoP sufficient to fulfil the needs of your country in terms of ADAS approval?
4. Is there a need for this Code of Practice in your country and would you find it useful?
5. Does the Code of Practice need to be discussed between Member States and industry at a European level: for example to agree the contents, approach and implementation? If so, how would you like such discussions to take place?
6. Do you think it is (a) useful or (b) necessary for Member States to receive recommendations from the EC regarding implementation of the CoP.

Coverage

7. Do you have any comments on the scope or topics covered in the Code of Practice? And from the Public Authorities point of view are there any additional topics you would like to see included?

Dissemination

8. How likely is it (Very likely, likely, not likely) that you would use each of the following methods to disseminate the Code of Practice in your country?
   - Publicise the document (e.g. publish, website, workshops, forums)
• Provide a summary to key stakeholders
• Present the Code of Practice at a meeting of national stakeholders
• Set up an on-going Working Group for key stakeholders
• Other (please give details)

Implementation

9. Which of the following steps to implementation of the Code of Practice are likely in your country? Please rank according to your Authority’s priority with ‘1’ being the most important:

• Memorandum of Understanding between EC and industry (ACEA-self commitment strategy)
• International Code of Practice
• Endorsement of the CoP at the European level
• Government endorsement (National Code of Practice)
• Changes to national legislation
• Study of the impacts of the Code of Practice
• Study of the long term effects of ADAS on safety and driving
• Clarification of Liability
• Other (please give details)

11. Do you have any other comments to make about the Code of Practice or its implementation?

12. From a Public Authorities point of view do you identify any barriers to the implementation of the CoP?

4.2 Analysis of results

The contacts all agreed that a self commitment to the Code of Practice from manufacturers would be a good way to introduce ADAS into the market in a safe and rapid way. (Although as noted above, the French view was that the CoP would need to be integrated into legislation before it could be implemented). However, three officials noted that a self commitment represents an excellent first step but should be followed by legislation.

Four officials agreed that there was a need for the CoP in their country. However Austria felt that their small industrial sector which is comprised mainly of suppliers does not require such a code. The official contacted within the Czech Republic felt the CoP would protect users but was not needed from a Public Authority point of view, while acknowledging that it may be useful in the future. All contacts except the German official felt the CoP would be sufficient to prove the safety of new ADAS and fulfil the needs of their country in terms of ADAS approval. The German official noted that in past experience (such as pedestrian safety) a self-commitment has not been satisfactory to the European Commission and legislation is preferable.

Opinions were sought on whether the Code of Practice needs to be discussed between Member States and industry at a European level: for example to agree the contents, approach and implementation, and if so, on how such discussions should take place. All Member States except Austria agreed that discussions should take place.

All officials who completed the consultation agreed that they envisage disseminating the CoP in their country by publicising it through websites, workshops, forums and formal document publication. The majority consider a presentation to national stakeholders to be important and half of the contacts
would consider providing a summary to key stakeholders. Finland and Germany would also consider a working group for key stakeholders.

The contacts were asked to comment on which steps are likely to be taken in their country before implementation of the Code of Practice. Options offered included: Memorandum of Understanding between EC and industry; International Code of Practice; endorsement of the CoP at the European level; National Code of Practice; Changes to national legislation; Study of the impacts of the Code of Practice; Study of the long term effects of ADAS on safety and driving; Clarification of liability. Four of the Member States felt that endorsement of the Code of Practice at a European Level was an important step towards implementation. Three of the contacts considered a national CoP to be important, while only one would consider changes in national legislation to be necessary. The Czech Republic and Austria felt that a Memorandum of Understanding between industry and the Commission was the most important step to implementation. Most Member States agreed that it would be important to undertake clarification of liability and study the long term effects of ADAS on safe driving. Overall it is clear that there is support for the European Commission to get involved in helping Authorities implement the Code of Practice.

Contacts were asked if they felt it was useful/necessary for Member States to receive recommendations from the EC regarding implementation of the CoP. All responses except the UK indicated that recommendations would be useful and two felt it was essential. The UK noted that it would be more appropriate for the EC to negotiate directly with manufacturers to ensure compliance with the CoP.

The Officials that responded to the consultation generally could not identify any barriers to implementation. Austria noted that driver acceptance is an important issue. The UK noted the importance of disseminating the information appropriately to manufacturers to aid the implementation process. Germany felt that regulation rather than industry self commitment would be a more successful implementation. The Czech Republic noted that implementation would be aggravated if a requirement was introduced for existing ADAS systems in existing vehicles to comply with the principles within the CoP.

In summary the results of the initial consultation indicate that Public Authorities will support a self commitment from industry and they agree that the CoP is sufficient to demonstrate adequate safety and fulfil the needs of their country in terms of ADAS approval but would be in favour of regulations or legislation stemming from the CoP in the future. In France however, the CoP would need to be integrated into legislation before it could be implemented. It appears that Member States would find it useful to receive recommendations from the EC regarding implementation of the CoP and would be in favour of endorsement of the CoP at a European Level. The main method of dissemination through Member States is likely to be through publication of the CoP and presentations to national stakeholders. Member States have identified no serious barriers to implementation of the CoP.

5 Stakeholder workshop, September 2006

5.1 Introduction

The final RESPONSE 3 Workshop took place on 26th-27th September 2006. The aim of the workshop was to present the Code of Practice (CoP) developed in RESPONSE 3 to a wide audience of vehicle manufacturers and other stakeholders and to discuss its future. In addition there was information on how the integrated project PReVENT, of which RESPONSE 3 is a part, is progressing and will present its results at an exhibition next year as part of the i2010 Intelligent Car initiative.
5.2 Discussion on the Code of Practice

In a talk on the need for the CoP, Audi emphasised that within the proportion of accidents that are the result of human error (over 90%), over 60% are due to “information errors”, mainly overlooking, or ignoring, traffic signs and signals.

In informal discussions, representatives of the VW group said that they expected to gain senior management support for the CoP. Adoption within the company would then be a simple top down process and they expected good compliance. A representative from the active safety department of PSA (Peugeot Citroen) said that he expected the company to adopt the CoP.

During the workshop there was also a general discussion of the Code of Practice. Some specific points were made:

- A suggestion that a tutorial could be built into the car to allow drivers to experience individual ADAS components at times when the vehicle sensors indicated that it was safe. The reasoning behind the suggestion was that some drivers are unaware of the effect of the system on the vehicle. For example, in the case of adaptive cruise control, the driver may be unsure about the effect on vehicle speed and how this is controlled.

- The EU project officer for PReVENT asked whether the emphasis on controllability meant a transfer of responsibility from the manufacturer to the driver. He was told that this was definitely not the case. The objective was to build safe systems that will reduce the number of accidents due to driver error, not to transfer responsibility to the driver.

- A delegate with experience of both the aviation and motor industries expressed the view that voluntary adoption of the CoP will not be sufficient and legislation will be needed. He also said that a formal record of in-service performance, as provided by aircraft black boxes, will be needed to ensure that system objectives have been met and to provide indicators of where improvements are needed. In response, it was noted that good evidence on performance is being collected from the data acquisition capabilities built into ACC systems.

On the final day of the workshop, a TRW spokesman reported on potential acceptance by a selection of manufacturers in the USA. He saw no major problems with acceptance of the CoP in the USA, but noted that however good it was, it would not guarantee freedom from liability claims in the USA, although it should help significantly.

In a presentation on the i2010 initiative, it was commented that the European Commission is concerned with the slow rate of take up of e-safety systems; ABS is still not universally fitted and ESP is a minority fitment and not offered by some manufacturers. One of the barriers that he saw is the manufacturers’ worries about litigation and product recall in case of poor performance and that the CoP directly attacked these problems. Another major problem is the lack of awareness by the public and Authorities of the capabilities of such systems and consequent lack of public demand. An objective of i2010 is to address the lack of awareness and interest.

5.3 Panel discussion

A panel of representatives of the motor industry discussed their experiences and attitudes to the CoP.

5.3.1 PSA

The representative, leading work in active safety and simulation, said that PSA had not yet undertaken a full end to end trial of the CoP. However, as part of their work in the project they had retrospectively applied checklists A and B to projects that were still in development, but beyond the stage where the checklists would normally be used. The initial reaction was that the checklists were rather complicated. At the end of the trial, the engineers were much more positive, accepting that the
checklists were feasible, but saying that they required some days work. They also commented that they had learnt many things through using them.

The company has made an interactive presentation to introduce the CoP to engineers and to use it as a training tool for beginners.

5.3.2  BMW

The head of the BMW HMI Department noted that different experts from within a company should come together and use the CoP, despite some open questions remaining. During the next 2 years, or so, companies need to determine:

- the scope of where the CoP is applicable
- resources required
- benefits

Controllability is still a problem; the same assessment may well not be applicable for the three situations:

- normal use
- when approaching system limits
- during system failure

His opinion was that validation in use and a review is needed in about 2 years time before the company can fully commit to the CoP. The validation should consider the balance between:

- controllability
- system efficiency or benefit
- user acceptance

5.3.3  Bosch

The representative from Bosch said that his organisation had been using the RESPONSE methods for some time, from the end of the original RESPONSE project. The main benefit had been as a filter of ideas and to widen the view of technicians of what needs to be included in the development of the system. The RESPONSE approach had filtered out some ideas as impracticable and the company had avoided the cost of building prototypes.

He said that a weakness in the CoP is that it does not give guidelines on how much to spend on testing. There is a very large difference in cost between a quick expert panel and a major user trial.

It is not possible to answer yes to all the questions in ‘Annex B’. Therefore, the developer could be documenting that he is aware of a potential problem and has not solved it. The example he quoted was of a driver of an automatic car pressing the brake pedal as if it were the clutch when wanting to change gear.

He said that there needs to be a breakdown between the responsibilities of a system supplier and the OEM. He agreed with BMW that there needs to be a balance. The CoP is a risk assessment tool, but there were no guidelines on assessing benefits. He would like templates or example sheets for systems that are on the market, although the systems would not have used the CoP, the checklists etc. could be completed retrospectively as examples. He would like them to include details of the testing to show the level of testing that had been considered acceptable.
5.3.4 Audi

Audi’s representative said that the CoP was a big advantage for inexperienced engineers to emphasise the importance of considering all the possible system limits and potential failures. It was also good for experienced engineers who do consider all the possibilities, but can overlook some details. With the checklist they can document that they have considered all the foreseeable risks.

5.3.5 Ford

The representative from Ford stated that their HMI development process needs to improve. He noted that the amount of testing, as raised by Bosch, is a serious problem, but it cannot be specified in detail. It is necessary for individual companies, and individuals within them, to apply the CoP conscientiously and take responsibility for specifying a suitable testing programme.

