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UK eCall Impact Assessment

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(Claire Rees)

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Executive Summary

eCall is an in-vehicle safety device which manually or automatically generates a call in
the event of an accident, establishing a voice link to the emergency services and
transmitting data that specifies the vehicle’s details and location. This has the potential
to reduce the response time of emergency services, which may in turn reduce casualties
and reduce disruption to other traffic.

This study is intended to support the evidence base that will feed into policy
development in the UK. Evidence is available from a study commissioned by DfT in 2006
from Secure by Design (the ‘UK 2006 study’), work for the Highways Agency on the
implications of eCall for their operations (Anjum et al 2010), and a European study on
the potential impact of eCall which was completed for the European Commission in 2009
and included a UK case study.

These studies provide information on the status of the eCall service chain, institutional
issues associated with implementation and assessments of the costs and benefits under
a range of scenarios which represent different potential options for the roll-out of eCall
and the timescales over which the ‘fleet’ of vehicles on the roads would be equipped with
eCall devices.

This report contains:

- A review of the European Commission report, summarising and commenting on
the evidence and focusing on the UK case study in particular, looking at the
assumptions used and benefits identified
- A summary of the current status of eCall implementation in the UK, looking at
areas of progress among the various groups of stakeholders
- A summary of the costs and benefits for the UK, including the data and evidence
for an initial UK Impact Assessment
- A discussion on implementation issues including the current status of standards, a
summary of the risks to effective implementation and the implications of the
various European policy options
- Conclusions and recommendations.

The conclusions are summarised below.

eCall is widely accepted as having potential to save lives and reduce injury outcomes,
and recent research has also shown likely benefits in congestion reduction. However,
more controversial are the costs, implementation steps and practicalities of realising
these benefits.

The 2009 EC Impact Study identified costs and benefits of eCall at a European level and
its quantitative analysis, based on clusters of European countries, showed somewhat
lower Benefit/ Cost ratios than in previous studies. It was concluded that only
mandatory introduction of eCall would achieve a Benefit/ Cost ratio greater than 1 by
2030. The work also included an in-depth UK study; this made different and more
specific assumptions based on stakeholder interviews and concluded that achieving a
Benefit/ Cost ratio greater than 1 by 2030 would be challenging. So whilst eCall may be
beneficial in some countries (e.g. Finland), no clear social benefit case has been
established for the UK or at European level. Beyond the quantitative analysis, the
Impact Study has highlighted a number of potential qualitative benefits (and possible
drawbacks). The EC continue to strongly support eCall.

Has the situation changed from that reported in the UK study in 2006? This report has
identified a number of developments. In particular, standardisation has advanced
considerably and many technical aspects of implementation (in-band modem, eCall flags,
dormant SIMs) have been resolved, such that better estimates of implementation costs
can be made; these are substantially lower than previous estimates. In terms of
benefits, less reliance is now being placed on older studies, and more recent work with relevant medical experts has somewhat downgraded the potential benefits. Quantitative data on benefits, particularly fatality reductions, remains a significant research gap but a methodology based on analysis of in-depth accident reports, piloted in the EC Impact Study, offers much potential. Overall, the impact situation remains unchanged from 2006: no clear social benefit case has been established for the UK.

As noted above, since 2006, many technical issues have been solved or have known solutions, such that technology in itself is not a barrier to implementation. The UK is well placed to implement eCall with Public Safety Answering Point (PSAP) costs being modest. Private services are already supported and the new standardised Public European eCall and TPS eCall could also be supported with minor developments. Based on recent discussions and a UK workshop, individual stakeholders in the UK appear clear regarding what would be required to implement eCall in the UK, although there are undoubtedly “edges” between the stakeholders that represent issues which are unlikely to be fully resolved in advance of actual roll-out.

What are the barriers to implementation? In essence these have not changed since eCall was first developed as a concept: eCall implementation is dependent on joint action from a number of stakeholders. Public European eCall can only be realised if the vehicle industry, the communications industry (MNO) and the national infrastructure operators all play their part in the eCall “chain” and, since the vehicle and MNO industries are European in outlook, whether eCall is implemented in the UK is highly dependent on European developments. This is why the EC has a significant interest in eCall and has been trying to align and encourage the stakeholders through discussion platforms and a voluntary Memorandum of Understanding (whose status and implications in terms of commitment are open to multiple interpretations).

Despite signing the MoU, the business and commercial case for public eCall looks weak from the point of view of the vehicle industry and MNOs. The vehicle industry wants to see a substantial number of national PSAPs being eCall ready before it can invest in eCall hardware for vehicles. Also, the different market dynamics of the vehicle and mobile industries is problematic; the vehicle industry require a solution to work for 15 years, whereas the communications industry will not undertake to maintain existing services which can develop through one or two generations in the 15+ year timescale of vehicle durability.

The third link in the chain requires readiness of the national infrastructures to deal with eCall. Here, Member States do not have a single view but (despite having signed the MoU) many national PSAPs have an insufficient business case or insufficient funds for investment to modernize and streamline for eCall readiness. Without widespread Member State action in readying their PSAPs, the vehicle manufacturers will not support roll-out of public eCall.

In the authors’ opinion, voluntary encouragement will not lead to rapid and widespread eCall deployment but to private services in a relatively small number of (high end) vehicles initially, and then a slow diffusion down the vehicle fleet. It is suspected that this judgement is also being made by the EC - the recent EC Impact Report supports this conclusion - and it has signalled a readiness to take actions to, effectively, mandate implementation. However, whether the EC has (or will shortly have) sufficient powers and whether Member States will have mechanisms for implementing any recommendations or regulatory measures is still a matter of debate.

In summary, the situation concerning eCall implementation is still unresolved.

The following recommendations are made:

- Signing the European eCall Memorandum of Understanding would be a symbolic and political action from the UK and no recommendation is made concerning this.
Quantitative data on eCall benefits, particularly fatality reductions, remains a significant research gap but the methodology based on analysis of in-depth accident reports, piloted in the EC Impact Study, offers much potential. Ideally research should be undertaken in several Member States, so it is recommended that the DfT encourages the EC to take UK interests into account.

As there is a high level of interest from UK stakeholders in eCall, it is recommended that a UK Steering Group or Implementation Platform be set up, both as a forum for information exchange and to facilitate any future implementations of public or private services. Such a group is likely to be beneficial whether European eCall is implemented on a voluntary or mandatory basis. It could serve both as a forum for information exchange and to facilitate any future implementations of both public and private services. Meetings about every six months are suggested.

Participating in the European eCall Implementation Platform has a number of benefits. As well as first-hand information it provides a mechanism for informal discussions with a wide range of European stakeholders. It offers an opportunity to influence the EC and other stakeholders and it maintains the UK profile in the area. Therefore, it is recommended that this continues to be supported by providing a UK government delegate to each meeting.

Participating in the European eCall Implementation Platform has a number of benefits. As well as first-hand information it provides a mechanism for informal discussions with a wide range of European stakeholders. It offers an opportunity to influence the EC and other stakeholders and it maintains the UK profile in the area. Therefore, it is recommended that this continues to be supported by providing a UK government delegate to each meeting.

The European Platform has initiated a number of working groups on specific aspects of eCall. It is recommended that these groups be reviewed for relevance to UK interests and then appropriate mechanisms developed to ensure that UK interests are being taken into account. This may be through submissions to, or appropriate participation in, one or more groups.

Irrespective of European development in public eCall, private services will increasingly need to interface through mobile networks to UK national PSAPs. To some extent, implementation issues will be addressed through the national platform and by bi-lateral discussions. However, there is also an opportunity, whether assisted by the EC or not, to undertake a pilot trial of eCall in the UK. TRL recommends that the UK should develop a UK pilot for eCall, for example through discussions with a UK Steering Group or Implementation Platform if this is established. A pilot trial would assess the effectiveness of end-to-end system technology and highlight implementation issues. Trials would help UK stakeholders to understand any practical difficulties and unforeseen costs that might occur should the Commission succeed in seeking mandatory deployment across the EU, but would not provide substantial new evidence on the safety benefits of eCall.
Abstract

eCall is an in-vehicle safety device which manually or automatically generates a call in the event of an accident, establishing a voice link to the emergency services and transmitting data that specifies the vehicle’s details and location. This has the potential to reduce the response time of emergency services, which may in turn reduce casualties and reduce disruption to other traffic.

This study is intended to support the evidence base that will feed into policy development in the UK. Evidence is available from work in the UK carried out in 2006 and a European impact assessment in 2009 which included a UK case study. These studies provide information on the status of the eCall service chain, institutional issues associated with implementation and assessments of the costs and benefits under a range of scenarios which represent different potential options for the roll-out of eCall and the timescales over which the ‘fleet’ of vehicles on the roads would be equipped with eCall devices.

This report provides a review of the European impact assessment, a summary of the current status on eCall with particular reference to the UK and a summary of the evidence that the UK Department for Transport would need in order to carry out an initial UK Impact Assessment.
1 Introduction

eCall is an in-vehicle safety device which manually or automatically generates a call in the event of an accident, establishing a voice link to the emergency services and transmitting data that specifies the vehicle’s details and location. This has the potential to reduce the response time of emergency services, which may in turn reduce casualties and reduce disruption to other traffic.

This study is intended to support the evidence base that will feed into policy development in the UK. Evidence is available from a study commissioned by DfT in 2006 from Secure by Design\(^1\) (the ‘UK 2006 study’ - McLure and Graham 2006), work for the Highways Agency on the implications of eCall for their operations (Anjum et al 2010), and a European study on the potential impact of eCall which was completed for the European Commission in 2009 and included a UK case study (TRL et al 2009).

These studies provide information on the status of the eCall service chain, institutional issues associated with implementation and assessments of the costs and benefits under a range of scenarios which represent different potential options for the roll-out of eCall and the timescales over which the ‘fleet’ of vehicles on the roads would be equipped with eCall devices.

This report contains:

- **A review of the European Commission report**, summarising and commenting on the issues and evidence on benefits and costs, focusing on the UK case study in particular (Section 2)
- A summary of **the current status of eCall implementation in the UK**, looking at the various stakeholder groups involved in the emergency response ‘chain’ and the status of private services (Section 3)
- A summary of **the costs and benefits for the UK** including the data and evidence for an initial UK Impact Assessment and a commentary on the changes which have taken place since the UK 2006 study (Section 4)
- **A discussion on implementation issues** including privacy, liability, the current status of standards; a summary of issues from the perspective of the various groups of stakeholders involved; and a summary of the main issues and the risk of them remaining unresolved, with an assessment of the impact which each of these could have if it were not able to be solved (Section 5)
- **Conclusions and recommendations** (Section 6).

The report includes three Appendices:

- Details of the approach used to assess benefits in the UK study (Appendix A)
- eCall standards (Appendix B)
- Key European Commission policy documents (Appendix C): the Memorandum of Understanding and four ‘Communications’ from the European Commission.

\(^1\) SBD
2 Overview of 2009 EC Impact Study Report

2.1 Objectives

In 2009 the European Commission funded a study entitled ‘Impact assessment on the introduction of the eCall service in all new type-approved vehicles in Europe, including liability/legal issues’.

The specific objectives of the work were to:

- assess all impacts and benefits of eCall, also fully covering the indirect benefits due to lessened congestion, fewer secondary accidents, improved operations of rescue services, traffic management, national economy, etc
- assess all costs of eCall
- assess all other key deployment issues related to eCall
- compare the three scenarios - do nothing voluntary agreement/mandatory installation - with regard to their socio-economic benefits and costs.

The European Commission’s longer term objectives for the work were to:

- “utilise the results in deciding on further steps to accelerate the deployment of pan-European eCall; and
- solve the urgent deployment issues requiring to be settled”.

2.2 Consortium and Timetable

The European Commission contracted a consortium to carry out the assessment, which was led by TRL with the following partners:

- TNO (Netherlands)
- VTT (Finland)
- ERTICO (Belgium/pan European)
- Inter-utXXI (Hungary)
- eSafetyAware (Belgium)
- Vrije Universiteit (Netherlands)

The work began at the end of 2008 and the first version of the final report was submitted to the European Commission in the summer of 2009. Following discussions and clarifications, the final version of the report was completed in the autumn of 2009 (TRL et al 2009) and made available on the eSafety web site.

2.3 Scope of the work

The project included the following elements:

- A review of previous studies, summarising their results in terms of the impacts on traffic safety, congestion and the environment, socio-economic profitability and implementation issues
- Four in-depth country studies (which are discussed in more detail in Section 2.4)
- A review of ethical, moral and economic issues, liability and privacy issues relevant to eCall (discussed further in Section 2.5 and Section 5)

A socio-economic assessment of policy options for the European Commission based on bringing together the results of four in-depth country studies, other data that had been assembled on the remaining EU-27 Member States and some non-EU countries and the outcome of the review of previous studies (see Section 2.6 for more details).

2.4 Overview of In-depth Country Studies

The in-depth country studies covered four strategic EU Member States: the UK, The Netherlands, Finland and Hungary. They were selected to represent countries in the EU in terms of population density, quality of emergency services and traffic management, length of road network and subscription to mobile phone services.

In each of the four countries an in-depth analysis of the direct and indirect costs and benefits of eCall was carried out, including:

- Reduction in the number of fatalities and mitigation of accident consequences
- Estimated reduction in traffic congestion and secondary accidents
- Optimisation of intervention resources and reducing costs in the value chain
- Estimated implementation costs of eCall in the emergency services chain.

The studies were based on a combination of analysis of existing data, new analysis to inform specific aspects that had not previously been investigated in the context of eCall, interviews with stakeholders, and expert judgement to assist with assessing the possible impacts of eCall. The emphasis of the activities in each country depended on the quality of the analyses already available.

The results of the four in-depth country studies were used as the basis for scaling up to the EU-level analysis, which covered the 27 EU Member States and six associated countries. Based on the characteristics of the countries (population density and fatalities\(^3\) per million passenger km), EU-27 and associated countries were grouped into clusters based on national average values for population density and fatality rates. Each of the main clusters included one of the four case study countries and the data from these were used to ‘represent’ their respective clusters.

The approach used in the UK case study is outlined here and set out in more detail in Appendix A, providing the context for the discussion of assumptions and the benefits and costs assessment in Section 4.

The UK study was designed to use the results of the UK 2006 study as a starting point, identifying areas where it was possible to update the assessment with new information, revised estimates or additional analysis given that more than two years had elapsed since the study was published. The main focus of the analysis of benefits was on the effect of eCall on the timing of emergency response, and the consequences of shorter response times both for casualties involved in accidents and the traffic on routes affected by these accidents. It included:

- an assessment by experts of the improvement which eCall could bring to the timing of emergency response
- a re-evaluation of the safety consequences of eCall based on case studies of fatal accidents
- modelling the traffic impacts of improving the emergency response time
- analysis of the implications of different roll-out options
- a critical examination of the UK 2006 study
- a principal factors Cost-Benefit Analysis and sensitivity study.