5.4 Future

The RESPONSE project coordinator will present the CoP to the eSafety Forum for its adoption. In addition there is a proposal to ACEA (European Automobile Manufacturers Association / Association des Constructeurs Européens d'Automobiles) to monitor the CoP and discuss the need for modifications. TRL reported the results of the TRL consultation with public bodies that showed a willingness to publicise and promote the CoP.

6 Early Trials of the Code of Practice

In addition to the application of the Code of Practice by the organisations listed above, the checklists were piloted by the vertical sub-projects (those that are developing “products”) of the PReVENT integrated project. These trials were undertaken in 2005 so that the comments could be incorporated into the final Code of Practice. The main points of feedback that were received are listed below:

- Good to have a full list to avoid overlooking topics
- Some scope for improved explanations depending on experience of user
- May need to be customised in a company by specifying personnel qualified to answer particular parts of the assessment
- Should specify confidence in answers, not just yes or no.
PART 2 – IMPLEMENTATION OF THE CODE OF PRACTICE

7 Dissemination of the Code of Practice by TRL

The sections below shows where the Code of Practice has been disseminated and promoted to a wide audience:

7.1 ITS World Congress 9th October 2006

A Paper titled “The institutional context for Advance Driver Assistance Systems (ADAS): A Code of Practice for development” was presented by Sally Cotter at the ITS World Congress (Cotter et al, 2006). The presentation was on the 9th October within a technical session “Intelligent vehicle – driver information II”. The full paper and presentation can be seen in Appendix A. The paper did not describe the contents of the Code of Practice in detail. It provided an introduction on why a Code of Practice is required, described ADAS functions and provided a brief outline of the contents of the code. The paper then went on to describe the context and the role of the Code of Practice. The paper described the consultation with authorities and the presentation provided the full results of the consultation. The paper then discussed the UK Government role in a section written by the Department for Transport. Finally the paper discussed possibilities for future implementation.

Approximately 80 people attended the presentation given at the World Congress and there was significant interest and enthusiasm for the RESPONSE Code of Practice. After the presentation two questions were asked:

Question: What method was used in the consultation?

Answer: A questionnaire was sent to a list of ten Government contacts (responsible for ADAS). The questionnaire asked the contacts to give their views on the role, content and implementation of the Code of Practice.

Question: Can you give some examples of other documents from which the ‘lessons learned’ were taken?

Answer: The JAMA (Japanese Automobile Manufacturers Association) guidelines, European Statement of Principles, (ESoP), U.S Statement of Principles, The British Standards Institution “Guide to in-vehicle information systems”, MISRA (The Motor Industry Software Reliability Association) guidelines and the Canadian discussion document and public consultation to prepare Memorandum of Understanding. (Full references to these can be seen in Appendix C)

7.2 International Harmonisation Research Agenda (IHRA-ITS) meeting, October 13, 2006

Alan Stevens attended the IHRA meeting in London on 13th October 2006. During this meeting he gave a presentation about the RESPONSE CoP. The presentation can be referred to in Appendix B. Following this meeting the IHRA committee asked the UK to write an article on RESPONSE in their next newsletter (Newsletter Number 3) to be published shortly.

The following organisations attended the IHRA meeting: Transport Canada, UK DfT, JARI (Japan), INRETS (France), Australia and SNRA (Sweden). The main topic for IHRA discussion during the meeting was ‘Warnings’, particularly for “high level” warnings for the driver to take an immediate action or decision (within 0-3s) and which may result in severe injury or death (ANSI “Danger” level) if not heeded. It was agreed that a set of warning guidelines outlined during the meeting will be expanded (by members of the Committee) in a format similar to that used in the European Statement of Principles on HMI (ESoP). This is independent of the RESPONSE project and the scope is narrower as it only concerns warnings.
7.3 **Article in ITS Solutions (October 2006)**

To gain a wider audience and further publicity of the RESPONSE Code of Practice the paper written for the ITS World Congress was also published in an edited form, in the October 2006 edition of ITS Solutions (supplement to TEC) (ITS Solutions, 2006).

8 **Lessons learned from other Codes of Practice**

8.1 **Introduction**

This section seeks to explore experience gained from developing similar guidance, to the RESPONSE CoP, to ensure that the RESPONSE code is progressed in the most effective way following the completion of the RESPONSE 3 project towards an accepted European (or wider) Code. There are several examples of codes of practice that have been developed and each one has had a slightly different audience, author combination and role. Therefore it is useful to put all these experiences together to establish lessons which can be learned when developing a Code of Practice. Although we are unaware of any codes of practice that have been developed for ADAS systems, several have been developed for In Vehicle Information Systems (IVIS) with the aim of minimising driver distraction and encouraging safe in vehicle devices. However, we suggest that many of the same issues will exist when developing a Code of Practice for ADAS so we can learn from the experiences of others.

The following documents have been used to develop a broad understanding of what makes a successful Code of Practice and how to implement such a document effectively:

- ESoP (European Statement of Principles)
- JAMA (Japanese Automobile Manufacturers Association) Guidelines
- US Alliance guidelines
- MISRA Guidelines for vehicle based software
- UK In vehicle Systems Code of Practice (BSi)
- Canadian discussion document and public consultation to prepare Memorandum of Understanding
- Swedish Memorandum of Understanding

A summary of the above guidelines can be seen in Appendix C and references are provided on page 30.

8.2 **Summary of Findings**

The recommendations which were developed on the basis of the analysis of lessons learned are summarised in the following paragraphs.

- Developing and agreeing a Memorandum of Understanding (MoU) is a difficult process. It has taken the Canadian Government in the region of 5 years to come close to agreement with industry. An MoU needs to be based on something, so a CoP is recommended as a first step.

- To be successful, guidance (codes of practice, MoUs, guidelines) must be accepted and applied by the entire community.

- A European agreement is probably easier to achieve than a global agreement.

- To implement a European Code of Practice on ADAS, a European working group should be established in order to conduct a full consultation with Member States and provide recommendations to the European Commission. For example an eSafety Working group could
be established for 18 months to focus on consultation and preparation for implementation/publication.

- In order for an MoU or European CoP to be successful and appropriate for all stakeholders, all Member States should provide comments on how the CoP applies to their country.
- The acceptance of an MoU is more likely to be successful if it is produced in conjunction with the industry, stakeholders and the public.
- Any Code of Practice should include assessment criteria to determine safety and controllability of the device.
- In the European Context, it is likely to be necessary to develop common guidance for all Member States. Hence, countries should work together and develop a common European guidance document.
- If European guidance (or a European Code of Practice) is to be developed the Commission should obtain advice from a wide range of experts spanning several European countries. The experts should include manufacturers and researchers.
- In order for a Code of Practice to be relevant and successful a full consultation should take place between Member States and The European Commission.
- During consultation, a suitable period of time (9-12 months) should be allowed, to collate comments from stakeholders such that appropriate revisions can be made before the final version is published. This should increase stakeholder acceptance of the final version and enable the guidance to be implemented with immediate effect once the final version is agreed.
- In order for guidance to be meaningful for manufactures and easy to follow, the key issues should be condensed into 5-10 pages. Supplementary information such as examples, background information, etc should be placed in an appendix or a supporting document. The contents of a Code of Practice should include the headings listed below.

8.3 Document contents and layout
The following structure is recommended for a Code of Practice document.

- Definitions (glossary, abbreviations etc)
- Driver/system Interaction
- Responsibilities of the Supplier including system instructions
- Responsibilities of the Driver
- Summary of assessment methods to be used by supplier/assessor
- Annex – Detailed material to aid development/assessment

8.4 Application of the lessons learned to the RESPONSE Code of Practice
The RESPONSE Code of Practice for ADAS will benefit from the lessons learned if it is taken to a further stage of adoption across Europe or even within the UK. DfT and authorities in other Member States may wish to apply these lessons and shape the current RESPONSE CoP document into a more appropriate and concise National Code of Practice for ADAS, as an interim measure before a European CoP is established, because a European CoP is likely to take some time to develop and agree. National CoP(s) will encourage development and installation of safer systems within individual Member State(s) in the meantime.

The RESPONSE CoP has been developed by industry with a limited input from scientific research institutes (TRL, TNO). Therefore industry acceptance is unlikely to be an issue. After the completion
of RESPONSE 3 a formal structured consultation with Member States is advisable because the involvement of Member States in shaping the CoP has been limited; Member States were invited to respond to a brief survey about the CoP during the latter stages of the RESPONSE 3 project, but the scope of the consultation was limited by the short timescale available, and not all Member States took part. The outcome of this initial consultation was promising however, and indicated that there would be support from Member States for implementing the Code of Practice at National and European levels. It is suggested that further involvement of Member States should take the form of a more focused consultation by means of a dedicated working group within the eSafety forum; this could be set up specifically to focus on more comprehensive consultation with Member States and preparing the CoP to become a European initiative, and should work closely with the Commission.

It is expected that industry will find that the RESPONSE 3 CoP is suited to their needs and easy to implement within their current processes, given that it has been developed by a team largely consisting of industry partners. However, the next stage should be for researchers and safety experts who specialise in ADAS to ensure that the CoP includes all relevant material and promotes maximum safety for road users, providing Governments with reassurance that the CoP will help to meet their safety objectives. For example, Member States may be particularly interested in the confidence levels specified for tests of the controllability of systems. The proposed consultation with Member States would enable them to have further involvement in such details of the content.

The RESPONSE CoP contains much information on the development process for ADAS systems which provides useful background material. If the RESPONSE CoP was to be adopted as a basis for a national (or European) Code of Practice, it may be pertinent to put the detailed development cycle information in the annex in order to shorten the document. The RESPONSE CoP does not currently include specific information on supplier and driver responsibilities. Although some of this information may be inferred throughout the checklists within the annex. It is suggested that it would be beneficial to include sections on supplier, driver and manufacturer responsibilities within the main body of the CoP.

8.5 Conclusions from other Codes of Practice

The RESPONSE Code of Practice for ADAS can benefit from the lessons learnt from other Codes of Practice during progress to the next stage of adoption across Europe. DfT may wish to apply these lessons and shape the current RESPONSE document into a UK Code of Practice for ADAS in the interim period before a European CoP is agreed and published. It is believed that industry is already beginning to adopt the RESPONSE CoP as a self commitment. RESPONSE industry partners have already done so, and others will follow. DfT, as an active Member State, should seek to influence the content and structure of the CoP document through a process of consultation and participation in any European initiatives which are set up to work towards a European CoP, thus providing greater encouragement to industry to develop and install safer ADAS.

9 Implementation Road Map

The final report of the eSafety working group on Implementation Road Maps have been studied to determine what aspects of the recommendations for roll-out of the systems are covered by the Code of Practice and whether the Code of Practice is likely to be sufficient. The eSafety Implementation Road Maps group identified as a priority five in-vehicle systems and six infrastructure-based systems for developing implementation road maps. This analysis has focussed on the five in-vehicle systems (electronic stability program, blind spot monitoring, adaptive head lights, obstacle and collision warning, lane departure warning) plus the speed alert infrastructure-based system.