\(^3\) Cars and powered two wheelers only
The safety study focused on the potential for reducing fatalities by looking in detail at a small sample of case studies of accidents of three types which the UK 2006 study had concluded that eCall would have ‘low’, ‘medium’ and ‘high’ probability of improving the outcome. Using statements from witnesses, emergency services, medical reports and post mortems, the timeline and chain of events were analysed. A detailed review of 27 cases was carried out by a doctor specialising in emergency response, to assess how much saving in response time would have been necessary to save the lives of those who had died. The study also assessed the potential for using this approach on a larger scale in a more robust study.

The traffic impacts study used work for the Highways Agency which had modelled the traffic impacts of eCall on motorways and other major routes, and on the basis of differences in accident rates on this and the remainder of the road network, estimated the traffic impacts for the UK as a whole. The traffic impacts were estimated using a range of assumptions for the rate of roll-out of eCall in the vehicle fleet.

The results of the work carried out in the UK case study are discussed in more detail in the remainder of this report.

2.5 Ethical, Legal and Implementation Issues

A further strand in the EC Impact Study was an investigation of ethical, legal and implementation issues. Information was collected from stakeholders across Europe by means of a questionnaire and was supplemented by ‘discussion pieces’ prepared by experts in specific areas and summarising some of the key issues.

The findings on ethical issues are summarised here. Section 5 discusses the legal and implementation issues.

The ethical issues looked at the following topics:

- Cost-benefit analysis and political decision making
- The “Vision Zero” concept
- Moral and ethical aspects of eCall investment
- The basis for and interpretation of cost-benefit calculations.

As a road safety application, the methods for deciding whether to invest in eCall are not sheltered from scrutiny and moral criticism. Cost-benefit calculations for eCall systems were conducted showing different scenarios for the system’s implementation. The two important questions in this decision are what costs and benefits should be included for this pan-European technology and whether the decision should be based on Cost-Benefit Analysis or if moral and ethical issues should also be borne in mind.

For example, eCall will initially benefit people with a higher level of disposable income who will be able to afford to buy it when it first becomes available; it will become more affordable to a mass market as time goes on. This raises the question as to whether it is ethical for governments to invest in the infrastructure necessary to support eCall, when the benefits will not be distributed evenly across society, when the introduction of eCall is left to market forces. In case of mandatory introduction of the system, the take up rate would increase substantially and thus the question of the ethics of infrastructure investment would become irrelevant early in the deployment process.

Issues concerning macro economics and ethics were typically regarded as “too complex” for many stakeholders to engage with and they see this domain as one for policy experts. Vision zero is an innovative philosophical approach which is widely recognised but most national governments still use social cost-benefit as a starting point for policy development for decision making. An ethical critique of social cost-benefit analysis can be developed to argue that it is demonstrably unsatisfactory and there are, for example, wide national variations in treatment of costs and treatment of benefits. Many
frameworks exist that explicitly recognise qualitative as well as quantitative factors and public acceptability is often a decisive factor in deliverability of policies. Ultimately, every public policy decision depends on factors beyond the purely economic ones.

Even within social cost-benefit calculations a number of different choices are made within the various national approaches that exist. The future is uncertain and judgement has to be used concerning trends in fatalities and in the price of consumer equipment. Economic factors include choice of discount rate, whether equipment costs should relate to build cost or sale price, and how much allowance can be made for shared services or infrastructure and for employment generated. Also, there is debate about which measures should be used for which decisions (e.g. using Internal Rate of Return in preference to Benefit/ Cost ratio and the “threshold” Benefit/ Cost ratio which is acceptable for public investment).

2.6 European Benefit/ Cost Calculation

Estimates of the benefits in terms of accident cost savings, journey time savings resulting from reduced congestion after accidents, and savings in emissions costs resulting from the reduction in congestion were calculated for each of the clusters and used in cost-benefit analysis for each cluster. The results of these cluster Cost-Benefit Analyses were then scaled up to the EU-27 and associated countries.

Sensitivity analyses assessed the effect which the various assumptions made in the Cost-Benefit Analysis had on the overall Benefit/ Cost Ratio.

The European Benefit/ Cost calculation did not use the standard approach that would be used for assessing investment in the UK.

Due to the nature of the eCall investment, which is a one-off installation in any given vehicle, annual cost-benefit calculations for 2020 and 2030 were used to provide a snapshot of the social benefits of eCall investment for the years in question, taking into consideration the impact of eCall installation in vehicles in previous years through the eCall penetration rate, and the impact on accidents resulting from this penetration rate. In more conventional Cost-Benefit Analysis, where discount rates are used to analyse the profitability of an investment project, the investment is expected to take place over many years, whereas eCall investments take place during a given year. The disadvantage of using the discounting method in this case would have been that it would have excluded the possibility of some of the vehicles equipped with eCall having already left the fleet (due to accidents, breakdown of the equipment or other reasons). The approach therefore was to estimate the costs and benefits for the years 2020 and 2030, given the expected number of vehicles in the fleet (including motorcycles) and the installation costs.

The calculations used information on costs of eCall installation collected from stakeholders and other data collected from participating Member States and previous studies. For the EU-27 level calculations, averages of accident, emissions and vehicles forecasts were applied.

The European Benefit/ Cost calculation was carried out for three eCall implementation scenarios defined by the European Commission:

1) Do nothing: Left to the market with no further action from the Commission/eSafety Forum

2) Voluntary approach: All European vehicle manufacturers, all Member States and the EC agree by mid-2010 to provide eCall by signing a MoU (Memorandum of Understanding) on eCall deployment by 2015. The MoU sets specific responsibilities and timelines for the stakeholders signing the MoU

3) Mandatory introduction: EC will produce an EU directive mandating eCall devices in all new vehicles by the end of 2014 and the member states to set up facilities
for receiving and processing eCalls at Public Safety Answering Points (PSAPs) by the same date.

To estimate impacts in each of these three scenarios, some assumptions/values had to be chosen, such as for the size of the vehicle fleet and the rate at which eCall penetrates into the fleet (because the costs and benefits of the eCall implementation will depend on such factors). The penetration rates were estimated at:

- 6% in the ‘do nothing’ scenario
- 23% in the ‘voluntary’ approach
- 42% in the ‘mandatory introduction’ scenario in 2020.

In terms of costs, the most critical factor is the in-vehicle unit price. For each scenario, the price of eCall is different for various installation options as the price depends on the number of vehicles that are being equipped with eCall. The costs are highest in the do nothing situation, as the number of users is smaller and thus unit prices are higher. The assumptions made on costs under each scenario are summarised below.

<table>
<thead>
<tr>
<th>Installation option</th>
<th>EC implementation scenario</th>
<th>Do nothing</th>
<th>Voluntary</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEM - new vehicles</td>
<td></td>
<td>€1,000</td>
<td>€450</td>
<td>€60</td>
</tr>
<tr>
<td>Nomadic - if purchased as part of a service package such as in-vehicle navigation system</td>
<td></td>
<td>€30</td>
<td>€30</td>
<td>€30</td>
</tr>
<tr>
<td>Aftermarket (retrofit)</td>
<td></td>
<td>€200</td>
<td>€200</td>
<td>€70</td>
</tr>
<tr>
<td>Installation for motorbikes (most likely in helmets)</td>
<td></td>
<td>€100</td>
<td>€100</td>
<td>€100</td>
</tr>
</tbody>
</table>

The assumptions on savings in accident costs, congestion and emissions were:

- fatalities would be reduced by between 1% and 6%
- serious injuries would reduce by between 0.5% and 2%, depending on the cluster concerned
- the assumptions on reductions in congestion costs ranged from 3% to 17% in the various clusters
- the emission savings assumptions ranged from 0.0005% to 0.07%, depending on the cluster concerned.

Based on the casualty, congestion and other benefits and infrastructure costs identified for individual countries, an overall ‘snapshot’ Benefit/ Cost ratio for the EU-27 and associated countries was estimated for the three scenarios, taking account of the in-year costs and benefits in 2020 and 2030. The results are shown in Table 2.
Table 2: Overall estimates of Benefit/ Cost Ratio for EU-27 and associated countries

<table>
<thead>
<tr>
<th>Benefit/ Cost ratio</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
</tr>
<tr>
<td>Do nothing scenario</td>
<td>0.06</td>
</tr>
<tr>
<td>Voluntary approach</td>
<td>0.15</td>
</tr>
<tr>
<td>Mandatory introduction</td>
<td>0.53</td>
</tr>
</tbody>
</table>

According to this analysis and with the assumptions outlined above, only the mandatory introduction scenario would achieve a cost-benefit ratio greater than 1 by 2030 at an overall European level. (At a national level, with these assumptions, the Benefit/ Cost ratios may be substantially higher or lower.) For example the results for the countries in the cluster which included the UK showed that the Benefit/ Cost ratios were approximately half those shown in Table 2 for Europe.

Overall, the biggest factors in the calculations on the benefits side were the assumptions on penetration and impact rates. The higher these are, the more beneficial eCall will be, despite the increasing installation costs in the case of a higher penetration rate. This is because, proportionally, the impact on accidents starts to generate more savings when a larger proportion of the vehicle fleet is equipped with eCall, whether or not the impact rate is changed. On the costs side, the biggest item is the installation cost. If for any reason the figures reported by manufacturers change either way, this would automatically change the outcome of the Cost-Benefit Analysis calculations.

2.7 Qualitative benefits and costs

In addition to the Cost-Benefit Analysis, qualitative assessment of other factors was carried out on the basis of information from, and discussions with, stakeholders. Positive factors identified which would improve the case for eCall included: improved well-being associated with a reduction in fatalities and a small improvement in mobility and social cohesion resulting from reduced congestion. Few negative factors were identified; privacy is a potential issue but one which can be overcome by controlling access to data from vehicles.

Beyond the quantifiable benefits of eCall a number of additional potential benefits and costs were noted which were not (or not fully) taken into account in the analysis, while there are issues associated with implementation (discussed in Section 5), which were not taken into account either.

- Mandatory eCall would mean that the public investment in eCall infrastructure was shared more equitably between citizens rather than the benefit of public investment falling preferentially on citizens who can afford optional in-vehicle equipment
- The in-vehicle eCall equipment could form the basis for an in-vehicle platform that could support additional public or private telematic services giving further safety and economic benefits. For example, tracking of hazardous goods is one opportunity
- eCall would reduce the amount of underreporting of crashes, which is a problem in some countries, thus increasing the robustness of accident statistics
- eCall may have a positive or negative effect on false alarms. Automatically triggered eCall is likely to have a lower false alarm rate compared with conventional emergency calls. Future “consolidating” software could recognise
eCalls as arising from the same incident with reference to geographic location. This could increase PSAP efficiency.

- eCall provides benefit to road users travelling abroad who may be unfamiliar with the roads and their exact location. eCall also allows emergency calls to be made without language difficulties by virtue of the digital data. This is likely to reduce misunderstanding and stress. Thus European implementation of eCall benefits foreign travellers.

- eCall may highlight the need for improved mobile network coverage along roads and cross-network co-operation to route emergency calls (some countries do not yet have such agreements between rival mobile network service operators) and may stimulate improved coverage, although this would obviously increase costs for operators.

- Implementation of eCall on a widespread basis would generate employment (or displace employment from other areas) involved in building and installing equipment. There may also be economic activity related to additional services on the eCall platform.

- European-wide implementation (rather than national initiatives) would involve economies of scale in terms of, for example, equipment costs and education campaigns.

2.8 TRL comment on the EC impact study

The overall European analysis used a particular economic calculation technique. In any one country, with these assumptions or with different calculation methods, the Benefit/Cost ratio could be substantially higher or lower.

The benefits of eCall arise through a reduction in emergency response which may be seen in different stages of the response process: the time between the accident and the first call to the emergency services, improved information on accident location, and improved preparation by rescue services during their journey to the scene using information on vehicle type information transmitted in the eCall message.

However the time between the accident and the first call to the emergency services is not routinely logged and can only be estimated. The four country studies made independent estimates of the average reduction in response time arising from the immediate call and the improvement in details of the accident location. The average improvement estimated was around 2 – 3 minutes in each case.

In none of the four in-depth studies was a statistically proven relationship found between improvement of the timeframes in which the emergency services operate and a reduction in fatalities or casualties. It can be expected that the greatest benefit to accident victims can be achieved when eCall substantially improves rescue time (e.g. by 15 minutes or more). The greatest improvement is found in sparsely populated areas where accidents, especially single vehicle accidents, can remain unreported for a long time. However, the number of cases which go unreported for many hours (or more) is very small. The overall impact on fatalities of the reduced rescue time as a result of eCall was estimated on the basis of expert judgement and was different in different countries (due to geography, rescue service performance etc.). In Finland, with its sparse population and low volume of traffic on much of the road network, it was estimated as saving 4-8% of road fatalities while the estimate for the UK was just 1%. Similarly, a range of estimates concerning ultimate medical outcomes of surviving accident victims was made, from about 0.5% to 2% in the four countries studied.

The effect on congestion depends on the amount of accident related congestion and the estimated time saving from eCall. In Finland almost all congestion is the result of accidents. An improvement in the timeframe to rescue or clear accidents leads directly to a reduction in congestion and secondary effects. In the UK and the Netherlands there...
is more congestion because of the amount of traffic, weather conditions and road works. Nevertheless, congestion is still expected to be lower as a result of eCall. The saving in accident related congestion was estimated at between 3% (UK) and 17% (Netherlands and Hungary). This benefit is large in economic terms, and for some countries is larger than the safety benefit. However, in comparison to the total amount of congestion (from other incidents and overall volume of traffic) the effects of eCall are much smaller. In comparison with the other eCall benefits, the effect on emissions is marginal.

This particular method of analysis and set of assumptions produced a Benefit/ Cost ratio for eCall at a European level of greater than one in only one instance: in 2030 under the mandatory introduction scenario.

Before the 2008 EC Impact Study report, a great deal of reference had been made by stakeholders with an interest in eCall implementation to specific previous but preliminary work on benefits and costs. The analysis carried out in the EC Impact Study has reduced the uncertainty over costs and benefits, but it has at the same time reduced the size of the best estimate of the Benefit/ Cost ratio. Nevertheless, considerable uncertainty remains over the B/C case and the actual impacts, as well as a number of non-quantitative potential benefits.

The EC have released the report onto the eSafety website but it does not present an unequivocal quantified justification that can be used to convince Member States and other stakeholders of the quantitative benefit/cost case. The EC regard the qualitative aspects of the benefit case highly and continue to strongly promote eCall.

The study identified a research route to help clarify the safety benefits and the EC may take this up as a subject for future work. The research would investigate the frequency distribution of the response time between an accident occurring and emergency services being notified, and carry out a more substantial in-depth review of accident case studies to assess the extent to which lives could be saved if shorter emergency response times were achieved as a result of eCall.
3  Current status of eCall in the UK

3.1  UK emergency response ‘chain’

The UK emergency response chain consists of a landline or mobile telephone making an emergency call to a Public Safety Answering Point (PSAP1) which alert the most appropriate and local emergency service also known as PSAP2s. Road operators may also be involved in the final stages of response. Aspects of this chain relevant to eCall are briefly reviewed below.

3.1.1  Emergency call

Following a road accident or emergency, a call is made using a landline or mobile phone. Landlines, with their connection reliability and known location, provide an excellent communications link. All eCalls, however, use mobile telephony.

There are five principal Mobile Network Operators (MNOs) in the UK operating under Government licence, comprising: O2, Vodafone, Orange, T-Mobile and 3-UK. There are many other “virtual” operators such as Virgin, Ikea and Tesco that provide “badged” services through one of the principal five.

The five operators are differentiated by services offered, coverage of their network, number of subscribers, investment in technology and cost base. Figure 1 below illustrates the UK coverage of 2nd generation phones. For an operator to be counted as having coverage its network footprint in a particular area it has to cover 75% of that area, defined in terms of a postcode ‘district’.

![Figure 1: Number of 2G operators with at least 75% area coverage](image)

Source: Ofcom / GSM Association / Europa Technologies

The UK has recently implemented cross-network emergency calling, although if the subscriber’s own network is unavailable it is only possible to provide the cell location rather than a more accurate cell-triangulated position estimate. Network coverage is not 100% at present but is expected to gradually increase as newer technology becomes available.
### 3.1.2 PSAP1

There are a small number of PSAP1 locations operated by two different operators (BT and Cable & Wireless); however, the service provided is seamless. Once an emergency call has been made, the average time for the PSAP1 to answer the call is less than 5 seconds. The average time between the call being answered and passed on to the appropriate PSAP2s is 7 seconds.

The cell ID and zone code are processed to provide the PSAPs with latitude and longitude information, but the accuracy of this information varies from 100m in urban areas to 20km in rural locations.

“Silent” calls, are held open for at least 3 minutes while the emergency operator tries to contact the caller.

### 3.1.3 Emergency Services (PSAP2)

There are approximately 220 PSAP2s comprising ambulance stations, police stations, fire stations etc. Ambulance PSAP2s answer the call from the PSAP1 within 5 seconds in 95% of cases, while Police and Fire and Rescue PSAP2s answer within 10 seconds in 90% of cases.

Ambulances or other medical response (depending on the nature of the incident) are despatched to the postcode area or mobile phone cell from which the call was made within a further 30 seconds (i.e. 1 minute 5 seconds from the time when the call was received when the time elapsed in all elements of the chain is counted, including elements not listed above). The national targets set for the ambulance service are that a response should reach the scene of a life threatening incident within 8 minutes in 75% of cases, and within 19 minutes in 95% of cases. These targets are usually met. If the ambulance service is unable to find the incident, the PSAP2 phones the caller to clarify location details.

A police vehicle would be expected to arrive at the scene of an accident within 5-10 minutes in urban areas and 20-30 minutes in rural areas, in the cases of ‘medium’ severity. There are some cases where delays occur because the location information is not sufficiently accurate or detailed.

Whilst many emergency service vehicles are equipped with satellite navigation systems, only about half of the PSAP2s use full digital data and mapping. It has not been established whether PSAP2s will be in a position to process and use all of the information contained in the eCall message.

### 3.1.4 Road operators and recovery vehicles

The final part of the incident response chain can be incident clearance. Recovery vehicles are not called to accidents on motorways and trunk roads until the incident has been assessed and the requirements for recovery vehicles have been identified. This is because the first priority is accident investigation and protecting the scene in cases of fatalities or criminal investigations.

### 3.1.5 Overall quality and development plans

The UK has a sophisticated and robust emergency response chain which is probably among the best in Europe but still has room for improvements. As well as maintenance upgrades to communications and information technology equipment, a current priority is increasing provision of air-ambulances and more trained trauma personnel who can offer more effective assistance at the roadside and during the journey to hospital.
3.2 Private Automated Crash Notification Services

The current implementation in the UK cannot, technically, be called “eCall” because it differs from the implementations agreed through standardisation. It is shown diagrammatically in Figure 2.

Figure 2: UK “eCall” system

The proprietary in-vehicle device includes a GSM mobile phone with a GPS receiver. It is linked to an airbag and other crash sensors for automatic triggering as well as having a separate button for manual activation. When triggered the system provides a voice channel directly to the PSAP1 and a separate data call via SMS carrying the Minimum Standard Data (MSD), as defined for eCall.

A memorandum of understanding has been in place since 2000 which describes the overall operation of the system and the responsibilities of the private Value Added Service Supplier (VASS), the Mobile Network Operators (MNO), the Emergency Data Service Provider (EDSP) and the PSAP1. Essentially the VASS provide the customer interface and in-vehicle hardware, the MNO provide communications, and the EDSP processes the MSD message before passing it to the PSAP1.

Since 2000 there have been no significant developments in these arrangements although the number of participants has grown. There have been hardware and software upgrades and fine-tuning of the protocols, but essentially the service is the same and, according to all parties involved, works well. Currently those involved as VASS include Trafficmaster, the AA, BMW and Volvo. Mobile operators include O2 and Vodafone and the EDSP include Trafficmaster, AA, Mondial, and ATX. The extent of the service is relatively small. For example BT answers approximately 80% of UK’s emergency calls and responds to 28 million per year. The current level of “eCalls” from the private services currently amounts to around 3,600 per year (i.e. around 0.01% of all emergency calls).

Home Office policy requirements, as reflected in the MoU, include that:

- the voice call should be connected directly to the PSAP1 and quickly reach the Emergency Assistance providers in line with standard, voice-only 999/112 calls
- the location data should be processed immediately and forwarded to the PSAP1
- the data message should always include the Ordnance Survey map reference and other vehicle-specific data.

Although not an “eCall flag” as defined by standards, the voice call is delivered to the PSAP1’s network as a 998 call (not 999 or 112) in a manner that ensures the call set-up message carries the caller’s telephone number and the digits 998IIABCD (instead of 999IIABCD for normal GSM emergency voice calls), where II is the network identifier and ABCD is the zone code or cell identity.
In the event that a data message is received with no matching voice call, the PSAP1 will initiate a voice call to the Police and forward all available details.
4 Benefits and Costs for UK

4.1 Introduction
This section summarises the information on benefits and costs from the UK case study within the EC project. It summarises the assumptions and estimates in the UK 2006 study, and the additional information that was collected in the EC study which was used to develop revised estimates where appropriate.

4.2 Discussion of Costs

4.2.1 In-vehicle costs

UK 2006 study: assumptions and estimates
The in-vehicle costs were assessed by taking account of the costs of the bought-in parts for a basic eCall system produced in large volumes, and the vehicle manufacturers’ additional costs for development, production, distribution, after sales service and profit. The costs included fitting the unit, maintaining it during vehicle warranty, communications costs (embedded SIM card), training and supporting dealers and educating users. Information came from two automotive suppliers and a mobile network operator supporting pan-European eCall. The vehicle manufacturers’ associated costs were estimated on the basis of a rule of thumb that doubling the purchase price of the bought-in parts provides an approximation to the retail price to the customer.

The total whole-life cost of the in-vehicle system to the user was estimated on this basis to be €360 (then £250).

A wide variation between previous studies in estimates of the cost of eCall systems was identified. The assessment therefore included a ‘pessimistic’ case based on the costs quoted by manufacturers through ACEA, which was equivalent to €580 and a low cost equivalent to €150 as a sensitivity test.

EC impact study: further evidence
The stakeholders who were consulted noted that as with other new technologies, the costs are reducing over time. A rule of thumb is that the cost of a system when first envisaged is about four times higher than when it is eventually deployed. Manufacturers claim that costs will be lower if eCall is implemented voluntarily than if is mandatory in an inappropriately rapid deployment on a wide scale, because manufacturers will be able to manage the costs to their best advantage if they are driving the deployment. However this is not the assumption that was made in the EC impact study: the calculations assumed that mandatory deployment would not take place so rapidly that manufacturers would be unable to reduce the cost of equipment through economies of scale.

Other costs which may need to be considered are:
• whether the system would need to be tested during the annual vehicle roadworthiness check
• whether the vehicle would need to include any built in diagnostic testing of the eCall system.

Several pointed out that bundling eCall with other services seems to be the only practical way forward, and that this would reduce the costs significantly because the incremental cost of eCall would essentially be additional software.
Stakeholders provided a range of cost estimates with typical values ranging from around €200 – €250 in 2013 to €10 - €50 by 2020 when mass production is expected to have taken off, although some thought that even in 2013 the cost would be no higher than €55. One private service provider had carried out a detailed investigation of costs and quoted costs of €22 - €33 for an OEM fit full system or a manually triggered system, and €80 - €100 for an aftermarket fit of an automatic system.

It was noted that at some point in the future, 2G services might be switched off, which might lead to upgrade costs for eCall and issues with continuity of service.

**EC impact study: assumptions and estimates**

Taking into account the estimates provided by stakeholders, the following estimates were made:

- €150 per unit for an OEM device in 2014
- €50 per unit for an OEM device in 2020
- €200 per unit for an aftermarket (retrofit) device, including installation costs
- €50 per unit for a nomadic device, including installation by the user.

These costs were used in the UK Cost-Benefit Analysis presented in Section 4.7.

The costs are clearly lower than estimated in the UK 2006 study, which is to be expected given that the cost of new technologies declines rapidly between the time of developing the concept and deployment. Also, vehicles coming onto the market now are already equipped with some of the components necessary for eCall.

**4.2.2 Telecommunications costs**

**UK 2006 study: assumptions and estimates**

Telecommunications costs depend on issues such as who pays for the call charges and whether there will be a requirement to continuously monitor the location of vehicles. Currently mobile network operators in the UK pay £0.60 to PSAP1s for every 112 call that they connect so that the calls are free at the point of use.

An estimate of £500,000 per year was made (£720,000 then), based on predicted call volumes. On the basis of the operation of the Volvo eCall service in Sweden, it was assumed that mobile operators would cover these costs by a one-off charge for the SIM embedded in the vehicles; this amount was included in the cost of equipping vehicles.

**EC impact study: further evidence**

The cost paid by mobile network operators to PSAP1s remains at £0.60 (£0.67) per 3 minute 112 call connected. The cost of eCalls was estimated by telecommunications stakeholders as between £1.50 and £2.50 (£1.67 – £2.78) per call.

Emergency calls have a 'flag' which enables them to have priority in processing, even if the load on the network at the time is high. The cost for mobile network operators in implementing eCall 'flags' could be substantial for some companies, but others will already have the necessary equipment and will not incur significant additional charges.

Mobile Network Operators confirmed that the additional number of SIMs in circulation and the increase in signals and transmissions arising from eCall might mean that they may need to purchase additional equipment but no estimates of cost were provided. This comment was made before the issue of dormant SIMs was understood. No additional revenue is expected.
If eCall SIMs are dormant, then there will be a delay of 3-4 seconds while a connection with the PSAP1 is established. The benefit for mobile network operators would be less load on the network, but it may be possible for this additional capacity to be built into future plans for expansion without significant additional cost.

**EC impact study: assumptions and estimates**

In the light of this information, no revisions were made to the estimates made in the UK 2006 study.

The telecommunications costs were not included in the UK principal factors Cost-Benefit Analysis summarised in Section 4.7.

### 4.2.3 PSAP costs

**UK 2006 study: assumptions and estimates**

At the time of the study, the PSAP1s and many of the PSAP2s were equipped to handle private eCalls. Additional costs would be incurred for a public service.

Discussions with emergency services led to the following “conservative” estimates:

- Start up costs for PSAP2s: £4m (then €5.76m) to cover additional upgrades, training additional staff and transferring eCalls to other services
- Operational costs for PSAP2s: £3.5m per year (then €5.04m).

**EC impact study: further evidence**

The PSAP start up costs were not thought likely to be as high as £4m, because it is a similar call, just with better information, and costs would therefore be relatively minor.

PSAP2s could receive multiple calls from incidents (either passersby or multi-vehicle accidents) which could increase the resources devoted to dealing with these incidents. Screening out multiple calls could also result in secondary accidents being overlooked.

PSAPs would need to have a system for filtering out non-emergency calls. One of the current manual eCall services receives a large proportion (80%) of calls which are not emergencies.

**EC impact study: assumptions and estimates**

Taking into account the estimates provided by stakeholders, the following estimates were made in the EC study:

- €220,000 investment in the PSAP1 system
- €110,000 per year in operating the upgraded PSAP system
- No additional costs are likely to arise in the PSAP2 systems; these are likely to be absorbed in periodic upgrades.

These costs were included in the UK principal factors Cost-Benefit Analysis which is summarised in Section 4.7.

Since the UK 2006 study was carried out, the requirements are much better understood and technology is more capable. It is now known that the additional facilities needed in PSAPs are minimal, and given the timescales for eCall roll-out, the changes that are needed could be incorporated in planned upgrades at much lower cost than would be incurred if new systems had to be implemented specifically for eCall.
4.2.4 **Costs of driver education and publicity**

**UK 2006 study: assumptions and estimates**

The initial deployment of private eCall services in the UK has shown that driver education is important, both for maximising benefits when accidents occur and minimising inappropriate use of the service at other times. This is a cost that would be expected to be borne by the National or European government.

An estimate of £2 per new vehicle per year was made, which amounts to £4m per year (then €5.76m). This was equivalent to about a third of the government road safety advertising budget at the time.

**EC impact study: further evidence**

One of the government stakeholders agreed that a government publicity campaign would be expected in this type of initiative, but no information on costs was provided. One of the private service providers noted that people do not understand the benefits of eCall, so an information campaign would be an important element in eCall deployment.

**EC impact study: assumptions and estimates**

No evidence was obtained which would support a change in the UK 2006 study estimate so a cost of €2.22 per new vehicle per year, totalling €5.76m per year was assumed.

4.3 **Benefits – Saving in Emergency Response Time**

**UK 2006 study: assumptions and estimates**

The UK 2006 study derived assumptions about savings in response times from previous research and statistics from the emergency services about the chain of response. The previous research used was the German ‘STORM’ study (Ministerium für Umwelt und Verkehr, 1996), which appears to have been the basis for estimates of the impact of eCall on emergency response times in many assessments in a number of different countries. This German study estimated a reduction in response times of 10 minutes in rural areas and 5 minutes in urban areas.

No data were found on the length of time elapsed between an accident occurring and an emergency call being made. Ambulance response time data show that most ambulance services in the UK attend more than 75% of critical cases within a target time of 8 minutes from receiving the call.

The UK 2006 study consulted emergency services personnel about the estimates from previous studies and concluded that it would be reasonable to assume that eCall would result in a 10 minute improvement in response time. This was made up of a 5 minute saving in response time due to the automatic call and a 5 minute saving from the improved location information.

**EC impact study: further evidence**

In the UK case study for the EC, the general consensus among the range of stakeholders consulted was that the UK 2006 study assumption of a 10 minute saving in response times was too optimistic.