The results of the analysis are displayed in the tables and flow diagrams below. The tables classify the issues raised within the implementation road map report into six implementation categories (as shown in Column 1 of the table below). The categories are:

- Road and information infrastructure and need and availability
- Organisational requirements
- Regulatory requirements/barriers
- Business case/customer awareness and acceptance
- Key Success Factors
- Feasible Deployment Strategies (implementation plan)

For clarity each category is displayed in a different colour as shown in the table below:

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>e-Safety Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road and Information Infrastructure and Need and Availability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisation Requirements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulatory requirements/ Barriers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Case/Customer awareness and Acceptance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key Success Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feasible Deployment Strategies (Implementation plan)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each of the issues taken from the Implementation Road Map report are listed in the table in a separate row within the second column. For each issue the table provides information on the e-Safety Roadmap perspective (column 3) and TRLs interpretation of the role of the Code of Practice (Column 4).

Following each table is a flow diagram providing recommendations by TRL. The flow diagrams provide recommended steps for policy development. Following from this there are suggested actions for preparation for implementation and finally recommendations for implementation if this was required.
## 9.1 Speed Alert

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>eSafety Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of information infrastructure</td>
<td>Information infrastructure is not available in all parts of Europe (only Finland/Norway extensively, rest of Europe has limited coverage) Ensure digital road maps exist for all roads in member states</td>
<td>CoP can now represent European Guidance for ADAS development and specification. It may require some further adaptation/acceptance</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Organisation Requirements</td>
<td>Organisation responsible for updating speed limit data banks</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>European Standards</td>
<td>The European Commission and Member States should consider regulatory actions (such as making equipment mandatory in new vehicles) as a last option, voluntary solutions should be favoured. An updated European Statement of Principles (ESoP) for HMI is likely to beneficial. The Implementation Road Maps Working Group suggest that a revised ESCP should contain advice on: ISO compliance, system installation, system information, nomadic devices and service provider/fleet manager/owner and Employer</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Socio-economic issues</td>
<td>Undertake an assessment of technical and economical feasibility of speed limit data collection and maintenance at a European level</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Data quality requirements</td>
<td>Problems related to data quality requirements must be solved</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Problems related to responsibility must be solved</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>liability</td>
<td>Problems related to liability must be solved</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>updating</td>
<td>Problems related to updating must be solved</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>legal issues</td>
<td>Solve legal element of speed alert systems and speed limit systems</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>possible contradictions</td>
<td>Problems related to possible contradictions must be solved</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Market/exploit benefits</td>
<td>Currently there is not a substantial market. Need to market/exploit benefits. (EC automated speed enforcement; delivering safety quality-assured transport services, increasing familiarity to increase user acceptance)</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Business Case/Customer awareness and Acceptance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandatory or voluntary deployment</td>
<td>There should be European and National regulations aimed at mandatory or voluntary deployment</td>
<td></td>
<td>CoP Section 5.1 In the definition phase it is recommended to characterise the intended market for the ADAS</td>
</tr>
<tr>
<td>Speed limit database</td>
<td>An accurate and up-to-date speed limit database should be available to all potential service providers</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>European roll-out plan</td>
<td>A European roll-out plan should be endorsed by public and private sectors. The EC should support the deployment of the system on the TERN as well as other parts of the key network. EC and member States should agree on actions to encourage countries/regions to become ‘early adopters’</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Economic feasibility</td>
<td>Assessment of technical and economic feasibility of speed limit data collection and maintenance at European level</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Cost-benefit analysis and business case</td>
<td>A cost-benefit should be produced before implementation of the system. Research (Zuricher Versicherungsgruppe) had demonstrated positive cost benefit analysis for ADAS systems particularly for society (not always for user/vehicle manufacturer. Essential to develop a well balanced model in order to accelerate roll-out.</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Customer benefit / business case</td>
<td>Promote tax/insurance incentives to strengthen end-user interest</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Market introduction of incremental map update solutions</td>
<td>Industry, EC and Member States should develop an action plan to support market introduction of incremental map update solutions to enhance in-vehicle speed limit up-to-dateness. Ensure digital road maps exist for all roads in member states</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Cooperative system for variable speed limits</td>
<td>Ensure a cooperative system for variable speed limits and have speed alert applications as standard option in all new cars by 2015</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Provision of dynamic content</td>
<td>Deployment of Pan-European standardised infrastructure vehicle communication service to ensure provision of dynamic content</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Potential to reduce accidents and change behaviours</td>
<td>Road Map does not deal with this issue</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
</tbody>
</table>
### Possible Future Actions

**Speed Alert**

**Policy**
- Commission work to obtain UK opinion on regulatory action and voluntary solutions
- Commission a cost-benefit analysis of the speed alert system (incorporate UK accident statistics into analysis)
- Commission UK study on technical and economical feasibility and contribute to Europe. Conduct a economical analysis of the systems and the data collection required

**Preparation**
- Ensure information infrastructure is available in UK
- Set up an appropriate organisation to deal with database. Develop a plan for updating the database (including variable speed limit updates)
- Develop process to ensure database is readily available to service providers
- Clearly define the responsibilities of the database management organisation
- Ensure incremental map update solutions are possible
- Investigate benefits of Pan-European standardised infrastructure to UK. Contribute outcome to European Standards
- Commission work to ensure a cooperative system is deployed

**Implementation**
- Develop a strategy to market benefits
- Investigate feasibility of tax/insurance incentives, Commission project to introduce incentives
- Discuss roll-out plan, contribute positively as early adaptor
- Develop UK National regulation specifying mandatory or voluntary deployment
- Commission accident studies and research into long-term behavioural changes
## 9.2 Electronic Stability Program

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>eSafety Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road and Infrastructure and Need and Availability</td>
<td>No issues raised</td>
<td>The European Commission and Member States should consider regulatory actions (such as making equipment mandatory in new vehicles) as a last option, voluntary solutions should be favoured. An updated European Statement of Principles (ESOP) for HMI is likely to be beneficial. The Implementation Road Maps Working Group suggest that a revised ESOP should contain advice on: ISO compliance, system installation, system information, nomadic devices and service provider/fleet manager/owner and Employer</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Organisation Requirements</td>
<td>No issues raised</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Regulatory requirements/Barriers</td>
<td>European Standards</td>
<td>CoP can now represent European Guidance for ADAS development and specification. It may require some further adaptation/acceptance</td>
<td></td>
</tr>
<tr>
<td>Legal issues</td>
<td>Open legal issues such as the issue of driver responsibility with automatically activated systems must be solved taking into account all current regulations (e.g. Vienna convention)</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Business Case/Customer awareness and Acceptance</td>
<td>Market research</td>
<td>Current market research should be extended. Customers are becoming more interested in eSafety products.</td>
<td>CoP Section 5.1 In the definition phase it is recommended to characterise the intended market for the ADAS</td>
</tr>
<tr>
<td></td>
<td>Safety standard</td>
<td>New car buyers expect full safety standard in all available models.</td>
<td>CoP Section 3 - Development process. The system should pass through a series of phases. During the initial definition phase a ‘hazard analysis and risk assessment’ should take place. During the final validation and sign off phase evaluation planning for controllability is undertaken (including test at specification limits, at regular operation as well as controllability test of malfunctions in critical driving situations</td>
</tr>
<tr>
<td></td>
<td>Customer choice/availability</td>
<td>Consider making ESP essential for customers, especially buyers of small cars.</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td></td>
<td>Cost benefit</td>
<td>Research (Züricher Versicherungsgruppe) had demonstrated positive cost benefit analysis for ADAS systems particularly for society (not always for user/vehicle manufacturer. Essential to develop a well balanced model in order to accelerate roll-out.</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td></td>
<td>Customer information and awareness</td>
<td>Huge potential open market particularly in the lower car segment. Customer awareness is a key factor for deployment and must be improved (particularly in cost sensitive market).</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td></td>
<td>Potential to reduce accidents</td>
<td>Studies have proven high potential to reduce accidents.</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td></td>
<td>Availability</td>
<td>Commodity should be available in all car segments.</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Feasible Deployment Strategies (Implementation plan)</td>
<td>Safety benefits</td>
<td>A detailed European Accident database to enable the evaluation of the possible impact of different eSafety systems would be useful to aid decisions. Safety benefits should be verified through accident analysis for those countries not already considered (Germany, Sweden US already have studies showing significant reduction) - to assure public authorities and insurance companies before decisions on incentives.</td>
<td>CoP is designed to look for problems</td>
</tr>
<tr>
<td></td>
<td>Customer education / awareness</td>
<td>Increase customer education and awareness: *EuroNCAP rating (internationally accepted consumer information) *education program dissemination, driving schools, clubs and car dealers * Well structured and harmonised European campaigns. This is a significant option for enhanced consumer awareness.</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td></td>
<td>Customer benefit / business case</td>
<td>Promote tax/insurance benefits offered to customers to strengthen end user interest. Benefits are likely to accelerate deployment. All stakeholders should develop feasible sustainable business model for the system, such that those who benefit should contribute to the investment and costs</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td></td>
<td>Potential to reduce accidents and change behaviours</td>
<td>Road Map does not deal with this issue</td>
<td>CoP does not deal with such issues</td>
</tr>
</tbody>
</table>
POSSIBLE FUTURE ACTIONS
Electronic Stability Program

POLICY                 PREPARATION                  IMPLEMENTATION

as necessary        If required

Commission research into the potential for ADAS systems to reduce UK road accidents and the safety benefits of the systems

Commission a cost-benefit analysis of the electronic stability program (incorporate UK accident statistics into analysis)

Commission research into the safety standard of ESP systems

Consider UK opinion on regulatory action and voluntary solutions

Commission market research into 'electronic stability program' to help understand UK user expectations and opinion to determine if there is a market/need for devices and help promote their use

Commission accident studies and research into long-term behavioural changes

Develop a strategy to market benefits in order to inform consumers

Develop a Strategy for campaigns and be aware of campaigns within other Member States

Commission work to investigate and improve education through UK driving schools and car dealer

Investigate feasibility of tax/insurance incentives

Consider leading or contributing to a European Standard
## 9.3 Blind Spot Monitoring

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>eSafety Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road and Information Infrastructure and Need and Availability</strong></td>
<td>No issues raised</td>
<td>CoP does not deal with such issues</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td><strong>Regulatory requirements/Barriers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Standards</td>
<td>The European Commission and Member States should consider regulatory actions (such as making equipment mandatory in new vehicles) as a last option, voluntary solutions should be favoured. An updated European Statement of Principles (ESOP) for ADAS is likely to be beneficial. The Implementation Road Maps Working Group suggest that a revised ESOP should contain advice on: ISO compliance, system installation, system information, nomadic devices and service provider/fleet manager/owner and Employer</td>
<td>CoP can now represent European Guidance for ADAS development and specification. It may require some further adaptation/acceptance</td>
<td></td>
</tr>
<tr>
<td>Restrictions on short range radar control of restriction of 24GHz</td>
<td>24 GHz based systems must not exceed 7% of market penetration. Automatic deactivation in exclusion zones</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Interference with other systems</td>
<td>24 GHz systems are now regulated until 2013, after 2013 no new systems can be developed and new 79 GHz based systems will be available for reasonable prices.</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Legal issues</td>
<td>Open legal issues such as the issue of driver responsibility with automatically activated systems must be solved taking into account all current regulations (e.g. Vienna convention)</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td><strong>Business Case/Customer awareness and Acceptance</strong></td>
<td>Requirement for business case</td>
<td>A business case will be essential for customers, especially buyers of small cars</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Cost benefit</td>
<td>Research (Zürcher Versicherungsgruppe) had demonstrated possible cost benefit analysis for ADAS systems particularly for society (not always for user/vehicle manufacturer. Essential to develop a well balanced model in order to accelerate roll-out</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td><strong>Key Success Factors</strong></td>
<td>Customer information and awareness</td>
<td>Huge potential open market particularly in the lower car segment</td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Customer willingness to pay</td>
<td>Customer information and awareness systems compared with other comfort systems is a major aspect for drivers. Business case for OEM, supplier, dealer and vehicle owner must be positive.</td>
<td>CoP Section 5.1: In the definition phase it is recommended to characterise the intended market for the ADAS</td>
<td></td>
</tr>
<tr>
<td>Driver acceptance</td>
<td>The device should be easily 'usable' The member states and industry should follow the advice of the HMI Working Group to ensure user acceptance and safe application/function</td>
<td>Annex D.1: Expert Panel Annex D.2: HMI Concept simulation Annex D.3: Driving simulation Annex D.4: Driving tests with professional drivers Annex D.5: Car Clinic with naïve subjects</td>
<td></td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues Annex A.3: Hazard and risk analysis procedure Annex C.1: Risk assessment by HAZOP</td>
<td></td>
</tr>
<tr>
<td>Safety benefits</td>
<td>A detailed European Accident database to enable the evaluation of the possible impact of different eSafety systems would be useful to aid decisions Safety benefits should be verified through accident analysis for those countries not already considered to assure public authorities and insurance companies before decisions on incentives</td>
<td>Driving Simulation (Annex D.3) can be used to look for problems, but other information is needed on safety benefits</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>Industry should progressively make systems available in more vehicle models First system based on video imaging is already available in 2005, integrated with other applications combining comfort and safety</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Liability</td>
<td>Liability policies should be introduced to safeguard customer interests</td>
<td>Refer to previous section (Key Success Factors)</td>
<td></td>
</tr>
<tr>
<td>Customer education/awareness</td>
<td>Increase customer education and awareness: *EuroNCAP rating (internationally accepted consumer information) *education program dissemination, driving schools, clubs and car dealers Well structured and harmonised European campaigns This is a significant option for enhanced consumer awareness</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Customer benefit / business case</td>
<td>Promote tax/insurance benefits offered to customers to strengthen end user interest Benefits are likely to accelerate deployment All stakeholders should develop feasible sustainable business model for the system, such that those who benefit should contribute to the investment and costs</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Potential to reduce accidents and change behaviour</td>
<td>Road Map does not deal with this issue</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
</tbody>
</table>
POSSIBLE FUTURE ACTIONS

Blind Spot Monitoring

POLICY
as necessary

PREPARATION
if required

IMPLEMENTATION

Commission research into the potential for ADAS systems to reduce UK road accidents and the safety benefits of the systems.

Commission a cost-benefit analysis of blind spot monitoring systems (incorporate UK accident statistics into analysis).

Consider UK opinion on regulatory action and voluntary solutions.

Ensure exclusion zones are in place in the UK for 24GHz broadband systems (see 2005/50/EC: Commission Decision of 17 January 2005 on the harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community).

Commission market research into ‘blind spot monitoring systems’ to understand UK user expectations and opinion to determine if there is a market/need for devices and help promote their use.

Commission work if necessary to update knowledge on the usability of blind spot monitoring systems.

Commission accident studies and research into long-term behavioural changes.

Develop a Strategy for campaigns and be aware of campaigns within other Member States.

Commission work to investigate and improve education through UK driving schools and car dealers.

Investigate feasibility of tax/insurance incentives.

Develop a strategy to market benefits in order to inform consumers.

Consider UK opinion on regulatory action and voluntary solutions.
## 9.4 Adaptive Headlights

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>eSafety Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road and Information Infrastructure and Need and Availability</td>
<td>No issues raised</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Organisation Requirements</td>
<td>No issues raised</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Regulatory requirements/ Barriers</td>
<td>European Standards</td>
<td>The European Commission and Member States should consider regulatory actions (such as making equipment mandatory in new vehicles) as a last option, voluntary solutions should be favoured. An updated European Statement of Principles (ESOP) for HMI is likely to beneficial. The Implementation Road Maps Working Group suggest that a revised ESOP should contain advice on: ISO compliance, system verification, system information, nodal devices and service provider/fleet manager/owner and Employer</td>
<td>CoP can now represent European Guidance for ADAS development and specification. It may require some further adaptation/acceptance</td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td></td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues</td>
</tr>
<tr>
<td>Legal issues</td>
<td>Open legal issues such as the issue of driver responsibility with automatically activated systems must be solved taking into account all current regulations (e.g. Vienna convention)</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Requirement for business case</td>
<td>A business case will be essential for customers, especially buyers of small cars. Experts estimate 50% of accidents which occur at night are effected by insufficient visibility/lighting. Hence adaptive head lights provide significant potential to reduce fatalities</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Market research</td>
<td>The total market for adaptive head lights is growing rapidly. Better head light are directly experienced by the driver. The effects for road safety are likely to be acknowledged by the consumer</td>
<td></td>
<td>CoP Section 5.1 In the definition phase it is recommended to characterise the intended market for the ADAS</td>
</tr>
<tr>
<td>Cost benefit</td>
<td>Research (Zuicher Versicherungsgruppe) had demonstrated positive cost benefit analysis for ADAS systems particularly for society (not always for user/vehicle manufacturer. Essential to develop a well balanced model in order to accelerate roll-out</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Customer information and awareness</td>
<td>Customer awareness is a key factor for deployment. It is thought that customer awareness of adaptive head lights is improving</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Customer willingness to pay</td>
<td>The additional cost of safety systems compared with other comfort systems is a major aspect. Business case for OEM, supplier, dealer and vehicle owner must be positive. It is thought that customer willingness to bear additional costs for adaptive head lights is improving</td>
<td></td>
<td>CoP Section 5.1 In the definition phase it is recommended to characterise the intended market for the ADAS</td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td></td>
<td>Refer to previous section (Regulatory Requirement/Barriers)</td>
</tr>
<tr>
<td>Safety benefits</td>
<td>A detailed European Accident database to enable the evaluation of the possible impact of different eSafety systems would be useful to aid decisions. Safety benefits should be verified through accident analysis for those countries not already considered to assure public authorities and insurance companies before decisions on incentives</td>
<td></td>
<td>CoP is designed to look for problems</td>
</tr>
<tr>
<td>Availability</td>
<td>Industry should progressively make systems available in more vehicle models. The system is available as an option in several European models. Manufacturers predict that 10% of cars produced in Europe in 2007 will feature AFS (Advance Front light System)</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Customer education/awareness</td>
<td>Increase customer education and awareness: *EuroNCAP rating (internationally accepted consumer information) *Education program dissemination, driving schools, clubs and car dealers *Well structured and harmonised European campaigns. This is a significant option for enhanced consumer awareness</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Customer benefit / business case</td>
<td>Promote tax/insurance benefits offered to customers to strengthen end user interest. Benefits are likely to accelerate deployment. All stakeholders should develop feasible sustainable business models for the system, such that those who benefit should contribute to the investment and costs</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
<tr>
<td>Potential to reduce accidents and change behaviours</td>
<td>Road Map does not deal with this issue</td>
<td></td>
<td>CoP does not deal with such issues</td>
</tr>
</tbody>
</table>
POSSIBLE FUTURE ACTIONS
Adaptive Headlights

POLICY                  as necessary                  IMPLEMENTATION

PREPARATION        if required

No need for regulatory action - a draft European Regulation already exists

Commission research into the potential for ADAS systems to reduce UK road accidents and the safety benefits of the systems

Commission market research into 'adaptive headlight systems' to help understand UK user expectations and opinion to determine if there is a market/need for devices and help promote their use

Commission accident studies and research into long-term behavioural changes

Develop a strategy for campaigns and be aware of campaigns within other Member States

Commission work to investigate and improve education through UK driving schools and car dealers

Investigate feasibility of tax/insurance incentives

Develop a strategy to market benefits in order to inform consumers

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### 9.5 Collision Warning System