The estimated average time from accident to making emergency call was 2 minutes (unless no one at the scene is conscious, in which case 10 minute average estimate). Other figures quoted are summarised in Section 3.1.
Highways Agency Regional Control Centres have access to detailed operational data on incidents; operational staff estimated that eCall would reduce the ‘desk time’ taken to determine the precise location of an accident prior to despatching services to deal with it by a maximum of 4 minutes.

It was noted that in the ambulance service, the vehicle is despatched in the general direction of the scene using postcode or other information from the call, and identification of the exact location takes place during the journey using the vehicle’s satellite navigation equipment (and a phone call to the scene if necessary), with delays in finding the location taking place in less than 1% of cases on average (although the percentage is higher on motorways).

**EC impact study: assumptions and estimates**

Bearing in mind all the information from stakeholders, it was assumed in the EC study that on average a 2 minute saving in response time per accident involving an eCall vehicle would be seen as a result of eCall in the UK.

No further evidence has come to light since then that would support changing this assumption.

**4.4 Benefits – Casualty Reductions**

**UK 2006 study: assumptions and estimates**

The benefits of reducing response times were estimated on the basis of a European study\(^4\) which found that 30% of road accident fatalities occur within minutes, and 50% occur before reaching hospital, generally within 20 minutes following heart or respiratory failure. The cause of death for the other 50% of fatalities is massive bleeding, generally 10 – 60 minutes after the accident. Data from the German STORM project and a study in Sweden showed a reduction of 10% of serious injuries as they became slight injuries.

On the basis of this information and the figures on ambulance response times, the following assumptions were made:

1. Emergency services are unlikely to be able to attend all fatal accidents within 20 minutes even with eCall and 50% of fatalities (those with heart or respiratory failure) would die, with or without eCall.

2. 50% of fatalities occur through massive bleeding between 10 and 60 minutes after the accident, and for these, every minute of response time saved would save 2% of fatalities in the ‘medium’ benefits scenario, with these casualties becoming serious injuries instead of fatalities.

3. 10% of serious injuries would be reduced to slight injuries.

Under these assumptions, the impact of a 10 minute saving in response time would be to convert 20% of the fatalities occurring following massive bleeding into serious injuries; these represent 10% of all fatalities. (See the Glossary on page 47 for definitions of fatal, serious and slight road casualties in the UK.)

The estimates of 10% fatalities reduced to serious injuries and 10% serious injuries reduced to slight injuries were treated as an ‘average benchmark’ figure. The assessment also tested reductions in fatalities and serious injuries that were 5% greater and 5% less than this to provide a range of benefits for a ‘mean’ scenario. To reflect uncertainty in the extent to which notification times and emergency response times would improve, ‘optimistic’ and ‘pessimistic’ scenarios were tested, which provided a

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www.trueposition.com/e112_issues_and_answers.pdf)
range of estimates of accident severity change ranging from 22.5% to 0% in the case of
the types of accident where it was assumed that eCall would produce no benefits.

**EC impact study: further evidence**

The EC study looked at evidence from research on fatal accidents, survival times
following major trauma, police experience of attending accidents and the case studies of
fatal accidents which were examined by the air ambulance doctor (as described in
Section A.1.1.1A.2).

This medical assessment was not sufficiently large in scale to provide evidence to either
support or refute the assumptions made in the UK 2006 study. However the results
showed that there was just one out of 27 cases where eCall might have shortened the
response time enough for a fatality to have been avoided. In five cases, death was
instantaneous, while in three cases the casualty died in hospital and the rest died at the
scene, generally a short time after the accident happened. There was just one case
where the accident went unnoticed and was found eight hours later following a police
search.

One piece of information which is of particular interest is the distribution of times
between an accident occurring and it being notified to the emergency services. There is
no readily available source of information on the most extreme cases where eCall would
provide benefits, namely those which are not found until some time after they have
occurred; however the impression is that these are extremely rare events, although
newspaper coverage may give a false impression of how frequently they occur. The
study therefore relied on the professional experience of those involved in the emergency
rescue chain. The impression gained was that long notification delays are extremely
rare.

The responses from the various stakeholders on the reduction in casualties are
summarised in Table 3.

<table>
<thead>
<tr>
<th>Table 3: Summary of estimates of effect of eCall on medical response time</th>
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</thead>
<tbody>
<tr>
<td><strong>Reducing fatalities to serious injuries</strong></td>
</tr>
<tr>
<td>Ambulance service</td>
</tr>
<tr>
<td>Air ambulance service</td>
</tr>
<tr>
<td>Police</td>
</tr>
<tr>
<td><strong>Reducing serious injuries to slight</strong></td>
</tr>
<tr>
<td>Air ambulance service</td>
</tr>
</tbody>
</table>

**EC Impact Study: assumptions and estimates**

On the basis of the outcome of these discussions with stakeholders, including
consideration of their response to figures already published, the study estimated the
following impacts of eCall on road accident casualties (assuming full uptake of eCall):

- 1% of fatalities estimated to be saved, and reduced to serious injuries (equivalent
to €48m per year)
- 0.5% of serious injuries estimated to be reduced to slight injuries (equivalent to
€26.5m per year)

In addition to the reduction of some serious injuries to ‘slight’, it is likely that there
would be a reduction of injury severity within the ‘serious’ category, which covers a wide
range of injuries from those resulting in severe permanent disability to those with
concussion who are detained in hospital overnight for observation. However in cost-benefit terms, this would not provide a quantifiable benefit because an average value is used for preventing all serious injuries.

The reduction in secondary accidents arising from eCall was estimated at less than 0.5%. This is because any secondary accidents are likely to occur during the time when the call is being dealt with by PSAPs or the incident details are being verified by traffic centres before warning messages can be broadcast.

The estimates of savings in fatalities and reductions in injury severity were included in the Cost-Benefit Analysis described in Section 4.7.

4.5 Benefits – Traffic and Environmental

UK 2006 study: assumptions
In the UK 2006 study it was assumed that most of the benefit of eCall would be on roads with light traffic where an accident would not cause congestion. Traffic and environmental benefits were not included in the assessment.

EC impact study assumptions and evidence
The study assumed that the initial response is on the critical path to incident clearance, thus when an eCall is triggered, the incident duration is reduced by the amount of reduction in response time.

The traffic modelling study described in Section A.1.1.1A.3 estimated the relation between saving in incident duration and the value of journey time savings as shown in Figure 3. A two minute reduction in incident duration was estimated to reduce traffic delay of 2.26m vehicle hours per year (about 0.07% of the total number of hours spent in congestion or 3% of the congestion associated with accidents). This is equivalent to approximately €19.5m – using the average value of an hour of time to be €8.60 – of which €6.1m are on the motorways and trunk roads.

The environmental impacts of eCall arise from the reduction in congestion following improvement in incident response times. Calculations using standard vehicle emissions models showed that the percentage reductions in Nitrogen Oxide, CO₂ and Particulate Matter emissions would be negligible (all reductions less than 0.0002%). Reductions in fuel consumption were also estimated to be negligible.
Figure 3: Association between reduction in response time and value of journey time savings

EC impact study: estimates

A two minute reduction in the average duration of incidents was estimated to result in an average saving in delays on the road network of 2.26m vehicle hours per year, equivalent to €19.5m, of which €6.1m is on the motorways and trunk roads.

The estimates of journey time saving were included in the principal factors Cost-Benefit Analysis described in Section 4.7, but the environmental benefits were not included.

4.6 Benefits – Other

UK 2006 study: assumptions

The UK 2006 study identified a number of other benefits but these were not quantified. These are summarised in Table 4.
Table 4: Other benefits discussed in the UK 2006 report

<table>
<thead>
<tr>
<th>Other benefits</th>
<th>UK 2006 study assumptions and estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other accidents and incidents (non-road accidents, crime, manual eCall for medical emergencies in vehicles)</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Resource savings in incident response (arising from improved information in eCall)</td>
<td>The improved accuracy of location information in mobile phone calls was assumed to reduce the resources needed to respond to incidents but this benefit was not quantified.</td>
</tr>
<tr>
<td>More appropriate emergency response arising from improved information in eCall</td>
<td>The vehicle details and data about the impact would help emergency services to respond more quickly and with resources that are better targeted to the incident, but this was not quantified in the assessment.</td>
</tr>
<tr>
<td>Environmental impacts</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Wider benefits:</td>
<td>These benefits were identified but not quantified</td>
</tr>
<tr>
<td>• additional data on accidents that would not normally be reported</td>
<td></td>
</tr>
<tr>
<td>• improved accident location for analysis of clusters</td>
<td></td>
</tr>
<tr>
<td>• security of vulnerable drivers and lone workers</td>
<td></td>
</tr>
<tr>
<td>• cross border travel</td>
<td></td>
</tr>
</tbody>
</table>

EC impact study: further evidence

Other accidents and incidents

There was concern that some non-emergency use of eCall would occur, or that the manual eCall button may be used in cases where no accident has occurred. Some of these, such as vehicle breakdowns where the vehicle is not obstructing the traffic, would result in additional costs in processing the call which would not be offset by any saving in lives or reducing injury severity.

Resource savings in incident response

Information from some of the Regional Control Centres which are responsible for incident response and tactical traffic management on the Highways Agency network was used to assess resource savings.

One of the Regional Control Centres reported that the improvement in the quality of information received could reduce the number of staff carrying out incident response duties in the control room by one, with staff being redeployed elsewhere. They do not expect that the detailed information contained in the eCall message will change the way in which incidents are responded to (because the first response would still be to send a Traffic Officer to assess the incident), although there may be a possibility of saving on Traffic Officers patrolling the network, at least in some areas. Discussions were also held with other Regional Control Centres.

The National Traffic Control Centre (which is responsible for providing information to drivers) expect that if eCalls are filtered at the PSAP1 stage so that only real emergencies are passed on to PSAP2s, then eCall could remove the need for validation via traffic monitoring or contact with the police before warning messages are broadcast.
to drivers via Variable Message Signs and other traffic information services (for example to neighbouring road authorities in urban areas). Consequently there could be a resource saving and an improvement in the speed of informing road users.

The police representative also envisaged a reduction in the effort required in police control centres following the introduction of eCall, but did not provide an estimate of the extent of the reduction.

On the basis of these discussions, an overall maximum saving in the time which Regional Control Centres spend in locating incidents before starting to respond to them was estimated at a maximum of 4 minutes per eCall incident, and an average of 2 minutes per incident was used. This can be translated into an efficiency saving in staff in Regional Control Centres which amounts to €1.1m per year, based on full eCall uptake. In addition, there would be a similar saving in time spent by traffic officers locating incidents (two traffic officers per vehicle) resulting in saving of a further €2.4m per year.

More appropriate emergency response

Stakeholders commented that the vehicle information transmitted in the eCall message may enable appropriate equipment to be sent to the scene in a shorter timescale. In the case of the fire and rescue service, it may enable them to plan any extraction of vehicle occupants more effectively while travelling to the scene.

Wider benefits

Some of the wider benefits noted in the UK 2006 study were also raised by stakeholders in the EC study:

- Vehicle occupants who do not speak the local language (whether or not they are involved in cross border journeys) would benefit from the automatic element of the pan-European eCall service. Thus benefits would be seen both for people from the UK driving abroad, and people in the UK (whether visitors or residents) who do not speak English.

Some of the stakeholders noted further additional benefits which are ‘spin-offs’ of the eCall service and which are difficult to quantify:

- All of the Mobile Network Operators seem to be favourably disposed towards eCall and see it as a business opportunity for getting networks into vehicles. There could therefore be further benefits for users and for service providers
- Employment benefits: there could be additional jobs created in setting up systems and services for eCall. On the other hand there could be fewer 999 calls, which may reduce the number of people employed in PSAPs
- There are potential benefits for improving the efficiency of commercial services if they are able to receive immediate information relating to accidents: for example insurance companies arranging budget replacement car rental or supply of breakdown and vehicle repair services

Benefits from an ‘enhanced’ eCall service

Some stakeholders noted that an ‘enhanced’ eCall service would provide additional benefits:

- Information on the ‘g’ forces involved in the impact, combined with information on the type of vehicle, would help the medical services to plan the staff and equipment deployed to the scene
- Medical information on vehicle occupants would enable the most appropriate emergency response to be despatched more rapidly
- A picture channel would help to deal with the issue of silent calls
- A pre-accident black box would be beneficial for providing information about the circumstances leading up to the collision.
EC impact study: assumptions and estimates

The 'other' benefits estimated in the EC study (but not quantified in the UK 2006 study) can be summarised as follows:

- An average saving of 2 minutes (maximum 4 minutes) in Traffic Centres resulting in savings of €1.1m in control centre staff resources and €2.4m in efficiency savings by traffic officers, assuming full eCall uptake
- Environmental impacts are negligible.

The estimates of journey time savings have been included in the Cost-Benefit Analysis described in Section 4.7.

4.7 Quantitative Benefit/Cost Illustrations

In addition to the European Benefit/ Cost analysis, the EC impact study also assessed the combined effects of the various assumptions and estimates of the benefits and costs in the UK by carrying out a simple analysis of the principal cost and benefit drivers that was attuned to UK conditions.

4.7.1 Assumptions about eCall roll-out and performance

Three illustrative roll-out scenarios were developed:

- Aftermarket only: a high-end option fitted to an additional 3% of vehicles per year from 2010
- New vehicle fit: fitted to all newly type-approved vehicles from 2014 and all new vehicles from 2017 (assuming random introduction of new types and each type having a five year duration before it is superseded by another)
- New and aftermarket: Newly type approved vehicles from 2014, all new vehicles from 2017 and an additional 3% of the vehicles with an aftermarket fit from 2010.

It was assumed that the likelihood of eCall operating successfully after an accident would be between 95% and 98%. This was based on comments from stakeholders. By comparison, the assumptions in the UK 2006 study were 90% in 2010 and 98% in 2020.

4.7.2 Assumptions about costs and benefits

A simple spreadsheet implementation was developed with the following features and variables:

Costs:

1. The PSAP and infrastructure upgrade cost and maintenance cost specifically related to eCall. The upgrade cost was assumed to be absorbed over the next 20 years. The maintenance cost applied in all subsequent years.
2. The in-vehicle equipment cost. Costs were different for factory-fitted and aftermarket eCall. The cost in one year depends on the unit component cost and the number of vehicles equipped in that year. The unit cost was assumed to decrease over time by 5% per year as volumes increase and technology matures. The aftermarket take up rate was assumed to be 3% per year.

Benefits:

1. In previous studies eCall has been assumed to reduce the number of fatalities involved in road accidents by reducing the time before emergency assistance is at the scene. For this calculation, the benefit is the monetary
cost of a fixed proportion of accidents in which eCall equipment is available. Over time, as overall accident rates are predicted to decrease, the number of actual accidents which eCall helps will also decrease. As the proportion of the fleet equipped increases, the proportion of accidents in which eCall can potentially assist also increases. Strictly, this relationship would only be linear if all accidents involved just one vehicle, but a linear relationship was assumed here.