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>eSafety Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road and Information Infrastructure and Need and Availability</td>
<td>No issues raised</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisation Requirements</td>
<td>No issues raised</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulatory requirements/Barriers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Standards</td>
<td>The European Commission and Member States should consider regulatory actions (such as making equipment mandatory in new vehicles) as a last option. Voluntary solutions should be favoured. An updated European Statement of Principles (ESoP) for HMI is likely to be beneficial. The Implementation Road Maps Working Group suggest that a revised ESoP should contain advice on: ISO compliance, system installation, system information, nomadic devices and service provider/fleet manager/owner and Employer</td>
<td>CoP can now represent European Guidance for ADAS development and specification. It may require some further adaptation/acceptance</td>
<td></td>
</tr>
<tr>
<td>Restrictions on short range radar (control of restriction of 24GHz systems) - a key element of future systems</td>
<td>24 GHz based systems must not exceed 7% of market penetration. Automatic deactivation in exclusion zones</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Interference with other systems</td>
<td>24 GHz systems are now regulated until 2013. After 2013 no new systems can be developed and new 79 GHz based systems will be available for reasonable prices</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues</td>
<td>Annexe A.3: Hazard and risk analysis procedure Annexe C.1: Risk assessment by HAZOP</td>
</tr>
<tr>
<td>Legal issues</td>
<td>Open legal issues such as the issue of driver responsibility with automatically activated systems must be solved taking into account all current regulations (e.g. Vienna convention)</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Business Case/Customer awareness and Acceptance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirement for business case</td>
<td>A business case will be essential for customers, especially buyers of small cars</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Cost benefit</td>
<td>Research (Zürcher Versicherungsgruppe) had demonstrated positive cost benefit analysis for ADAS systems particularly for society (not always for user/vehicle manufacturer). Essential to develop a well balanced model in order to accelerate roll-out</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Customer information and awareness</td>
<td>Huge potential open market particularly in the lower car segment</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Customer willingness to pay</td>
<td>The additional cost of safety systems compared with other comfort systems is a major aspect. Business case for OEM, supplier, dealer and vehicle owner must be positive.</td>
<td>CoP Section 5.1 In the definition phase it is recommended to characterise the intended market for the ADAS</td>
<td></td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td>Refer to previous section (Regulatory Requirement/Barriers)</td>
<td></td>
</tr>
<tr>
<td>Key Success Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety benefits</td>
<td>A detailed European Accident database to enable the evaluation of the possible impact of different eSafety systems would be useful to aid decisions. Safety benefits should be verified through accident analysis for those countries not already considered to assure public authorities and insurance companies before decisions on incentives</td>
<td>CoP is designed to look for problems</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>Industry should progressively make systems available in more vehicle models</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Liability</td>
<td>Make clear liability policies prior to roll-out, to safeguard customers</td>
<td>Refer to previous section (Regulatory Requirement/Barriers)</td>
<td></td>
</tr>
<tr>
<td>Customer education/awareness</td>
<td>Increase customer education and awareness: * EuroNCAP rating (internationally accepted consumer information) * education program dissemination, driving schools, clubs and car dealers * Well structured and harmonised European campaigns. This is a significant option for enhanced consumer awareness</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Customer benefit / business case</td>
<td>Promote tax/insurance benefits offered to customers to strengthen end user interest. Benefits are likely to accelerate deployment. All stakeholders should develop feasible sustainable business model for the system, such that those who benefit should contribute to the investment and costs</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
<tr>
<td>Potential to reduce accidents and change behaviours</td>
<td>Road Map does not deal with this issue</td>
<td>CoP does not deal with such issues</td>
<td></td>
</tr>
</tbody>
</table>

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POSSIBLE FUTURE ACTIONS

Collision Warning System

POLICY

as necessary

PREPARATION

if required

IMPLEMENTATION

Commission research into the potential for ADAS systems to reduce UK road accidents and the safety benefits of the systems

Commission a cost-benefit analysis of obstacle and collision warning systems (incorporate UK accident statistics into analysis)

Commission work to develop a business case for all UK stakeholders once a cost-benefit analysis has been completed

Consider UK opinion on regulatory action and voluntary solutions

Ensure exclusion zones are in place in the UK for 24GHz broadband systems (see 2005/50/EC: Commission Decision of 17 January 2005 on the harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community)

Commission market research into ‘obstacle and collision warning systems’ to understand UK user expectations and opinion to determine if there is a market/need for devices and help promote their use

Commission accident studies and research into long-term behavioural changes

Develop a Strategy for campaigns and be aware of campaigns within other Member States

Commission work to investigate and improve education through UK driving schools and car dealers

Investigate feasibility of tax/insurance incentives

Develop a strategy to market benefits in order to inform consumers of benefits

Commission research into the potential for ADAS systems to reduce UK road accidents and the safety benefits of the systems
## 9.6 Lane Departure Warning System

<table>
<thead>
<tr>
<th>Implementation category</th>
<th>Road map - issues raised</th>
<th>eCommerce Roadmap perspective</th>
<th>TRL interpretation of Role of RESPONSE Code of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory requirements/Barriers</td>
<td>Requirement for good (unambiguous) lane markings</td>
<td>The European Commission and Member States should consider regulatory actions (such as making equipment mandatory in new vehicles) as a last option, voluntary solutions should be favoured. An updated European Statement of Principles (ESoP) for HMI is likely to be beneficial. The Implementation Road Maps Working Group should contain advice on: ISO compliance, system installation, system information, nomadic devices and service provider/fleet manager/owner and employer.</td>
<td>CoP can now represent European Guidance for ADAS development and specification. It may require some further adaptation/acceptance.</td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td>CoP Section 5.1 In the definition phase it is recommended to characterise the intended market for the ADAS.</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues.</td>
</tr>
<tr>
<td>Legal issues</td>
<td>Open legal issues such as the issue of driver responsibility (particularly systems with automatically activated systems) must be resolved taking into account all current regulations (e.g. Vienna Convention)</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues.</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues.</td>
</tr>
<tr>
<td>Business Case/Customer awareness and Acceptance</td>
<td>Requirement for business case</td>
<td>A business case will be essential for customers, especially buyers of small cars</td>
<td>CoP does not deal with such issues.</td>
</tr>
<tr>
<td>Customer information and awareness</td>
<td>Customer willingness to pay</td>
<td>The additional cost of safety systems compared with other comfort systems is a major aspect. Business case for OEM, supplier, dealer and vehicle owner must be positive.</td>
<td>CoP does not deal with such issues.</td>
</tr>
<tr>
<td>Customer information and awareness</td>
<td>Driver acceptance</td>
<td>The device should be easily &quot;usable&quot;. The device should not have false/missing alarms. The member states and industry should follow the advice of the HMI Working Group to ensure user acceptance and safe application/function.</td>
<td>CoP does not deal with such issues.</td>
</tr>
<tr>
<td>Liability</td>
<td>Problems related to liability must be solved</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues.</td>
<td>CoP designed to make development process robust so that the product is good and should not produce liability issues.</td>
</tr>
<tr>
<td>Feasible Deployment Strategies (Implementation plan)</td>
<td>Safety benefits</td>
<td>Safety benefits should be verified through accident analysis for those countries not already considered to assure public authorities and insurance companies before decisions on incentives. A detailed European Accident database to enable the evaluation of the possible impact of different eSafety systems would be useful to address differences.</td>
<td>CoP designed to look for problems.</td>
</tr>
<tr>
<td></td>
<td>Availability</td>
<td>Industry should progressively make systems available in more vehicle models. For commercial vehicles, systems have been available as extra fitment for several years. Some 2005 passenger vehicles also have this function.</td>
<td>CoP does not deal with such issues.</td>
</tr>
<tr>
<td></td>
<td>Liability</td>
<td>Make clear liability policies prior to roll-out, to safeguard customers.</td>
<td>Refer to previous section (key success factors).</td>
</tr>
<tr>
<td></td>
<td>Customer education/awareness</td>
<td>Increase customer education and awareness: &quot;EuroNCAP rating (internationally accepted consumer information) * education program dissemination, driving schools, clubs and car dealers. * Well structured and harmonised European campaigns. This is a significant option for enhanced consumer awareness. The user should be well aware of the capabilities - as they may have high expectations which cannot be fulfilled by the system yet.</td>
<td>CoP does not deal with such issues.</td>
</tr>
<tr>
<td></td>
<td>Customer benefit / business case</td>
<td>Promote tax/insurance benefits offered to customers to strengthen end user interest. Benefits are likely to accelerate deployment. All stakeholders should develop feasible sustainable business model for the system, such that those who benefit should contribute to the investment and costs.</td>
<td>CoP does not deal with such issues.</td>
</tr>
<tr>
<td></td>
<td>Potential to reduce accidents and change behaviours</td>
<td>Road Map does not deal with this issue.</td>
<td>CoP does not deal with such issues.</td>
</tr>
</tbody>
</table>
POSSIBLE FUTURE ACTIONS
Lane Departure Warning System

POLICY as necessary
PREPARATION if required
IMPLEMENTATION

- Conduct a socio-economical analysis of the systems
- Commission a cost-benefit analysis of lane departure warning systems (incorporate UK accident statistics into analysis)
- Commission work to develop a business case for all UK stakeholders once a cost-benefit analysis has been completed
- Commission research into the potential for ADAS systems to reduce UK road accidents and the safety benefits of the systems
- Consider UK opinion on regulatory action and voluntary solutions

Commission market research into 'lane departure warning systems' to understand UK user expectations and opinion and to determine if there is a market/need for devices and help promote their use

Commission work if necessary to update knowledge on the usability of lane departure warning systems

Commission accident studies and research into long-term behavioural changes

Develop a Strategy for campaigns and be aware of campaigns within other Member States

Commission work to investigate and improve education through UK driving schools and car dealers

Investigate feasibility of tax/insurance incentives

Develop a strategy to market benefits in order to inform consumers of benefits

Commission a cost-benefit analysis of lane departure warning systems (incorporate UK accident statistics into analysis)
10 Next steps

The RESPONSE 3 Code of Practice has been issued as a final draft and the project deliverable is waiting for European Commission Approval. In the mean time the industry partners of the RESPONSE project have already started to implement the Code of Practice as an industry “self commitment”. For example VW, PSA and Bosch are all implementing the CoP in their organisations. Over the next two years TRL recommends that it would be beneficial for industry to record the use of the Code and provide a review of the use of the document. All Industry organisations should be encouraged to use the RESPONSE CoP. In the UK, the Department for Transport should encourage industry to implement and review the Code of Practice. In order to help industry it would be advisable to develop training materials to help industry implement the CoP.

An industry self-commitment is only the first stage and it is recommended that the Code of Practice should be developed into a European Code of Practice or an EC Recommendation (as with the European Statement of Principles ESoP). This process should start through the eSafety Forum. During the final RESPONSE 3 workshop it was agreed that the RESPONSE 3 project Coordinator (DaimlerCrysler) will present the Code of Practice to the eSafety Forum.

From previous experiences of implementing guidelines we have learned that a European agreement is easier to achieve than a global agreement. However it was reported during the final RESPONSE workshop, that the USA have stated that the RESPONSE CoP would be useful for their needs in the USA and would assist with legislative issues.

From previous experience we can also conclude that community acceptance is vital. Therefore an important recommended next step is to conduct a full consultation over an 18 month time frame. The initial consultation conducted by TRL showed promising results and indicated that Member States would support the CoP and are in favour of its implementation. The eSafety forum may be a good place for this activity to take place. The lessons learned also indicate that advice should be obtained from a wide range of experts when implementing guidelines. Again, the eSafety forum would be the ideal environment to ensure this advice is followed.

It is also recommended, as a result of the lessons learned, that consideration is given to the further development of specific assessment criteria within the CoP before it is implemented as European Guidance or an EC Recommendation.

It is likely to take some time before a European Code of Practice is established; therefore, it is strongly recommended that the UK should consider developing a UK Code of Practice based on the RESPONSE CoP.