2. eCall is also assumed to reduce the time until the incident is cleared and the road is flowing freely again. For this calculation, the benefit is the monetary cost of the congestion time saved using the same time interval saved as in for the accident reduction. The congestion saved in this time depends on the number of vehicles affected and this was estimated using the model described in Section A.1.1.1A.3.

Discounting:

Having identified the costs and benefits in monetary terms arising in each future year these were then summed and discounted in the usual manner using a discount rate of 3%, which is the rate required for UK investment decisions.

(Note that the overall European Cost-Benefit Analysis did not use discounting to relate costs to a base year. Instead it calculated benefits and costs in two ‘snapshot’ years: 2020 and 2030.)

4.7.3 Illustrative calculations of costs and benefits

Illustrative calculations of the benefit/cost ratio were carried out under a series of scenarios. One scenario – Scenario 4 – was the ‘best estimate’ on the basis of the data available and the others were treated as sensitivity tests.

The scenarios, and the maximum value estimated for the benefit/cost ratio under each scenario in 2030 are shown in Table 5.

### Table 5: Summary of illustrative calculations of costs and benefits

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Assumptions</th>
<th>Maximum Estimated Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UK 2006 study mean figures</td>
<td>1.6</td>
</tr>
<tr>
<td>2</td>
<td>High operational cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High In-Vehicle Unit (IVU) Cost</td>
<td>2.3</td>
</tr>
<tr>
<td>3</td>
<td>Medium Operational Cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium IVU Cost</td>
<td>2.4</td>
</tr>
<tr>
<td>4</td>
<td>Medium Operational Cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium IVU Cost</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>Medium Operational Cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low IVU Cost</td>
<td>2.5</td>
</tr>
</tbody>
</table>

In these calculations different levels of benefit were represented by varying the proportion of the value of fatalities and serious injuries per year prevented.

The results showed that the highest Benefit/Cost ratio is provided in each of the scenarios by the “New after 2014” case which assumes that either through mandating or
by industry agreement all new type-approved vehicles are factory-fitted with eCall after this date.

The results for Scenario 4 which represents the ‘best estimate’ derived in the EC impact study are shown in Figure 4. The assumptions on which this is based are summarised in Table 6.

**Figure 4: Benefit/ Cost ratio for 'Best estimate'**

![Graph showing benefit/cost ratio over years](image)

<table>
<thead>
<tr>
<th>Safety benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of fatalities prevented per year</td>
<td>% reduction in in-vehicle unit cost per year</td>
</tr>
<tr>
<td>% of serious injuries prevented per year</td>
<td>Initial in-vehicle unit cost - OEM</td>
</tr>
<tr>
<td></td>
<td>Initial in-vehicle unit cost - Aftermarket</td>
</tr>
<tr>
<td></td>
<td>Operational cost per year</td>
</tr>
<tr>
<td></td>
<td>Initial infrastructure cost</td>
</tr>
</tbody>
</table>

**Aftermarket penetration**

Aftermarket take up rate: 3.0%

The graphs for Benefit/ Cost ratios under each scenario show an increase in benefit over time. This arises from the relatively low initial and annual infrastructure cost and the reduction in the cost of in-vehicle equipment with time. It was assumed that the cost of in-vehicle units will decrease in real terms as volumes increase and system integration increases. Indeed, it is possible that some equipment costs (e.g. GPS) could be shared amongst different functions thus reducing the cost attributable to eCall, although this was not explicitly taken into account. A 5% cost reduction per annum was assumed, which has the effect of reducing a €150 price to a €90 price in 10 years (at today’s
costs). This 5% reduction more than offsets the discount rate and the assumed reduction in accidents over time and therefore leads to an increasing B/C ratio over time.

In all scenarios the B/C ratio of the new vehicle fit is better than when aftermarket fit is also considered, despite higher eCall fleet numbers with aftermarket fitment also. This is because the assumed cost of aftermarket units is greater than the cost of equipping new vehicles.

The results from the other scenarios showed that the cost of in-vehicle units is a sensitive parameter in the analysis (and is much more important than initial investment and operational costs), while fatality/injury prevention is also a sensitive parameter.

### 4.8 Summary of costs and benefits in the UK

The EC study made a re-assessment of the UK 2006 study. It collected a limited amount of additional data and consulted further stakeholders. However the scale of the new study did not yield sufficient data to validate, or otherwise, the overall UK 2006 study methodology.

The UK 2006 study was found to have over-estimated eCall time saving and casualty reduction, but also the cost of in-vehicle equipment.

Two areas of benefit that were not included in the UK 2006 study, but worthy of consideration, are inclusion of all road vehicle types (the technology for powered two-wheelers is being developed) and inclusion of the benefits of congestion reduction.

Table 7 summarises the figures estimated and assumed in the Cost-Benefit Analysis carried out in the UK 2006 study and in the UK case study for the EC.

**Table 7: Summary of UK Benefits and Costs: UK 2006 study and EC study**

<table>
<thead>
<tr>
<th>Costs</th>
<th>UK 2006 study</th>
<th>UK data - EC study</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-vehicle costs (per unit)</td>
<td>€360 (Range tested in sensitivity analysis €150 - €580)</td>
<td>€150 (OEM, 2014) reducing at 5% per year €200 (aftermarket)</td>
<td>Technology costs have reduced and are expected to continue falling; standards have developed; more experience of in-vehicle units and after-market products is now available</td>
</tr>
<tr>
<td>PSAPs – infrastructure</td>
<td>€5.76m</td>
<td>€220,000</td>
<td>The call is similar to the existing calls but has better information so additional costs are absorbed in periodic upgrades. Some additional hardware is needed but if timescales are compatible with planned upgrades, then implementation costs are much lower</td>
</tr>
<tr>
<td>PSAPs - operations</td>
<td>€5.04m per year</td>
<td>€110,000 per year</td>
<td>It is not clear whether staffing levels would need to be increased; this uncertainty could be resolved by a pilot trial</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>€720,000 per year telecommunications</td>
<td>€720,000 per year telecommunications</td>
<td>Cost per call has not changed</td>
</tr>
<tr>
<td>Benefits</td>
<td>UK 2006 study</td>
<td>UK data - EC study</td>
<td>Comment</td>
</tr>
<tr>
<td>----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Driver education and publicity</td>
<td>€5.76m per year</td>
<td>€5.76m per year</td>
<td>No evidence available to support a different figure</td>
</tr>
<tr>
<td><strong>Reduction in response time</strong></td>
<td>10 minutes</td>
<td>2 minutes</td>
<td>A broader evidence base is now available for estimating, based on PSAP experiences; ambulance services are now equipped with satnav and locate incidents en route, thus reducing time lost</td>
</tr>
<tr>
<td>Reduction in fatalities</td>
<td>10% (Range tested: 0%- 22.5%)</td>
<td>1% i.e. 29 per year (€48m per year)</td>
<td>Consulted UK stakeholders more widely, especially trauma and first response</td>
</tr>
<tr>
<td>Reduction in serious injuries</td>
<td>10%</td>
<td>0.5% i.e. 67 per year (€26.5m per year)</td>
<td>Consulted UK stakeholders more widely, especially trauma and first response</td>
</tr>
<tr>
<td>Reduction in secondary accidents</td>
<td>Not estimated</td>
<td>&lt;0.5%</td>
<td>Likely to occur soon after the first accident before warnings can be broadcast</td>
</tr>
<tr>
<td>Reduction in journey time delays</td>
<td>Not estimated</td>
<td>2 minutes per accident (€19.5m per year)</td>
<td>Reducing response times of emergency services shortens incident duration</td>
</tr>
<tr>
<td>Reduction in emissions arising from reduction in congestion</td>
<td>Not estimated</td>
<td>Less than 0.0002%</td>
<td>Follows from reduction in journey time delays resulting from shorter incident duration</td>
</tr>
<tr>
<td>Reduction in fuel consumption arising from reduction in congestion</td>
<td>Not estimated</td>
<td>Negligible</td>
<td>Follows from reduction in journey time delays resulting from shorter incident duration</td>
</tr>
<tr>
<td>Improved efficiency of traffic centre staffing</td>
<td>Not estimated</td>
<td>€1.1m per year</td>
<td>Reduction in ‘desk time’ devoted to locating accidents before a response is initiated</td>
</tr>
<tr>
<td>Improved efficiency of Traffic Officer service</td>
<td>Not estimated</td>
<td>€2.4m per year</td>
<td>Reduction in Traffic Officer time devoted to locating accidents</td>
</tr>
</tbody>
</table>

**Benefit/ Cost Ratio**

<table>
<thead>
<tr>
<th>Best estimate</th>
<th>Range 0.1 - 0.7</th>
<th>1 in 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>1 – 2.5 in 2030</td>
<td></td>
</tr>
</tbody>
</table>
UK 2006 study Benefit/ Cost ratio
The Benefit/ Cost ratios produced in the UK 2006 analysis ranged from 0.1 to 0.7 under different scenarios for what was described as the 'overall UK business case'. However the analysis showed that if eCall were available in vehicles anyway, (removing the cost of in-vehicle equipment from the benefit/ cost equation) then there would be a case for supporting it, with the Benefit/ Cost ratio ranging from 7.3 to 44.0.

EC impact study – UK Benefit/ Cost ratio
The various illustrative calculations of benefits and costs calculated in the EC impact study confirmed that although no one denies that eCall is beneficial, the case in social cost-benefit terms still appears weak. The way in which the calculations were done meant that the benefit/ cost ratio improved over time in all of the scenarios investigated. The most realistic of the scenarios investigated in the illustrative Cost-Benefit Analysis showed that under the assumptions made (medium costs and medium benefits), the highest Benefit/ Cost ratio achieved in the time frame analysed would be 1, which would be achieved in 2030 if all new vehicles were equipped from 2014.
5 Discussion of Implementation Issues

In this section, a number of issues concerning eCall implementation are identified. For each, the current situation is outlined, along with ongoing activities that may help to clarify open issues and any mitigation measures to address problems or relieve difficulties. Links between issues are made where particularly relevant. In each case an assessment is made as to how important remaining issues are likely to be in determining future eCall roll-out. These are summarised at the end in an impact table.

5.1 Privacy

The deployment of eCall has privacy and data protection implications because it involves the processing of personal data including identification and tracking of vehicles. This means that the principles of relevant European Directives (mainly the Data Protection Directives 95/46/EC and 97/66/EC) and national data protection laws have to be applied.

In 2006 a working party on privacy (WP 29)\(^5\) published a paper on the issue considering implementation of eCall on a voluntary basis and as a mandatory service.

For voluntary eCall the WP29 paper called for an easy means of switching any location/tracking system off or a mechanism such that the location is only revealed when eCall is triggered (automatically or manually). The vehicle manufacturers (and other stakeholders) were not in favour of an on/off switch but, whilst the WP29 paper is not entirely unequivocal, it is widely believed that the “dormant SIM” approach (further described below) will provide an acceptable solution. For a mandatory service, eCall would probably need to be enforced by dedicated EU-wide regulation. Such regulations would need to apply Data Protection principles, including the principle of proportionality and also provide safeguards to prevent surveillance and misuse.

In current UK automatic crash notification systems, provided as part of a subscription service with other functions, privacy has not been an issue. For such systems the Article 29 Working Party identify the basic principles to be taken into account by third party providers, including:

1. The purposes for which the data may be used are to be clearly spelled out in the individual contracts. The contracts should also clearly set out that the third party service provider is the controller of the relevant data and is bound by all the data protection and privacy obligations that pertain to data controllers under both the Data Protection Directive and national laws.

2. Only such data which are “necessary” and “relevant” for the specific purposes may be transmitted, i.e. it must be ensured that each third party provider only receives those data that are required for the purposes of the respective contract.

Overall, it appears that privacy concerns can be addressed by suitable system design and should not, therefore, be an impediment to implementation of eCall. Also, privacy issues were not regarded as a barrier by any stakeholder consulted during the 2009 EC Impact study.

5.2 Liability

Chapter 8 of the 2008 EC Impact Report summarised the legal and liability situation and concluded that all actors in the production and service delivery chain are exposed to potential liability for negligence (breach of a duty of care) or attributable non-performance. In this section the situations for the three main stakeholders – vehicle industry, mobile network operators and PSAPs - are briefly reviewed.

\(^5\) This Working Party was set up under Article 29 of Directive 95/46/EC. It is an independent European advisory body on data protection and privacy. It is composed of a representative of the supervisory authority or authorities designated by each Member State and of a representative of the authority or authorities established for the Community institutions and bodies, and of a representative of the Commission.
For the vehicle industry, the ACEA position statement (ACEA, 2009) states that the “...vehicle manufacturer’s liability shall be restricted to technical product functionality. It shall not extend to exceptional circumstances, e.g. vehicle under water, no sensor being triggered off due to very unique accident situations or circumstances that are beyond vehicle manufacturers’ control, e.g. eCall switched off by driver, inadequate coverage of mobile phone network or Bluetooth connection not correctly activated, just to give a few examples”.

The actual liability position in judging whether a product is defective, i.e. whether it does not provide the safety a person is entitled to expect, will depend on:

(a) The presentation of the product;
(b) The use the product could reasonably be put to;
(c) The time when the product was put into circulation.

This makes clear that courts are allowed to take a broad range of circumstances into account when deciding product liability questions and therefore there are no clear and unambiguous answers when it comes to assessing product liability implications of eCall equipment. One important factor is the availability, cost, and practicability of a safer design. It can therefore be expected that courts, in judging these trade-offs, will value the evident benefits of eCall in favour of accepting inherent system limitations that cannot be easily avoided (in terms of costs and practicability) through an alternative design or adequate instructions. Furthermore, the fact that eCall does not create any substitute risks - is in fact only aiming at reducing damage that was caused by another factor than the product itself – may be taken as a relevant factor in assessing system defectiveness.

Another relevant factor, which is especially important in design defect cases, is whether or not the product complies with relevant performance and safety standards. Compliance with such standards may be help to determine the “safety a person is entitled to expect” but standards will be regarded as only providing minimum requirements and not an automatic defence. However, if eCall is to be made mandatory equipment for all new type approved vehicles than system requirements and conformance test procedures must be available for type approval authorities (and these do not yet exist).

For nomadic device manufacturers who plan to incorporate eCall, the liability regime of the Product Liability Directive equally applies; however, the fact that the vehicle and the eCall device are not produced by the same company may complicate product liability issues if this affects system reliability. It therefore appears unlikely that OEMs will provide an “eCall trigger“ and the aftermarket industry will need to develop stand-alone products.

For mobile network operators (MNO) the situation with eCall is essentially the same as the current 999/112 situation. This MNO is in principle not liable for interruption of failure of service if the non-performance has been caused by an event which he could not reasonably prevent and of which he was unable to avoid the consequences. However, the MNO will in principle be accountable if non-performance was caused by faults of his employees or services of a third person or if equipment used was defective or not fit for its purpose.

PSAPs are subject to the same liability rules as private persons and organisations. They may, for example, be exposed to liability if unsuccessful eCalls are caused by faults of staff (e.g. not correctly handling an eCall) or for inadequately installing or maintaining equipment. For PSAPs the extent to which eCall introduces new risks is limited in the sense that potential failures in eCall processing are not expected to differ substantially from failures that may occur in ‘normal’ emergency calls, although there is some uncertainty over the extent to which PSAPs will be able to use all of the detail contained in the eCall message.
Stakeholder questionnaire responses during the 2008 EC Impact Study showed awareness that liability issues need proper consideration; however they did not reveal that liability concerns are generally perceived as a threat to stakeholder involvement in the deployment of eCall.

Further development of equipment performance standards, standardisation of eCall handling protocols and agreed service performance levels will help clarify what is expected of stakeholders (and therefore how they may avoid liability risks) and to allocate risks within the production and service delivery chain.

5.3 Standards

Progress with formal standards to support eCall implementation in passenger cars is summarised in Appendix B. Standardisation is identified as a key issue (beyond the general role of standards in reducing implementation risks, hardware costs and barriers to entry for product and service providers) because the vehicle industry, represented by ACEA, has identified formal standardisation as a necessary prerequisite before implementation.

It should be noted that standards are not the same as specifications, so they do not provide a ready-made solution for hardware and service providers who still need to do detailed design, testing and implementation work based on the standards. Regulatory measures will also be needed if standards are expected to be used in a particular way.

Also, whilst standards provide a good engineering model of eCall, they do not provide a business model so various implementations are possible and the roles of different stakeholders are not fully defined but are matters for future negotiation.

Standards can confuse some stakeholders and propagate the impression that the situation is not fully resolved. This arises partly because of the plethora of numbers, acronyms and organisations involved in standardisation and the flexibility and ongoing development that is inherent in the area. As an example of flexibility, the eCall Minimum set of Data (MSD) contains 100 bytes of data which can be optionally used (e.g. to convey the number of passengers). As an example of ongoing development potential, 30 bytes of data within the MSD can be used for future expansion, and work is progressing on rules for management of data registries which gives a route for refining and supplying additional data.

Also, it can be noted that work is ongoing to develop the standards to include motorcycle and HGV eCall. This is not, in itself, an issue for eCall implementation in passenger cars (as developments in the new areas are not expected to change anything concerning passenger car implementation) but further serves to support the impression that standardisation is incomplete.

If eCall becomes mandatory for all new type approved vehicles then system requirements and conformance test procedures must be available to enable type approval authorities to assess whether the equipment can be approved as being in consistent with European Directives. In this case, further standardisation work would be necessary by ETSI and CEN and the work would need to be incorporated into the relevant European Directives/ UNECE regulations.

Overall, the situation concerning standardisation is no longer a major barrier to voluntary eCall implementation. A small amount of work is still required to finalise current standards but the risk of this being incomplete by the end of 2010 is low. If eCall is to be mandatory further work would be required but it is anticipated that with EC funding this could be completed in an acceptable timescale.

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6 Directive 2007/46/EC. Furthermore, eCall may also become a new item for periodical inspection (Directive 96/96 EC)
5.4 Dormant SIM

eCall requires a means of connection and an identity on the cellular mobile network and this identity is provided through a small microchip, called a Subscriber Identity Module or SIM. Conventionally, a SIM is activated by use of a unique numerical identifier; once activated, the identifier is assigned and the card is permanently locked in to the activating network. However, because of privacy concerns (see Section 5.1) a “dormant SIM” system has been devised. This SIM has no connection with the mobile network until eCall is activated. The SIM is then temporarily assigned a numerical identifier (e.g. for 24 hours) and connects to the network. As well as increasing privacy, the mobile operators can maintain a pool of numbers rather than a number for each SIM in existence which reduces overhead costs.

Some remaining issues include:

- There will be a delay of 3-4 seconds while the dormant SIM establishes a network connection
- The additional number of SIMs in circulation and the increase in signals and transmissions arising from eCall means that Mobile Network Operators will have to design and test new software and may need to purchase additional equipment. The approach has yet to be implemented
- There may be a small additional cost of maintaining the pool of re-assignable numbers; Mobile Network Operators would like to be notified when an eCall device is scrapped, rather than have an ever growing list of dormant SIMs
- There remain some privacy concerns such as whether national security services can activate a SIM remotely to identify a vehicle position and/or listen in to a conversation within a vehicle using the mobile phone’s microphone.

5.5 Robustness of In-Vehicle Hardware

The eCall in-vehicle hardware needs to achieve long term robustness; it needs to operate for the whole lifetime of the vehicle (typically 8-15 years but potentially much longer) and needs to operate after the vehicle has been involved in a severe collision. These are stringent requirements but ones that the vehicle industry routinely address. Air-bags and other safety devices have somewhat similar requirements but the eCall device has to not only generate a trigger but remain operative after the crash to communicate the eCall data and, if possible, open a voice channel. This places severe demands on the communications elements of the hardware which may need to operate in extreme environments and in any vehicle orientation.

Experience from private automatic crash notification systems is available. However, such systems usually involve multiple services and a communications channel that is more frequently used which provides a route for testing and software upgrades.

Would there be a need for annual inspection or for specific maintenance after extended periods? The vehicle industry as represented by ACEA, is against this solution. Until there is long-term experience of eCall operation, some uncertainty will remain concerning in-vehicle hardware robustness in the long term.

Another issue concerning the in-vehicle elements of eCall is the Human Machine Interface (HMI). eCall requires a means of manual operation to be provided. This would be used, for example, in case of medical emergency or for the “good Samaritan” call when a crash is witnessed. However, there is concern that an inappropriate design may generate “false” eCalls through, for example, inadvertent activation (e.g. by children) or by deliberate activation in non-emergency cases (e.g. to summon assistance following a vehicle breakdown). False calls would not prevent eCall from subsequently working in true emergency situations but would represent an additional workload on the PSAP.
So, design of the HMI becomes important. It has been suggested that a “preventer” or secondary required activation action should be necessary (such as a mechanical flap over the button). Others have suggested that false activation can only be reduced by also facilitating a non-emergency communications channel (e.g. providing breakdown assistance). Public information/ driver instructions on this issue are also likely to play a role. Vehicle HMI for eCall and driver instructions are not addressed by standards so uncertainties remain about how these issues will be handled and how effective they will be in terms of overall false alarm rate.

5.6 Product end of life

Industry needs to manage the whole product lifecycle and there is some concern that insufficient attention has yet to be given to this. One question is whether in-vehicle eCall hardware might be (in whole or in part) re-used as a spare part when a vehicle is scrapped. This could have consequences for the validity of the MSD which contains vehicle-specific data. There are also “end of life” issues such as what happens when a vehicle is finally scrapped. According to the EC, such issues are national ones. As a simple example, if the vehicle is roughly handled or placed in a crusher without adequate disassembly, an eCall might be generated (and provide the PSAP with unwelcome work of another false call). Also, the Mobile Network Operators would like to be notified that a dormant SIM will no longer be potentially active. This allows the pool of unallocated numbers available to the dormant SIMs to be efficiently managed.

These problems (and additional ones) have been scarcely considered by Stakeholders who need to understand them and negotiate responsibilities. Whilst no insurmountable problems are anticipated, there is some uncertainty at the moment.

5.7 Communications and lifecycles

eCall needs to operate for the life of a vehicle, which can be 8-15 years typically but can be much longer. However, the life-cycle of mobile systems is much shorter. The mobile industry launched 3G in 2001 and will be phasing out 2G. The next evolution will aim to offer broadband wireless access and may be based on the 3GPP LTE (Long Term Evolution) cellular standard and/or WiMax or other technologies. A “4G” system is expected to be a complete replacement for the current network infrastructure and products may be launched as early as 2011. Clearly there will be a voice channel and, in theory, the in-band modem approach to data transmission should be compatible (but antiquated) although some form of mid-life upgrade to the in-vehicle hardware will probably be required when 3G is no longer supported. Such an approach is not acceptable to the vehicle industry and this issue remains open and is of great concern to Mobile Network Operators and potential in-vehicle equipment providers.

5.8 eCall Flag

Emergency calls have a ‘flag’ which enables them to have priority in processing, even if the load on the network at the time is high. In response to requests from some national PSAPs, an eCall flag has also been assigned such that a PSAP can automatically distinguish between an eCall and a standard emergency call.

A remaining question until the end of 2008 was how eCall flags would be transmitted to the PSAPs. It was agreed by 3GPP at a meeting in December 2009 that eCall flag will end at the Mobile Service Centre. From there traditional 112 calls will be routed on one line to the PSAP and eCalls will be routed on a separate line.

This has yet to be implemented but is now not expected to be a major technical problem. The cost for mobile network operators and for the PSAPs to implement eCall ‘flags’ could be substantial for some companies, but others will already have the necessary equipment and will not incur significant additional charges.
5.9 Licensing of in-band modem

Mindful of the requirement for long-term support for eCall communications, the EC sought a simple and future-proof method for communicating the eCall data (MSD). After specific testing a solution proposed by the company Qualcomm was adopted and standardised. This is the in-band modem approach through which a burst of digital data is encoded on a voice communications channel. Qualcomm has stated that use of the technology for eCall will be royalty-free but that use for other services would require negotiation of a commercial licence.

On the one hand, this simple solution guarantees that the MSD can be communicated across any voice channel (2G, 3G or beyond 3G) but industry commentators have observed that the in-band modem technology is very basic and limited and that OEMs are unlikely to use the technology to support other services both because of technical limitations and licensing requirements.

5.10 VIN decoder

A Vehicle Identification Number, (VIN) is a unique serial number used by the automotive industry to identify individual motor vehicles. The eCall MSD incorporates the VIN but there has been a requirement from emergency services to have additional information such as the vehicle model and colour to assist identification and rescue planning. There was, therefore, a need to “decode” the VIN.

Since 1981 the VIN has consisted of 17 characters but there are at least four competing standards used to assign VINS worldwide. Prior to 1981, there was no accepted standard for these numbers. The VIN decoder is a piece of software commissioned by the EC that inputs the VIN and, using a database, produces as much additional information on the vehicle as is available. The database is the key to accuracy and, obviously, depends on collaboration from vehicle manufacturers for its content. However, some doubt has been expressed by vehicle industry commentators about the accuracy of the EC VIN decoder software and arrangements for updating, and the software is, as yet, largely untried.

To additionally provide a number-plate (vehicle registration mark) from the VIN requires collaboration from national licensing authorities. The EC hope that through a Dutch co-ordinated EC project, EUCARIS, which was set up to promote cross-border co-operation in stolen vehicles, the VIN decoder can additionally access number-plates. This would involve a short time delay to access an external database over an internet link (2 seconds has been suggested). This has yet to be agreed in principle and there may be additional issues of privacy to address. Access arrangements would need to be implemented and tested which would involve some additional expense at European and probably national levels.

Complete implementation of a “perfect” VIN decoder is not central to eCall implementation as it provides additional information, and any partial failure is only expected to be critical in a minority of cases. Thus, whilst there are issues and uncertainties around its implementation, it does not constitute a barrier to eCall implementation.

5.11 False alarms and multiple alarms

A number of situations can be discussed under this heading:

- As the eCall system incorporates a manual activation capability there is potential for an increase in false alarms from inadvertent activation (e.g. by the driver, passengers etc). Generally these would be screened out when the voice channel is activated (assuming correct operation) but could provide additional work for PSAP staff.
Similarly, the manual activation of eCall may be made on purpose but for non-emergency purposes, or for purposes which the initiator considers an emergency, such as vehicle breakdown. Again, this would require handling procedures at the PSAP.

A third potential situation is automatic generation of eCalls in non-emergency situations e.g. as a result of sensor failure, a small electrical fire, or if a sensor (such as an air bag) is triggered but there is no need for emergency services. This situation is, again, likely to be resolved through use of the voice channel.

Clearly it is to be expected that, as the number of eCall units increases, there will be an increased numbers of eCalls. Specifically there will be new calls from isolated vehicles – which is one of the key purposes of eCall. In addition, if two vehicles crash into each other there could be two eCalls. Also, whereas before eCall onlookers would call for emergency assistance there will, additionally, be calls from the vehicles involved. There is also likely to be an increase in “Good Samaritan” calls as drivers not directly involved in a crash could easily report the crash with their own manual eCall button.

The extent to which these situations will be problematic is an open issue. Better use of information technology and location intelligence could consolidate calls into incidents and even prioritise on the basis of automatic eCalls, but such software would need to be developed and tested by the PSAPs.

5.12 UK PSAP operational practices

The widespread use of eCall would require PSAP operational practices to be reviewed and updated. Some example issues are identified below:

- At the moment, “silent calls” are assigned a lower priority (e.g. dialled inadvertently by a mobile phone in a pocket). However, silent calls coming in as an eCall could be the most serious (triggered automatically and with no vehicle occupant able to respond on the voice channel).

- A new issue could be the robustness of PSAPs against “attack” such as fabrication of multiple false eCalls made more practical by the perpetrator through the availability of eCall hardware.

- eCall operators would need some additional training e.g. to expect the burst of data on the audio channel, to request re-sending of incomplete or missing MSD and to be prepared to speak with drivers or passengers in a crashed vehicle.

- Additional work might be expected dealing with “false” eCalls and multiple eCalls, as described above, and some new procedures and training may be required.

- Policy will need to be developed concerning Third Party Support (TPS) eCall and the role of third parties in the emergency call chain. Currently, private providers may facilitate but not interrupt the emergency service chain. One option would be to re-visit the national MoU used by the mobile operators and PSAPs for the current UK “eCall” implementations which specifies the roles and responsibilities and technical interfaces between the current Stakeholders. This could be adapted to the situation of public European eCall and TPS eCall.

Assuming voluntary introduction of eCall over an extended timescale, such adaptation would not be expected to be difficult, but will involve some time and cost. If eCall becomes mandatory, Member States may come under additional pressure or requirement to further regulate PSAP operation although it is currently unclear what would be mandated and whether mechanisms currently exist to facilitate this.
5.13 Member State/PSAP commitment and European implementation

eCall is being championed by the EC as a European emergency rescue system. The commercial stakeholders from the vehicle industry and mobile industry as well as many service providers look for a European-scale operation to support the business case for involvement. Therefore, irrespective of the UK policy position, eCall will only achieve successful implementation (high fleet penetration) if it succeeds as a European service.

For a voluntary approach to be successful the vehicle industry must be committed to installing in-vehicle hardware and they will not do this until they see eCall able to be received in a substantial number of national PSAPs. However, given the lack of robust benefit/cost figures, many national PSAPs have an insufficient business case or insufficient funds for investment to modernize and streamline their PSAP for eCall readiness.

Another option is mandatory deployment and the EC have announced that unless “significant progress” is made by the end of 2009, both in the availability of the eCall device in vehicles, and the necessary investment in PSAP infrastructure, the Commission will plan to take the following regulatory measures in 2010:

1. A Recommendation to the Member States targeting Mobile Network Operators on the transmission of eCall
2. A proposal for a regulation under vehicle type-approval legislation for the mandatory introduction of the in-vehicle part of the eCall service in new type approved vehicles
3. The assessment of a potential regulatory measure for the necessary upgrading of the PSAP infrastructure … in the framework of the proposed Directive on the deployment of ITS in Europe.