A summary of the next steps are shown in the flow diagram below:
Acknowledgements

The work described in this report was carried out in the ITS Group of TRL Limited. The authors are grateful to Alan Stevens who carried out the quality review and auditing of this report.
References


European Project PReVENT http://www.prevent-ip


Appendix A. Paper and presentation presented to the ITS World Congress, London, October 2006

A.1 Paper

The institutional context for Advanced Driver Assistance Systems: A Code of Practice for development

Cotter S1* Hopkin J1 Stevens A1 Burrows A2 Kompfner P3 Flament M3

1. TRL Ltd, UK,
2. Department for Transport, UK
3. ERTICO, Belgium

*Crowthorne House, Nine Mile Ride, Wokingham, Berks, RG40 3GA, +44 (0)1344 770311, scotter@trl.co.uk

ABSTRACT
The RESPONSE 3 project has developed a Code of Practice for designing, developing and validating advanced driver support and active safety systems. In addition to outlining the Code of Practice, the paper will draw on the outcome of consultation within the automotive sector and with public authorities, and consider the role of the Code of Practice within the framework of legal, institutional and standardisation issues associated with the market introduction of ADAS, and the role of authorities in supporting the introduction of ADAS as a means of contributing to casualty reduction targets.

KEY WORDS
Advanced Driver Assistance Systems (ADAS), Human Machine Interaction, Standards, eSafety, In-vehicle ITS, Legal and Institutional, Code of Practice (CoP)

INTRODUCTION
European Transport Policy has set a target to reduce road accident fatalities by 50 per cent over the ten years to 2010. While further improvements in road infrastructure and wide use of passive vehicle safety measures can contribute to achieving this target, considerable reliance is being placed on introducing Advanced Driver Assistance Systems (ADAS) into the vehicle market to help reach this target. These new active safety systems can help drivers in critical situations, and some can prevent or mitigate accidents. Potentially, some future systems could take control from the driver for certain driving tasks if necessary in extreme cases.

ADAS involve new challenges for system safety because of the complex interactions between the driver and the system in controlling the vehicle, and the complexity of the interactions between the system and the road environment, which alter the interaction between the driver and the vehicle. ADAS have been slow to reach the mass vehicle market, partly because of the risks for manufacturers if systems develop faults or are operated beyond design limits (or...
misused), and partly because they are not fully compatible with users’ needs and expectations.

The European eSafety initiative aims to accelerate the development, deployment and use of new technologies for increasing road safety in Europe. The initiative aims to promote intelligent vehicle systems, adapt regulatory and standardisation provisions, and remove obstacles in society and business. In this context, the European Commission is funding research to support the development and introduction of Advanced Driver Assistance Systems.

ADAS can fundamentally change the technical capabilities of the vehicle and in this respect the interaction between ADAS and existing vehicle regulations (that aim to provide minimum standards for safety and usability) and the relationship between the driver and the vehicle may need to be reviewed and developed in parallel with the developing ADAS technology. This paper discusses the important relationship between ADAS developers and those who develop policy (and regulation).

**ADAS FUNCTIONS AND SAFETY ISSUES: IMPLICATIONS FOR ADAS DEVELOPMENT**

It can be argued that “functions” rather than “systems” are the most relevant concept and that different types of functions can be easily distinguished into four categories (in-built, informing, warning and assisting) as shown in Figure 1. Each function performed by a system will require a separate development and evaluation cycle. There are currently well researched methods to evaluate functions as discussed in the Annex of the RESPONSE CoP. However an integrated methodology to assess several functions within a system does not yet exist and projects such as HUMANIST and AIDE are conducting research in this area.

<table>
<thead>
<tr>
<th>FUNCTION ISSUE</th>
<th>In-built</th>
<th>Informing</th>
<th>Warning</th>
<th>Assisting</th>
</tr>
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<tbody>
<tr>
<td>Example</td>
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<td>Warning the driver</td>
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</tr>
<tr>
<td>Driver’s locus of control</td>
<td>None</td>
<td>Full</td>
<td>Depends</td>
<td>Overrideable</td>
</tr>
<tr>
<td>System supplier</td>
<td>OEM</td>
<td>OEM aftermarket, Nomadic</td>
<td>OEM aftermarket</td>
<td>OEM</td>
</tr>
<tr>
<td>Safety issue</td>
<td>Technical</td>
<td>Distraction</td>
<td>Understandability</td>
<td>Controllability</td>
</tr>
<tr>
<td>Typical human interface</td>
<td>None (or via existing controls)</td>
<td>Screen + Audio</td>
<td>Buzzer, Symbol</td>
<td>Button, Small display, Existing controls</td>
</tr>
</tbody>
</table>

**Figure 1: ADAS Function matrix**

**OVERVIEW OF RESPONSE CODE OF PRACTICE**

RESPONSE 3 has developed an improved methodology for defining and validating vehicle systems affecting safety and active safety systems, using a Code of Practice. This Code of Practice describes current procedures used by the industry to develop safe ADAS systems with particular emphasis on the human factors requirements for ‘controllability’.
The CoP contains the following information:

Background information and rationale; safety assessments; terms and definitions; a generic system development process; an introduction to the essential concept of controllability and a more detailed definition of ADAS; requirements for ADAS specific development activities. The annex provides reference material such as checklists for system specification and verification and an overview of various methods to help fulfil requirements and specifications. The contents of the annex are intended to assist system developers to consider all relevant design aspects. For example a checklist is provided to assist in the specification of ADAS; a hazard and a risk analysis procedure provides assistance in setting up a systematic analysis of driving situations in order to determine potential risks.

For assistance functions the CoP provides guidance on controllability. This refers to the whole ADAS-driver-environment interaction, which consists of:

- normal system use within system limits,
- use at and beyond system limits and
- during and after system failures.

Controllability is dependant on the possibility and driver’s capability to perceive the criticality of a situation; the driver’s capability to decide on appropriate countermeasures (e.g. override, system switch-off) and the driver’s ability to perform the chosen countermeasure (e.g. reaction time, sensory-motor speed, accuracy).

During ADAS development controllability has to be estimated in the early stages and should be confirmed during further system development. Two equally respected methods designed to show that the driver can and will react are offered by the CoP. These are ‘controllability confirmation by an independent expert panel’ and ‘controllability confirmation by a test with naive subjects’ i.e. the system should be tested at appropriate confidence levels to ensure controllability.

The Code of Practice will help manufacturers to assert that development is using state of the art techniques. It helps to promote public and industry consensus for the requirements associated with two specific issues which represent obstacles to market introduction: the legal concept of ‘reasonable safety’ and the manufacturer’s ‘duty of care’. This Code of Practice is thus intended to help to speed up the introduction of ADAS into the mass vehicle market.

THE CODE OF PRACTICE IN THE CONTEXT OF OTHER FRAMEWORKS FOR ADAS

Before RESPONSE 3 there was no comprehensive framework for the design, development and validation of ADAS. These systems are largely regarded as close to market and are the subject of intense competition between manufacturers. However, there is very good cooperation between manufacturers at the level of global standardisation.

Standardisation is a systematic harmonisation that may affect many areas, for instance procedures, measurements, properties etc. A number of key aspects of vehicle standardisation relating to safety systems and HMI are dealt with in the International Standardisation Organisation (ISO), in Technical Committee 22.

Examples of standards for ADAS HMI-Design are ISO Ergonomic aspects of transport information and control systems 15005 - 15008 Standards, EN 61508 Functional Safety of

The application of a standard, regardless whether National, European or International is voluntary, even if the standard is considered a safety standard in certain product safety laws. However, the application of a standard may lead to the presumption that a product is not defective and / or that the manufacturer has observed the necessary duty of care. Therefore, this assumption may become binding, even if it is not legally binding.

In conjunction with standards, a ‘technical rule’ serves as an instruction to resolve a multitude of issues in the field of engineering, and is accepted among experts in the relevant specialist area. Accepted means that the experts are familiar with this specification and that they apply it convinced that the specification is correct. The application of a technical rule by any manufacturer is voluntary, meaning that the manufacturers may apply alternative procedures or techniques as long as they prove safe.

In this sense, the Code of Practice remains a technical rule but, by detailing a formal process of ADAS development, a self-commitment from the ADAS manufacturer might become binding.

Examples of technical rules and guidelines for ADAS HMI-Design that may be applied are the ESoP: European Statement of principles of the design of HM Interaction, the AAM Guidelines, the MISRA Development Guidelines for Vehicle Based Software, and ISO TS 16949:2002 Application of ISO 9001:2000 for Automotive Production.

Perhaps the closest parallel to the Code of Practice is the European Statement of Principles (ESoP) for HMI for in-vehicle information and communication systems. This short document contains a number of principles for system design, operation, installation, interaction and information presentation, that were elaborated by a working group of experts from automotive manufacturers and national research institutes. The principles were subsequently expanded with examples of good practice and further explanation. The document has been widely promoted within the industry and by governments, and will be adopted as an EC Recommendation. However, it is not equivalent to a Code of Practice as it simply states principles to be observed. Also, the ESoP only applies to in-vehicle HMI and not to ADAS and their functions.

THE ROLE OF THE CODE OF PRACTICE
As described above, the vehicle industry is highly regulated in terms of performance of its technology. There are Regulations and Directives governing the minimum performance of vehicles and components. This is the European Domain in the system diagram (Figure 2).

In terms of driver behaviour, the situation is regulated by Member States who each have codes and laws concerning drivers’ operation of vehicles on the road. ADAS brings new challenges in terms of both technology and behaviour: Technology performance will continue to be regulated and it is expected that regulations and directives will develop to meet the new situation. The situation in terms of behaviour is less clear.

From the manufacturer’s perspective it is clear (or reasonably clear) what technological performance has to be achieved, and internal quality assurance procedures are in place to ensure the required standards are achieved. The manufacturer has no equivalent clear targets to aim for concerning behaviour and ergonomic/traffic safety. The RESPONSE CoP tries to
fulfil this position. The manufacturers would like to see the CoP occupying the position “X” in the system diagram (See Figure 2). However, the Member states see it within the manufacturer’s domain. At present, the system “X” does not exist and Member States may (or may not) see it as part of their role to define/agree it.

![Figure 2: System Diagram](image)

The aim of the CoP is to provide a link between research activities and development of advanced driver assistance systems (ADAS). The CoP is intended to allow flexibility of design while ensuring that safety and good practice are followed. The RESPONSE Code of Practice represents the current state of the art and technology concerning guidelines for design and evaluation of ‘safety optimised’ ADAS. It provides a voluntary agreement for suppliers covering design and validation requirements within the context of current legislation and standards, and covers the entire development process for ADAS up to the point when the ADAS product production process starts. It therefore provides the latest information on risk identification, risk assessment, and methods for evaluating drivers’ controllability of vehicles equipped with ADAS.

The Code of Practice has been developed so that it can be implemented by vehicle manufacturers and suppliers as part of company-specific development procedures and quality processes. It takes the form of structured guidance, supported by detailed checklists, procedures and technical guidance required at the various stages of the process of developing and evaluating ADAS.