There seems little doubt that the EC have powers to undertake (2) but whether under the Action Plan or through the Lisbon Treaty they have, or will have, powers in areas (1) and (3) and then whether Member States will have mechanisms for implementing any recommendations or regulatory measures is still a matter of debate.

Using the accepted UK methodology to evaluate eCall, no robust social cost-benefit case can be established at this time. At European level the quantitative social cost-benefit case is only slightly better but the EC appear to give greater weight to qualitative factors such as the moral case for reducing road casualties, social equity (equal access to provision of public infrastructure) and benefits to foreign travellers. Thus, the EC remains committed to eCall whilst the UK government (and probably many other Member States) are not in a position to demonstrate a clear social cost-benefit case to support its introduction.

The European Commission has recently announced the intention to support pilot trials of eCall through the 7th Framework Programme. Proposals have been invited for submission by 1st June 2010.

5.14 Commitment from vehicle industry

Vehicle manufacturers are aware that the roll-out of eCall may be seen as providing a template for future services involving vehicle communications to infrastructure. They are therefore keen to establish a strong position in relation to the communications industry. The position of the vehicle industry is expressed through an ACEA position document (ACEA, 2009). Some key points, summarised from the ACEA position, which would place considerable constraints on other Stakeholders, are:

- Private eCall services should be allowed to run in parallel with Public eCall in every Member State

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• A positive business case for eCall is an important prerequisite but currently this does not exist
• An optional approach is preferred where eCall can be chosen from a list of customer options
• eCall could either be a stand-alone option, an interface, part of a safety package or offered in combination with other safety features
• Industry requires a three-year lead-time after all necessary specifications have been bindingly approved. Additionally, a one year test phase of the whole rescue chain is necessary
• To allow sufficient testing appropriate infrastructure must be made available at least 2 years prior to introduction of eCall in the following countries: U.K., France, Germany, Spain, Poland, BENELUX\(^8\) and Italy
• The wireless communication approach should remain unchanged/compliant at least for a life-time of a vehicle (15 years)
• Commitments from other key stakeholders like Member States, Public Authorities, Telecommunication companies and Insurance companies are still insufficient
• A staggered approach where Member States introduce the final infrastructure at different dates and partly with years in between is a non-feasible scenario for the industry.

ACEA conclude that the Automotive Industry is not yet able to commit to any concrete roll-out plan but will, meanwhile continue to introduce private emergency services based on customer demand and market needs.

5.15 Commitment from Mobile Network Operators

GSMA, the body representing the worldwide mobile communications industry signed the European eCall MoU in September 2009 (GSMA, 2009). According to their press release this formalises its members’ commitment to participate with other stakeholders in deploying the eCall service.

The European public eCall can be seen as a minimum service. The individual members within GSMA are likely to have a range of opinions about this eCall proposition in terms of their business, determined in part by existing and foreseen business relationships - i.e. some will benefit and some may not.

It is not yet clear how current regulatory and licensing arrangements (e.g. for handling 999 calls) affect the handling of eCalls by Mobile Network Operators.

The Mobile Network Operators will incur cost in deploying public eCall:
• As with other emergency calls, eCalls will have to be “free” at the point of use (as required by the Universal Services Directive)
• Mobile Network Operators will have to implement changes within their networks e.g. for carriage of the eCall flag
• There will be additional internal numbering and management requirements for the dormant SIMs
• They are unclear how eCall can be supported into the future when 2G and even 3G is to be replaced.

The Mobile Network Operators will need to build new hardware and software and test the new systems. The timetable the industry claim to need to upgrade systems in an optimal

\(^8\) i.e. Belgium, the Netherlands and Luxemburg
way is approximately 2 years (end of 2011). The cost per MNO is expected to be in the range of £10k - £100k.

Whether individual Mobile Network Operators will find benefits to offset these costs is unclear. Indeed, for some there could be loss of business from TPS eCall or other existing bundled services but many will aim to deepen relationships with vehicle OEMs and motoring service providers in the hope of increased mobile data traffic.

Concerning the in-vehicle communications equipment and SIMs, it is yet to be established if the cost model will be Pay up front, Annual fee or Pay per use. How eCall is implemented, possibly within a bundle of other services, and what commercial relationships will exist between the vehicle industry, mobile operators and third party service providers develops is yet to be determined. Hence, there is considerable uncertainty over establishment of a business case.

So, although industry-level commitment has been given, some individual MNO operating in the UK may be wary of the costs and impacts of eCall.

### 5.16 Summary of eCall issues

The following table summarises the key implementation issues. It includes an estimate of the remaining risk of the issue remaining unsolved (High/Medium/Low) and also the impact that the issue could have if it were not able to be solved (High/Medium/Low).

#### Table 8: Summary of eCall issues risk and impact

<table>
<thead>
<tr>
<th>Issue</th>
<th>Risk (HML)</th>
<th>Impact (HML)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy</td>
<td>L</td>
<td>M</td>
<td>Issues can be addressed by suitable design and Stakeholders do not see this as a barrier</td>
</tr>
<tr>
<td>Liability</td>
<td>M</td>
<td>L</td>
<td>Stakeholders are prepared to manage liability risks</td>
</tr>
<tr>
<td>Benefit &amp; Cost uncertainty</td>
<td>H</td>
<td>M</td>
<td>Uncertainty exists which constrains many MS from making PSAP investment. This constrains and delays investment from vehicle and mobile communications industries. B/C uncertainty can be reduced (in time) through research and trials</td>
</tr>
<tr>
<td>Standards</td>
<td>L</td>
<td>M</td>
<td>Any uncertainty or delay over standards will delay industry implementation (or will be used as a reason for delaying implementation)</td>
</tr>
<tr>
<td>Dormant SIM</td>
<td>L</td>
<td>L</td>
<td>Technical solution feasible but needs to be implemented</td>
</tr>
<tr>
<td>I-V Hardware Robustness</td>
<td>L</td>
<td>L</td>
<td>Hardware design and HMI design should be addressable issues by the vehicle industry (and are long-term issues)</td>
</tr>
<tr>
<td>Product end of life</td>
<td>L</td>
<td>L</td>
<td>It seems likely that the end of life issues can be successfully addressed</td>
</tr>
<tr>
<td>Communications and lifecycle</td>
<td>H</td>
<td>H</td>
<td>The vehicle industry demand 15 year support from communications technology but the MNO cannot provide this and suggest mid-life upgrades. A solution is yet to be found</td>
</tr>
<tr>
<td>eCall Flag</td>
<td>L</td>
<td>L</td>
<td>Technical solution feasible but needs to be implemented</td>
</tr>
<tr>
<td>Issue</td>
<td>Risk (HML)</td>
<td>Impact (HML)</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Licensing of in-band modem</td>
<td>L</td>
<td>M</td>
<td>Solution is OK for public eCall but licensing may impede future upgrades and services</td>
</tr>
<tr>
<td>VIN Decoder</td>
<td>M</td>
<td>L</td>
<td>Technical solution probably feasible but needs to be implemented. However, impact of deficiencies should be relatively minor</td>
</tr>
<tr>
<td>False alarms and multiple alarms</td>
<td>H</td>
<td>M</td>
<td>Both false alarms and multiple alarms are likely to increase. However, impact can probably be managed by the PSAP</td>
</tr>
<tr>
<td>UK PSAP operations</td>
<td>M</td>
<td>L</td>
<td>Some issues have to be resolved. This is likely to be achieved in pilots or initial implementations</td>
</tr>
<tr>
<td>MS/PSAP Commitment</td>
<td>H</td>
<td>H</td>
<td>Case for public investment not established so coherent European PSAP implementation unlikely without mandatory approach. However, there are also uncertainties about implementation of a European mandatory approach</td>
</tr>
<tr>
<td>Vehicle Industry Commitment</td>
<td>H</td>
<td>H</td>
<td>Waiting for standards completion and require coherent PSAP and sustainable MNO implementations. Want voluntary approach but, in reality, only regulatory one will produce public European eCall</td>
</tr>
<tr>
<td>MNO Commitment</td>
<td>M</td>
<td>H</td>
<td>Can support eCall implementation (on their own timetable) using 2G/3G but cannot provide 15 years support option</td>
</tr>
</tbody>
</table>
6 Conclusions and Recommendations

6.1 Conclusions

eCall is widely accepted as having potential to save lives and reduce injury outcomes, and recent research has also shown likely benefits in congestion reduction. However, more controversial are the costs, implementation steps and practicalities of realising these benefits.

The 2009 EC Impact Study identified costs and benefits of eCall at a European level and its quantitative analysis, based on clusters of European countries, showed somewhat lower Benefit/ Cost ratios than in previous studies. It was concluded that only mandatory introduction of eCall would achieve a Benefit/ Cost ratio greater than 1 by 2030. The work also included an in-depth UK study; this made different and more specific assumptions based on stakeholder interviews and concluded that achieving a Benefit/ Cost ratio greater than 1 by 2030 would be challenging. So whilst eCall may be beneficial in some countries (e.g. Finland), no clear social benefit case has been established for the UK or at European level. Beyond the quantitative analysis, the Impact Study has highlighted a number of potential qualitative benefits (and possible drawbacks). The EC continue to strongly support eCall.

Has the situation changed from that reported in the UK study in 2006? This report, particularly in Sections 4 and 5, has identified a number of developments. In particular, standardisation has advanced considerably and many technical aspects of implementation (in-band modem, eCall flags, dormant SIMs) have been resolved, such that better estimates of implementation costs can be made; these are substantially lower than previous estimates. In terms of benefits, less reliance is now being placed on older studies, and more recent work with relevant medical experts has somewhat downgraded the potential benefits. Quantitative data on benefits, particularly fatality reductions, remains a significant research gap but a methodology based on analysis of in-depth accident reports, piloted in the EC Impact Study, offers much potential. Overall, the impact situation remains unchanged from 2006: no clear social benefit case has been established for the UK.

As noted above, since 2006, many technical issues have been solved or have known solutions, such that technology in itself is not a barrier to implementation. The UK is well placed to implement eCall with PSAP costs being modest. Private services are already supported and the new standardised Public European eCall and TPS eCall could also be supported with minor developments. Based on recent discussions and a UK workshop, individual stakeholders in the UK appear clear regarding what would be required to implement eCall in the UK, although there are undoubtedly “edges” between the stakeholders that are unlikely to be fully resolved in advance of actual roll-out.

What are the barriers to implementation? In essence these have not changed since eCall was first developed as a concept: eCall implementation is dependent on joint action from a number of stakeholders. Public European eCall can only be realised if the vehicle industry, the communications industry (MNO) and the national infrastructure operators all play their part in the eCall “chain” and, since the vehicle and MNO industries are European in outlook, whether eCall is implemented in the UK is highly dependent on European developments. This is why the EC has a significant interest in eCall and has been trying to align and encourage the stakeholders through discussion platforms and a voluntary Memorandum of Understanding (whose status and implications in terms of commitment are open to multiple interpretations).

Despite signing the MoU, the business and commercial case for public eCall looks weak from the point of view of the vehicle industry and MNOs. The vehicle industry wants to see a substantial number of national PSAPs being eCall ready before it can invest in eCall hardware for vehicles. Also, the different market dynamics of the vehicle and mobile industries is problematic; the vehicle industry require a solution to work for 15 years,
whereas the communications industry will not undertake to maintain existing services which can develop through one or two generations in the 15+ year timescale of vehicle durability.

The third link in the chain requires readiness of the national infrastructures to deal with eCall. Here, Member States do not have a single view but (despite having signed the MoU) many national PSAPs have an insufficient business case or insufficient funds for investment to modernize and streamline for eCall readiness. Without widespread Member State action in readying their PSAPs, the vehicle manufacturers will not support roll-out of public eCall.

In the authors’ opinion, voluntary encouragement will not lead to rapid and widespread eCall deployment but to private services in a relatively small number of (high end) vehicles initially, and then a slow diffusion down the vehicle fleet. It is suspected that this judgement is also being made by the EC - the recent EC Impact Report supports this conclusion - and it has signalled a readiness to take actions to, effectively, mandate implementation. However, whether the EC has (or will shortly have) sufficient powers and whether Member States will have mechanisms for implementing any recommendations or regulatory measures is still a matter of debate.

In summary, the situation concerning eCall implementation is still unresolved.

6.2 Recommendations

- Signing the European eCall Memorandum of Understanding would be a symbolic and political action from the UK and no recommendation is made concerning this.

- Quantitative data on eCall benefits, particularly fatality reductions, remains a significant research gap but the methodology based on analysis of in-depth accident reports, piloted in the EC Impact Study, offers much potential. Ideally research should be undertaken in several Member States, so it is recommended that the DfT encourages the EC to take UK interests into account.

- As there is a high level of interest from UK stakeholders in eCall, it is recommended that a UK Steering Group or Implementation Platform be set up, both as a forum for information exchange and to facilitate any future implementations of public or private services. Such a group is likely to be beneficial whether European eCall is implemented on a voluntary or mandatory basis. It could serve both as a forum for information exchange and to facilitate any future implementations of both public or private services. Meetings about every six months are suggested.

- Participating in the European eCall Implementation Platform has a number of benefits. As well as first-hand information it provides a mechanism for informal discussions with a wide range of European stakeholders. It offers an opportunity to influence the EC and other stakeholders and it maintains the UK profile in the area. Therefore, it is recommended that this continues to be supported by providing a UK government delegate to each meeting.

- The European Platform has initiated a number of working groups on specific aspects of eCall. It is recommended that these groups be reviewed for relevance to UK interests and then appropriate mechanisms developed to ensure that UK interests are being taken into account. This may be through submissions to, or appropriate participation in, one or more groups.

- Irrespective of European development in public eCall, private services will increasingly need to interface through mobile networks to UK national PSAPs. To some extent, implementation issues will be addressed through the national platform and by bi-lateral discussions. However, there is also an opportunity, whether assisted by the EC or not, to undertake a pilot trial of eCall in the UK. TRL recommends that the UK should develop a UK pilot for eCall, for example through discussions with a UK Steering Group or Implementation Platform if this is
established. A pilot trial would assess the effectiveness of end-to-end system technology and highlight implementation issues. Trials would help UK stakeholders to understand any practical difficulties and unforeseen costs that might occur should the Commission succeed in seeking mandatory deployment across the EU, but would not provide substantial new evidence on the safety benefits of eCall.
7 Acknowledgements
The work described in this report was carried out in the Transportation Division of the Transport Research Laboratory. The authors are grateful to Richard Walker who carried out the technical review and auditing of this report.
8 References


9 Glossary of terms and abbreviations

2G, 3G, 4G   Various generations of cellular radio communication systems

3GPP   Organisation responsible for cellular communication standards

ACEA   European vehicle constructors’ organisation

Article 29   Article 29 of Directive 95/46/EC ‘on the protection of individuals with regard to the processing of personal data and on the free movement of such data’. Article 29 concerns safeguards to protect individuals where personal data is processed

CEN   Comité Européen de Normalisation: European Committee for Standardisation

Dormant SIM   A microchip – Subscriber Identity Module – providing the Mobile Network Operator with the identity of the eCall unit. The SIM has no connection with the mobile network until eCall is activated

EC   European Commission

eCall   An in-vehicle safety device which manually or automatically generates a call in the event of an accident, establishing a voice link to the emergency services and transmitting data that specifies the vehicle’s details and location

eCall flag   The identifier within the eCall message which enables it to be given priority in processing even when the load on the phone network is high

GSMA   GSM Association: the body representing the worldwide mobile communications industry

HMI   Human Machine Interface

In-band modem   Method for communicating the eCall data in which a burst of digital data is encoded on a voice communications channel

ISO   International Standards Organisation

MNO   Mobile Network Operator

MSD   Minimum Set of Data – data in the eCall message which is required to transmit information about the eCall vehicle and its location

OEM   Original Equipment Manufacturer

PSAP   Public Safety Answering Point

SIM   Subscriber Identity Module – microchip in a mobile phone or other device connected to mobile network operator which identifies the device on the cellular mobile network

UNECE   United Nations Economic Commission for Europe: the body that oversees vehicle regulations in Europe

VIN   Vehicle Identification Number: a unique serial number used by the automotive industry to identify individual motor vehicles

VIN decoder   A piece of software commissioned by the EC that inputs the Vehicle Identification Number and, using a database, produces as much information on the vehicle as is available from the VIN number

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Defining the severity of road casualties in the UK

**Fatal**   A ‘fatal’ road accident injury is one that causes death within 30 days of the accident; suicides are not included.
| Serious | A ‘serious’ injury is one for which a person is detained in hospital as an in-patient, or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, “crushings”, burns (excluding friction burns), severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident. |
| Slight | A ‘slight’ injury is defined as being of a minor character such as a sprain (including neck whiplash injury), bruise or cut which are not judged to be severe, or slight shock requiring roadside attention. This definition includes injuries not requiring medical treatment. |

An injured casualty is recorded as seriously or slightly injured by the police on the basis of information available within a short time of the accident. This generally will not reflect the results of a medical examination, but may be influenced according to whether the casualty is hospitalised or not.

Note that definitions of fatal, serious and slight injuries are not identical across Europe. For example in a fatality is defined if death occurs within 6 days of a road accident in France, 7 days in Italy and 24 hours in Greece and Portugal. For further details see the EU road accident database - CARE:

Appendix A  

Approach used to assess benefits in UK Study

A.1 Timing of emergency response

eCall is expected to improve the timing of emergency response as a result of both the reduction in time between an accident occurring and a call to the emergency services being made, and the improved accuracy of location information contained within the eCall message (compared with the location information available by other means such as the description given by the caller reporting the accident or the cell ID for the message if a call is made using a mobile phone).

Data on the timeline of the emergency service chain responding to road accidents is not routinely collected so the study relied on expert judgement. The assumptions made in the UK 2006 study were presented to representatives from the police, ambulance service, the Highways Agency and a PSAP1. These individuals were asked to consider whether a 10 minute improvement was in their view a reasonable assumption. Experience of the response times in the case of current private eCall services was also available.

A.2 Safety

The safety benefits of eCall are expected to arise where a more rapid and in some cases more targeted response by the emergency services means that some people who would previously have died as a result of their injuries would be saved while others may have less severe injuries. This study focused on assessing the potential for reducing fatalities.

The UK 2006 study identified types of accident in which eCall was expected to have ‘high’, ‘medium’ and ‘low’ probability of improving the outcome. Using detailed records of fatal accidents held at TRL which are linked with the Stats19 accident database for Great Britain, three groups of cases were defined, one each from a ‘high’, ‘medium’ and ‘low’ impact group:

- single vehicle accidents in the dark on non-built up roads (high)
- single vehicle accidents in daylight on non-built up roads (medium)
- single vehicle accidents in the dark on motorways (low).

Together these three types of accident comprise a quarter of all vehicle user fatalities in Great Britain. A sample of 10 recent cases was extracted for each of these three groups. The sample excluded accidents involving HGVs on the basis that the injuries in such cases are generally severe and improving incident response times would in general be unlikely to affect the outcome, but was in other respects a random sample within each group. The sample included motorcyclists, on the basis that it is anticipated that motorcycles would be equipped with eCall devices in the future.

Using the statements from witnesses, emergency services, medical reports and post mortems, the timeline and chain of events were analysed. For 27 out of the 30 cases, there was enough information to identify the timing of the emergency response and a description of the injuries; for these a detailed review was carried out on a case by case basis by a doctor specialising in emergency response in a helicopter ambulance service. In each case, an assessment was made of how much saving in response time would have been necessary in order to save the lives of those who died in these accidents.

The sample of cases extracted was clearly not representative of all fatal accidents in the UK. It was designed to provide a cross section of cases with different levels of potential eCall safety benefit, while at the same time maximising the chances of an expert being able to assess potential for improving the outcome, namely the proportion of fatalities that might be prevented as a result of improving emergency response times.
A further objective of the study was to establish whether this approach would be suitable for a larger scale investigation if resources became available for a more robust study. The analysis served to demonstrate that it is possible to use in-depth investigations of this nature to build up a picture of the timing and nature of the emergency response, and to assess the extent to which a shorter response time could have resulted in a different outcome.

A.3 Traffic impacts

The traffic impacts of eCall are expected to be seen where a more rapid response by the emergency services and incident handling teams improves the time taken to clear up accidents, thus reducing delays to vehicles on the road network.

The UK 2006 study assumed that most of the benefits would be on roads with light traffic so savings in response times as a result of reduced congestion were not included in the assessment.

During 2009, TRL carried out an assessment of the implications of eCall for the Highways Agency (HA), including an analysis of the traffic impacts on motorways and other major routes for which the HA is responsible, which together carry over 33% of the traffic in England. The results of this analysis were used in the EC study to estimate traffic impacts for the whole of the UK.

The approach adopted was to use data from the HA's detailed traffic information system as input to the Incident Cost-Benefit Analysis (INCA) model, a software tool owned by DfT which is designed for analysing the impact of schemes affecting the duration of incidents on motorways and inter-urban dual carriageways. INCA was run for all links on the HA network, calculating monetary savings arising from time saved when incident durations are reduced, using standard values of time. These provided data which were fed into the Cost-Benefit Analysis. The modelling focused on two types of incident relevant to eCall: single lane accidents and multi-lane accidents.

As INCA is not designed for assessing impacts on single carriageways, the benefits on these links had to be estimated. This was done by treating single carriageways as being equivalent to one carriageway of a dual carriageway. This was expected to result in a slight underestimation of delay (because the modelled traffic is not held up by traffic coming in the opposite direction on the same carriageway) and an underestimate of the benefits, but was the considered to be the most efficient and robust method available within the scope of the project.

The benefits calculated using INCA are based on all accidents triggering an eCall. In reality the take up of the technology will be gradual. This was modelled by using the predicted uptake of eCall; a simple model of the eCall equipped fleet was developed based on past data on vehicle scrappage rates, the rate of increase in the number of licensed vehicles and a range of options for market penetration:

a. Aftermarket only: Only as a high-end option fitted to 3% additional vehicles per year from 2010

b. New vehicle fit: All new type approved vehicles from 2014 and all new vehicles from 2017 (assuming random introduction of new types and each type having a 5 year duration)

c. New and Aftermarket: Option (b) + the 3% aftermarket additional to existing fleet.

To provide a proxy for the probability of vehicles involved in an accident being equipped with eCall, it was assumed that the proportion of accidents triggering an eCall can be related to the proportion of vehicles equipped with eCall, with the average number of vehicles involved in accidents recorded in Stats19 as one of the factors in the model.
The INCA modelling produced two matrices (one for single carriageways and dual carriageways), showing the saving in the value of journey time following from faster response to incidents under a range of improvements in response times. The figures were then used to infer the values for the whole of the UK based on the relative difference in accident rates per km on HA and non-HA roads and the length of the HA and non-HA network. Linear regression was used to obtain benefits for discrete one minute savings for the aggregate benefit, combining single and dual carriageway roads.
### Appendix B eCall Standardisation

The following list summarises the eCall standards and their current status (January 2010).

<table>
<thead>
<tr>
<th>Standard</th>
<th>Lead</th>
<th>Reference numbers</th>
<th>Status</th>
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<tr>
<td>eCall requirements for data transmission</td>
<td>ETSI/3GPP</td>
<td>3GPP TS 22.101</td>
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<td>ETSI TS 122 101</td>
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<td>eCall Discriminator Table 10.5.135</td>
<td>ETSI/3GPP</td>
<td>3GPP TS 24.008</td>
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<td>ETSI TS 124 008</td>
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<td>eCall Data Transfer – General Description</td>
<td>ETSI/3GPP</td>
<td>3GPP TS 26.267</td>
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<td></td>
<td></td>
<td>ETSI TS 126 267</td>
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<tr>
<td>eCall Data Transfer - ANSI-C Reference Code</td>
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<td>ETSI TS 126 268</td>
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<td>ETSI TS 126 269</td>
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<td>eCall Data Transfer - Characterisation Report</td>
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<td>3GPP TS 26.969</td>
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<td>ETSI TS 126 969</td>
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<tr>
<td>eCall minimum set of data</td>
<td>CEN</td>
<td>CEN TS 15722</td>
<td>Adopted as Technical Specifications. Being balloted as full standard</td>
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<tr>
<td>Pan-European eCall operating requirements</td>
<td>CEN</td>
<td>CEN WI 00278220</td>
<td>Adopted as draft. Being balloted as full standard</td>
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<td>- Draft EN 090316</td>
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<tr>
<td>High Level Application Protocols</td>
<td>CEN</td>
<td>CEN WI 00278243</td>
<td>Finalised. Sent for Committee Comments and subsequently for ballot</td>
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Appendix C  Key EC Policy Documents

Five key policy documents have been issued by the EC; these are listed in chronological order:


These are summarised briefly below.


European Road Safety Action Programme

In 2003 the EC stated that it intended to issue guidelines on implementing the requirement for telephone network operators to provide emergency services with information making it possible to locate the position of emergency calls using 112, the common emergency call number.

Memorandum of Understanding (MoU)

The European Commission published the ‘Memorandum of Understanding for Realisation of Interoperable In-Vehicle eCall’ (MoU) in August 2004. Since then, the Commission has been working with Member States, telecoms operators, vehicle manufacturers, service providers and other stakeholders encouraging them to sign up to the MoU, which commits them to working towards eCall deployment. The list of countries within the EU and other organisations which have signed is available from the eSafety web site at: http://www.esafetysupport.org/en/ecall_toolbox/memorandum_of_understanding_mou/

‘Bringing eCall to the Citizens’

In September 2005 the European Commission issued a Communication on eCall: ‘Bringing eCall to the Citizens’. This urged governments to act and to invest in the necessary emergency services to support eCall, with the view to a pan-European launch in 2009. Governments were also encouraged to promote eCall at national and international level. In addition, the Commission stated that it is promoting the use of 112 and is urging Member States to improve their responses to 112 emergency calls.

The actions for Member States:

- Sign the eCall MoU, thereby helping to encourage commitment from industry
- Promote 112 and E112 (the single European emergency number and the location-enhanced version), which are currently used in parallel with national numbers in most Member States
- Upgrade PSAPs to handle location-enhanced E112 calls and eCalls
- Provide adequate location-enhanced emergency services and language support.

In April 2006, and in response to this Communication, the European Parliament adopted a resolution on eCall which supported the implementation of pan-European eCall and the
Commission’s actions, and called for all stakeholders to pursue the actions needed for roll-out of eCall.

Bringing eCall back on track – Action Plan (3rd eSafety Communication)’

In November 2006, the European Commission issued another Communication: ‘Bringing eCall back on track – Action Plan (3rd eSafety Communication)’. This recognises that with the long lead times in product development and slow progress in eCall infrastructure implementation in Member States, the original target date for eCall implementation would not be realised. It sets out a new Action Plan for achieving eCall as a standard option in all vehicles in Europe receiving type approval from 1st September 2010. The Communication lists actions for Member States and industry aimed at eCall deployment by 2010. The actions for Member States are similar to those listed in the second Communication but with more specific actions:

- rolling out PSAP infrastructure by mid-2009
- carrying out field tests
- supporting the EC Expert Group on Emergency Access
- supporting the EC Working Party on Data Protection and Privacy Issues.

Among the European Commission’s actions to facilitate eCall deployment are: support through the 7th Framework Programme for large scale field operational tests of eCall to assess the impacts and user acceptance of the service, and support for industry in developing a positive business case for eCall.

‘eCall: Time for Deployment’

In August 2009 the European Commission’s Communication: ‘eCall: Time for Deployment’ noted the progress with eCall which had taken place but described it as having been “too slow”, with the roll-out of a pan-European service described as being “severely delayed”. The Commission described three possible policy options that were being considered:

1. not intervening and leaving the introduction to market forces
2. supporting voluntary introduction by industry or
3. mandating introduction through regulatory measures.

The Commission proposed measures to accelerate the introduction of eCall and stated that if the voluntary approach had not resulted in “significant progress” by the end of 2009, then during 2010 the Commission would consider introducing new regulatory measures for making the eCall system standard in newly type-approved vehicles in Europe.
UK eCall impact assessment

eCall is an in-vehicle safety device which manually or automatically generates a call in the event of an accident, establishing a voice link to the emergency services and transmitting data that specifies the vehicle’s details and location. This has the potential to reduce the response time of emergency services, which may in turn reduce casualties and reduce disruption to other traffic.

This study is intended to support the evidence base that will feed into policy development in the UK. Evidence is available from a UK study in 2006, work for the Highways Agency on the implications of eCall for their operations, and a European study on the potential impact of eCall which was completed for the European Commission in 2009 and included a UK case study.

These studies provide information on the status of the eCall service chain, institutional issues associated with implementation and assessments of the costs and benefits under a range of scenarios which represent different potential options for the roll-out of eCall and the timescales over which the ‘fleet’ of vehicles on the roads would be equipped with eCall devices.

This report reviews the evidence, summarises the current status of eCall implementation in the UK and the costs and benefits for the UK, and discusses implementation issues and risks and the implications of the various European policy options. On the basis of the conclusions drawn from this analysis, a series of recommendations are made for further eCall activities in the UK.

Other titles from this subject area

PPR091 Guidelines for safe and effective vehicle routing. S Thompson, A Stevens, A Maxwell and K Wood. 2006


PPR175 A Code of Practice for developing advance driver assistance systems: Final report on work in the RESPONSE 3 project. S Cotter, J Hopkin and K Wood. 2007


PPR259 Occlusion Protocol. T Horberry, A Stevens, S Cotter, R Robbins et al. 2007