The Code of Practice is being validated by the companies involved in the PReVENT integrated project, of which RESPONSE 3 is a part. A consultation process during 2005-6 is also under way to obtain support for the Code of Practice amongst European authorities as described below.
THE ROLE OF AUTHORITIES IN SUPPORTING THE INTRODUCTION OF ADAS

Consultation
TRL have recently conducted a consultation of member states to both raise awareness of the RESPONSE CoP and to obtain opinions on the role, contents and implementation of the CoP. Government officials from nine member states were contacted and asked to provide their opinions.

Contacts were asked if there was a need for the CoP in their country. They were asked if industry ‘self commitment’ was the best way to introduce ADAS into the market in a safe and rapid way. They were also asked to comment on whether the CoP is sufficient to prove the safety of a new ADAS and fulfil the needs of their country in terms of ADAS approval. Opinions were sought on whether the Code of Practice needs to be discussed between Member States and industry at a European level: for example to agree the contents, approach and implementation, and, if so, on how such discussions should take place.

The consultation gathered opinion on the coverage of the CoP. The contacts were also asked their opinion on how they would expect to disseminate the Code of Practice in their country (e.g. publicise the document; provide a summary to key stakeholders; present the Code of Practice at a meeting of national stakeholders; set up an on-going Working Group for key stakeholders).

The final aim of the consultation was to gather opinion on implementation and potential barriers. The contacts were asked to comment on which steps are likely to be taken in their country before implementation of the Code of Practice. Options offered included: Memorandum of Understanding between EC and industry; International Code of Practice; endorsement of the CoP at the European level; National Code of Practice; Changes to national legislation; Study of the impacts of the Code of Practice; Study of the long term effects of ADAS on safety and driving; Clarification of liability. Contacts were asked if they felt it was useful/necessary for Member States to receive recommendations from the EC regarding implementation of the CoP.

The full results from consultation with member states are not yet available but preliminary results indicate that Public Authorities will support a self commitment from industry and they agree that the CoP is sufficient to demonstrate adequate safety and fulfil the needs of their country in terms of ADAS approval. It appears that Member States would find it useful to receive recommendations from the EC regarding implementation of the CoP. The main method of dissemination is likely to be through publication.

UK Government Role
The UK government, like those of many other countries, is committed to continued improvements in road safety and believes that advanced technologies which assist the driver to avoid an accident can make a significant contribution to this objective. However, there is a need to ensure that such systems do not increase the risk to safety through their influence on driver behaviour. At a European level, CARS 21 also noted the potential safety benefits of new technologies and the need for research to validate their impact on safety.

Governments and authorities should play a key role in encouraging the safe introduction of these technologies; the Code of Practice will help to ensure technologies that are introduced function as intended without any detrimental effect on safety. A number of options are available to assist with the introduction of the Code including:
• Dissemination and promotion of the Code
• Implementation workshops
• Pledges
• Regulation and policy development

It is crucial that all the key stakeholders are aware of the Code of Practice; authorities can facilitate this by ensuring the Code is widely disseminated. The UK government will ensure awareness of the Code is quickly raised among manufacturers and seek to encourage its use. However, while authorities can promote the benefits of using the Code to manufacturers, they cannot guarantee implementation. The relevant industry associations also have a significant role to play by encouraging their members to apply the Code.

Some stakeholders may need additional guidance and help on how to implement the Code in their organisation. One option is to provide workshops to demonstrate how the guide can be applied in different organisations and for different technologies. Authorities are well placed to arrange such events which should be tailored to industry needs (based on their experiences of using the Code).

A voluntary agreement from industry has already been used to ensure compliance with the European Statement of Principles on HMI of in-vehicle information systems. A similar agreement could be implemented to encourage the use of the CoP. To ensure the widest possible agreement, a measure such as this is best pursued through the European Commission with support from Member States.

The most robust way to ensure compliance with safety requirements is through regulation. However, the slow pace of the regulatory process means that it would be sometime before regulations could be implemented. There is also a risk that regulation could hinder the introduction of new safety technologies rather than promote it. However, authorities should ensure that the Code is used to guide the development or extension of any regulations covering ADAS functions. As part of its “Better Regulation” agenda, the UK will use the Code to inform the development of policy and/or legislation in this area.

BEYOND THE CODE OF PRACTICE: ENCOURAGING IMPLEMENTATION
The RESPONSE Code of Practice now needs to be validated in real – or realistic – use by ADAS developers, and to be fully adopted by the industry. This process needs to be promoted actively, and with support from various quarters and in successive stages.

The first stage is to achieve industry-wide commitment. This will need active promotion by the automotive manufacturers’ associations, but is likely to follow once a number of leading manufacturers – and automotive suppliers - have adopted the CoP into their own ADAS development process. It seems logical that the forerunners in this should be the RESPONSE3 partners, from whose current best practice the CoP was developed. They will want to set up a monitoring process to record the use of the CoP in their own business and the effects of its use.

The next stage is to enlarge support to the wider stakeholder community. These are, at political level, the national public authorities and European institutions. These should examine how the RESPONSE CoP fits within their own frameworks for consumer protection and road safety, and might then give official recognition to the CoP as a ‘quality mark’ that provides consumers with some assurance that ADAS products bring user benefits and greater
driver safety. It might be thought necessary beforehand to organise a formal validation of the CoP within a relevant national or European R&D programme.

The European Commission could adopt the CoP as an EC Recommendation, as it did for the European Statement of Principles for HMI for in-vehicle information systems. This is unlikely to happen before there is some experience and validation of the CoP in use. Also, the CoP may need some input from other stakeholders besides automobile manufacturers before governments are content to endorse it.

In a final stage of promotion, end users (e.g. car buyers) should be educated about what ADAS are available, how easy they are to use and their actual safety benefits. This could be done by the automotive industry and also by governments.

The eSafety Forum could be the appropriate body to accompany all these stages of promotion and exploitation of the CoP. The Forum includes all significant stakeholders and has a number of relevant working groups, such as R&D, HMI and Implementation Roadmaps working groups. The CoP would need to be introduced as a work item in a specific working group and its implementation could then become one of the Forum’s official priorities.

Other codes of practice have been developed, each with a slightly different audience, author combination and role. The RESPONSE 3 team has reviewed these experiences.

1. It is clear that a European agreement is likely to be easier to achieve than a global agreement.

2. The review found that to be successful, guidance (codes of practice, MoUs, legislation) must be accepted and applied by the entire community, and to promote that a full consultation should take place between Member States and the European Commission. During consultation, a suitable period of time (9-12 months) should be allowed to collate comments from stakeholders such that appropriate revisions can be made before the final version is published. This should increase stakeholder acceptance of the final version and enable the guidance to be implemented with immediate effect once the final version is agreed.

3. If European guidance (or a European Code) is to be implemented the Commission should obtain advice from a wide range of experts spanning several European countries. The experts should include manufacturers and researchers. In terms of the content, it is recommended that any Code of Practice should include assessment criteria to determine safety and controllability.

The current version of the RESPONSE Code of Practice for ADAS can benefit from these lessons during progress to the next stage of adoption across Europe.

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REFERENCES
Further information concerning the RESPONSE code and other projects and publications referred to in this paper may be obtained from the authors.
A.2 Presentation

Outline of presentation

- Background
- ADAS functions & safety issues
- Outline of Code of Practice
- Context & role of Code of Practice
- Consultation with authorities
- UK government role
- Implementation

Introduction

- Accident targets
- New challenge for system safety
- Slow to meet mass market
  - eSafety initiative
- ADAS presents new relationships
**ADAS functions and safety issues**

- **A system** may have one or more functions
  - “functions” vs “systems”

- Each function will require a separate development and evaluation cycle
  - Different methods for evaluating different functions
    - HUMANIST and AIDE

**ADAS function matrix**

<table>
<thead>
<tr>
<th>FUNCTION ISSUE</th>
<th>Warning</th>
<th>Assisting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>LDWS, ISA Advisory</td>
<td>ACC</td>
</tr>
<tr>
<td>Focus</td>
<td>Warning the driver</td>
<td>Impacts of longitudinal and lateral control</td>
</tr>
<tr>
<td>Driver's locus of control</td>
<td>Depends</td>
<td>Overrideable</td>
</tr>
<tr>
<td>System supplier</td>
<td>OEM aftermarket</td>
<td>OEM</td>
</tr>
<tr>
<td>Safety issue</td>
<td>Understandability</td>
<td>Controllability</td>
</tr>
<tr>
<td>Typical human interface</td>
<td>Buzzer, Symbol</td>
<td>Button, Small display</td>
</tr>
</tbody>
</table>

- Code of Practice (CoP)

**Content of ADAS CoP**

- Definitions and presumptions
- Checklists and method descriptions
- Chapter is structured according to the generic development process

зи content of recommendations
Function Safety: Controllability

• Controllability refers to the whole ADAS-driver-environment interaction
  – normal system use within system limits,
  – use at and beyond system limits and
  – during and after system failures.

• During development controllability has to be estimated in the early stages and confirmed during system development.
  – controllability confirmation methods:
    • independent expert panel
    • test with naive subjects

Role of the Code of Practice

• ADAS brings new challenges
  – technology & behaviour

• CoP provides structured guidance for developing and evaluating ADAS

• Helps promote public and industry consensus on two obstacles to market introduction
  – Legal concept of ‘reasonable safety’
  – Legal concept of ‘manufacturer’s duty of care’

SPEED UP INTRODUCTION OF ADAS ONTO MASS MARKET

Institutional context for CoP

• No previous framework
  – global standardisation by manufacturers

• European Statement of Principles (ESoP)
  – closest parallel to CoP
    • Now widely promoted within industry and by governments
    • Current step: EC Recommendation
Consultation with authorities

- 7 Member States
- Support self-commitment by industry
- CoP is sufficient in short term
- EC endorsement and implementation approaches
- Publication and presentation
- No serious barriers to implementation

UK government role

- Committed to improve road safety
- Encouraging safe introduction of ADAS
  - Support implementation and encourage use
    - Dissemination, workshops, pledges and policy development
    - Role of industry to encouraging members
- Support the Commission to roll out European guidance (like ESOP)
- In UK use CoP to inform the development of future policy and/or legislation
Implementation

Validate in real use – five stages
1) Industry wide commitment
2) Forerunners set up monitoring process
3) Formal validation of CoP
4) Gain support from wider stakeholder community
5) Promotion – user education
   • Possible adoption as EC “Recommendation”
     – experience/validation and stakeholder input

Encouraging implementation

• How?.............e-Safety forum

• Learn from previous experiences

1. European agreement easier than global
2. Community acceptance is vital: consultation
3. Commission obtain advice from wide range of experts
4. Further development of specific assessment criteria

Summary

• Industry self commitment
• Best practice guidance
• Possible future regulations
• Promote safe introduction of ADAS

SAFER ROADS
LESS ACCIDENTS
Appendix B. Presentation given at the IHRA-ITS (International Harmonisation Research Agenda) Meeting, October 13, 2006

Code of Practice for ADAS
Alan Stevens
TRL

RESPONSE viewpoints

• Historical
• Organisational
• Legal
• Technical
• Procedural
• Political

Legal: Law, Regulations, Standards and Guidelines

- ECE R13 / ECE R13-H
- ECE R79
- Annex 6/8/18
- Complex Electronic Braking System / Steering Systems etc.
- ISO WD 26262-3
- Functional Safety of Electronics
- Vienna Convention
- AAM-Design Self Commitment
- Euro NCAP
- ISO 15622
- ACC Standard
- ISO 17287
- Suitability Standard
- ISO 15005
- Dialogue Management
- ISO 15008
- h-vehicle visual presentation
- ESoP Draft 2008
- ISO 15623
- Collision Warning

PRODUCT LIABILITY

Minimising Risk
Damage Hazard

Minimising Risk
Damage Hazard
Technical: Functions/Issues

<table>
<thead>
<tr>
<th>FUNCTION ISSUE</th>
<th>In-dash</th>
<th>Interim</th>
<th>Warning</th>
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<td>Typical human interface</td>
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<td>Button + display</td>
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Controllability

- Controllability refers to the whole ADAS-driver-environment interaction
  - normal system use within system limits,
  - use at and beyond system limits and
  - during and after system failures

- During development controllability has to be estimated in the early stages and confirmed during system development

ADAS Safety assessment methods

- Safety checklists
- HAZOP
- FMEA
- Fault Tree Analysis
- Market research
- Expert Panels
- Professional driver testing (simulator/track/road)
- Car clinics with naive participants
- Independent expert panel
- Test with naive subjects
Political: Need for a CoP

First ADAS already available on the market

More ADAS functionalities are waiting for market introduction

Road fatalities can be reduced using ADAS

Still very low penetration rates - because of unknown ADAS risks
Appendix C. Summary of the guidelines, codes and standards used to develop ‘lessons learned’

C.1 BSi
The British Standards Institution published the “Guide to in-vehicle information systems,” DD 235: 1996, which was commissioned by the U.K. Department for Transport. First proposed in 1996, it was ratified in August 1999. The Guide provides recommendations to designers, manufacturers, suppliers and installers of in-vehicle information systems, and it applies to all information systems, except those giving information about the state of the vehicle or its equipment, such as the speedometer and fuel gauges.

The guide lays out the fundamental steps that should be followed in the design process, including a list of the questions to be considered. It also gives guidance on the presentation of information to the driver, the design and location of controls and displays, user instructions, training requirements, and how to assess the telematics device at different stages of the design process.

In February 2002, the British Department for Transport produced a new document that was intended to replace the guide: “Design Guidelines for Safety of In-vehicle Information Systems.” This guideline document followed the “Safety Checklist for the Assessment of In-vehicle Information Systems: A User’s Manual” published in 1999. The purpose of the Guideline is to serve as “a ‘user friendly’ synthesis of current knowledge and provide up-to-date guidance on where to locate more detailed information”. The Checklist, which includes an 11-page in-depth assessment form with boxes for scoring the suitability of the different characteristics of a device, is meant to serve as “a structured aid to an expert for the assessment of the safety-related features” of a telematics device. Together, these two documents contain a wealth of information on accepted codes and practice, but again no objective criteria upon which to base a safety evaluation.

C.2 ESOP
The European Statement of Principles was produced by a consortium of experts representing both public organisations and industry. The document summarises essential safety aspects to be considered for the Human Machine Interface (HMI) for in-vehicle information and communication systems. The European Statement of Principles is intended to be of particular use to manufacturers who may be unaware of the safety implications to HMI and the importance of good design practice. The Statement of Principles explores the following issues:

- How to design and locate information and communication systems in such a way that their use is compatible with the driving task.
- How to present information so as not to impair the driver’s visual allocation to the road scene.
- How to design system interaction such that the driver maintains safe control of the vehicle, feels comfortable and confident with the system and is ready to respond to unexpected occurrences.

The main topics covered are overall design, installation, information presentation, interaction with displays and controls, system behaviour and information about the system.

The Statement of Principles is not intended to act as a barrier to innovative design and is therefore expressed in terms of the goals to be reached by the HMI.

C.3 US Alliance Guidelines
The USA Alliance Guidelines (AAM, 2002) are under development by the Alliance of Automobile Manufacturers in response to the request of NHTSA that the manufacturing industry address the rising
safety concerns relating to in-vehicle information and communication systems. The Statement of Principles document sets out the “best practices” for the design and assessment of such systems.

The design guidelines focus on light vehicles and are intended for use by equipment manufacturers and the aftermarket. The topics covered in the statement of principles are overall design, installation, information presentation, interaction with displays and controls, system behaviour and information about the system. The guidelines are limited to safety aspects of human-machine interface (HMI) under the following conditions:

- “New” information and communication technology and devices with visual and manual/visual interfaces
- Features and functions designed for use by the driver while driving (vehicle speed ≥ 5mph)
- Under routine driving conditions.

The document is still under development. Currently, only the eleven most significant sections of the document contain specific criteria, technical justification, verification procedures and illustrative examples on how to satisfy the principle.

C.4 Japanese Guidelines

The JAMA (Japanese Automobile Manufacturers Association) guidelines apply to in-vehicle display systems, installed in a vehicle and visible to the driver. The document covers several topics relating to in-vehicle displays: display location, display requirements, operational requirements and software. The JAMA guidelines simply state that in-vehicle display systems shall be easy for the driver to handle and complex operations should be prohibited when the vehicle is in motion.

JAPAN MLIT was produced by MLIT (Ministry of Land, Infrastructure and Transport) and replaces and includes the previous JAMA Guidelines. The document covers similar topics to the JAMA guidelines and provides more specific guidelines relating to in-vehicle display systems. It states that “Information manipulation should not require keeping a close watch on the screen.” This document recommends the occlusion method to ensure this requirement is met. It states that the total shutter opening time from the start to the end of the control, with vision intervals of 1.5 seconds and occluded intervals of 1.0 second, should be 7.5 seconds.

This guideline is based on a study by Hashimoto and Atsumi (2001) who measured total glance time required for tasks on several different in-vehicle navigation systems and related this to driver errors. A total task time of less than 8 seconds resulted in no driver errors. TGT was found to be very highly correlated with TSOT when the occlusion intervals of 1.5 seconds vision interval and 1.0 second occluded are employed. Occlusion is therefore proposed as a good criteria to evaluate interactions with an in-vehicle system. Hashimoto and Atsumi (2001) recommend a TSOT of < 7 seconds as a standard.

C.5 Transport Canada Discussion document

In April 2003 Transport Canada published a discussion document “Strategies for reducing driver distraction from in-vehicle telematic devices”. In this document they outlined the problem of driver distraction on system integration and discussed their concerns. The document also discusses different solutions to address driver distraction. Non regulatory options included public awareness initiatives and/or a Memorandum of Understanding or advisory between government and industry concerning appropriate design guidelines and/or design processes to be implemented by manufacturers. Possible regulatory initiative included standards that limit the access of drivers to certain device functions, impose limits on the amount of visual distraction, or prohibit certain features of telematic devices that would allow the use of untested, aftermarket applications.
It was suggested that the current situation with telematic devices was unsatisfactory and intervention was required to improve the situation. The document was distributed to a variety of industry stakeholders and placed on their website for public viewing. Transport Canada invited comments to the following ten questions:

1. Is the status quo in dealing with this problem of driver distraction sufficient?
2. Should a public awareness campaign be initiated to warn people of the dangers?
3. Should MoUs be negotiated to voluntarily commit the automotive industry in Canada to follow certain human factors design guidelines, provide telematics information on event data recorders, contribute to a vehicle features database and apply a driver-system integration process when designing telematics.
4. Should an advisory be issued to industry stating the need to follow strict safety guidelines and a driver-system integration process when designing telematics devices?
5. Should a regulation be made requiring manufacturers to follow a human factors process standard for designing telematics devices?
6. Should a regulation be made requiring telematic devices to be automatically disabled when a vehicle is moving? What should be included?
7. Should a regulation be made requiring manufacturers to follow JAMA guidelines?
8. Should manufacturers be required to limit the total glance time away from the road and maximum glance duration for in-vehicle tasks?
9. Should Transport Canada make a regulation requiring manufacturers to prohibit the use of open architectures and configurable interfaces and set limits on the design and number of functions available through multifunction interfaces on telematics devices?
10. Are there any suggestions for other regulatory initiative that could be explored to limit the risk of collision caused by driver distraction from telematic devices.

In addition to inviting answers to the above questions Transport Canada also conducted a public opinion survey and held focus groups of participants from the general public.

C.6 Transport Canada report on industry and public consultations

This document was published in September 2005 and discusses the results of the industry stakeholder and Canadian public consultations. The overall finding was that a government-industry MoU, to include both performance and human factors design process requirements, was the preferred option to limit driver distraction from telematic devices. Following consultations and gaining support from both industry and the Canadian public, Transport Canada decided to negotiate a MoU with industry that is intended to limit driver distraction from in-vehicle telematics devices.

In 2004 a joint industry-government working group was created to develop the key elements of the MoU. Progress with developing the MoU was slower than expected. The main element of discussion was the definition and introduction of a process-based safety management system for telematics device design and development.

C.7 MISRA Guidelines

In 1994 MISRA (The Motor Industry Software Reliability Association) published guidelines to assist the automotive industry in the creation and application of safe, reliable software within vehicles. The MISRA consortium was formed in response to the UK Safety Critical Systems Research Programme, supported by the Department of Trade and Industry and the Engineering and Physical Sciences
Research Council. The guidelines were intended to be used by software engineers, managers and others involved in the creation, procurement and maintenance of embedded vehicle software. The guidelines cover guidance for the entire lifecycle of software development as well as quality planning:

- **Software lifecycle**
  - Project planning
  - Integrity
  - Requirement specification
  - Design
  - Programming
  - Testing
  - Product support

- **Software quality planning**
  - Management responsibilities
  - Education and Experience
  - Human Factors in Software Development
  - Quality Assurance
  - Documentation requirements
  - Sub-contracting

The guidelines make recommendations on system issues that are considered to influence software development.

**C.8 Unsuccessful Implementation of Guidance**

**Sweden:**

The SNRA proposed a Memorandum of Understanding with Swedish Industry concerning HMI. This was not successful as the principal potential signatories (Saab, Volvo, Scania) were reluctant to sign unless this was also agreed to by all European Industries.
Appendix D. RESPONSE Code of Practice

A full copy of the RESPONSE 3 Code of Practice can be found on the EC project PReVENT website (www.prevent-ip.org) (from home page click on ‘Public Documents’, ‘deliverables’, ‘RESPONSE 3 deliverables’, ‘D11.2’) or use the following link: