eCall UK 2013 Review and Appraisal

Final Report

Department for Transport

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ATKINS

Plan Design Enable

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Executive Summary

The European Commission (EC) has proposed the introduction of the pan-European in-vehicle emergency call service (eCall) based on 112 and on common pan-European standards (starting with certain categories of vehicles). It is proposed as a priority action to mitigate the consequences of road accidents, the EC's justification being that there has been a significant market failure in the provision of eCall, and only the implementation of regulatory measures can result in an effective solution.

The EC produced an Impact Assessment (IA) in 2011 with the aim of finding the most appropriate option for the implementation of eCall. Three options were compared:

- **Option 1: No EU action**, which assumes no action is undertaken by the EU Member States, thus leaving the initiative to the market. This is the baseline, 'Do nothing' scenario.
- **Option 2: Voluntary Approach**, which consists of supporting the development of common European standards, conducting eCall awareness campaigns and waiting for the Member States and relevant stakeholders to implement eCall voluntarily, relying on the eCall Memorandum of Understanding (MoU) and the common specifications to be approved within the Directive 2010/40/EU.
- **Option 3: Regulatory Measures**, which would require eCall to be fitted as standard factory equipment in all new vehicles in Europe, starting with certain categories, as well as setting up the framework for handling eCall in the telecommunication networks and Public Service Answering Points (PSAPs).

The EC found that the benefit-cost ratio (BCR) for Option 3 being taken forward on all cars and vans across the whole of the European Union (EU) would be 1.74. This is a relatively low return on investment and we have identified some aspects of the economic appraisal method applied by the EC's 2011 IA which suggest that the BCR calculated using best practice methods could be even lower.

The EC's 2011 IA assessed 'clusters' of countries with different predicted benefits and acknowledged that the benefits in some countries would be higher than others. This means some countries, including the UK, are likely to suffer a net loss as a result of implementing eCall.

This study has reviewed the assumptions made by the EC's 2011 IA and gathered new evidence based on data analysis and discussions with stakeholders. The economic appraisal of eCall in the UK has been updated. The conclusions are:

- The key benefit will be due to casualty severity reduction but this will be lower in the UK than elsewhere due to a good national road safety and emergency response infrastructure.
- Incident-related congestion savings will be very low, mainly because if there are sufficient vehicles for congestion to result from a collision, there will be minimal delay in reporting it so the benefit of eCall will be very low.
- In-vehicle system (IVS) costs will make up the vast majority of quantified costs and will be borne by vehicle buyers.
- For both the voluntary approach and regulatory measures, using the assumptions documented in this report, the costs far outweigh the benefits with BCRs of 0.11 and 0.16 for Options 2 and 3 respectively for the UK.
- The BCR values for the UK are lower than the 1.74 predicted by the 2011 EC IA due to a combination of factors: the lower benefits expected in the UK compared to elsewhere mean that the BCR for the UK will be lower than that for the whole of the EU; our analysis has led us to believe that the UK casualty severity and congestion savings are likely to be lower than those assumed by the EC; and a more rigorous appraisal methodology has been used (WebTAG[1]).
- A sensitivity test in which casualty severity savings were approximately doubled and congestion savings were added still only provided a very low Option 3 BCR of 0.44.
- A further sensitivity test using the EC's 2011 IA assumptions of UK casualty severity and congestion reductions in the WebTAG-compliant model resulted in an Option 3 BCR of 0.52 which is still much lower than the EC's estimate for the whole of the EU. This is likely to be only partly due to the UK benefits being lower than elsewhere and at least partly due to the more rigorous appraisal method.

In summary, while eCall might be beneficial in some countries, no clear business case has been established at a UK or a European level.

[1] WebTAG is the DfT's appraisal guidance, https://www.gov.uk/transport-analysis-guidance-webtag

1. Introduction

1.1. Background and Purpose of this Report

eCall is an in-vehicle safety system which automatically generates a call in the event of an accident, establishing a voice link to the emergency services and transmitting data relating to the vehicle's location. It also has a button allowing the occupant to make a manual call. The introduction of eCall has been developed and promoted at a European level to provide safety benefits; it is viewed as a measure that offers the potential of saving lives and reducing injury outcomes.

This report is intended to provide an evidence base to inform the Department for Transport of the expected costs and benefits of introducing eCall within the UK, from both a voluntary and mandatory perspective, and any other key issues for consideration. It builds on previous studies undertaken and reflects updated evidence that the study team has identified through research and from consultations with various stakeholders.

Two key EC documents are particularly relevant to this study:

- 2011 'European Commission Impact Assessment' [1], hereafter referred to as 2011 EC IA;
- 2009 'Impact assessment on the introduction of the eCall service in all new type-approved vehicles in Europe, including liability / legal issues' [2], (hereafter referred to as 2009 EC Study); this was produced by a TRL-led consortium commissioned by the EC to perform a detailed assessment including four in-depth country studies for Finland, United Kingdom, Netherlands and Hungary, and was used by the 2011 EC IA when making its own assumptions.

TRL summarised the key results relevant to the UK from the 2009 EC Study in the 'UK eCall Impact Assessment' [3], (hereafter referred to as the 2010 UK IA) although this did not include an economic appraisal for the UK.

Prior to this, in 2006 the DfT commissioned Secured By Design (SBD) to produce 'eCall – The Case for Deployment in the UK Final Report' [4], (hereafter referred to as the 2006 UK Study); this included an economic appraisal and discussion of implementation issues.

All of the above reports have been reviewed as part of this study, in particular the 2011 EC IA and 2009 EC Study. New evidence has been reviewed and data analysis performed, and consultations have been held with representatives from the various stakeholder groups including:

- automotive industry – original equipment manufacturers (OEMs) via the Society of Motor Manufacturers and Traders (SMMT);
- eCall experts Andy Rooke from ERTICO and Andy Graham from White Willow Consulting;
- emergency services – fire and ambulance and also BT who run most of the PSAP services in the UK. (NB representatives for the police were not available in timescales.)

Based on all the information collated, an economic appraisal for voluntary and mandatory eCall in the UK has been performed in accordance with the DfT WebTAG [5] guidance which applies the principles of the Treasury Green Book [6] for appraisal of all UK transport projects. This report contains:

- **Overview of 2011 EC IA:** Provides an overview of the Impact Assessment, including objectives, policy definitions and summary of the economic appraisal methodology and results (Section 2).
- **Review of Evidence:** Provides a review of the assumptions used in the 2011 EC IA and also in the 2009 EC Study. Also reviews other recent evidence available from sources including discussions with stakeholders and review of relevant literature (Penetration Rate, Costs and Benefits are reviewed in Sections 3, 4 and 5 respectively).
- **UK Economic Appraisal:** Provides a description of the assumptions and methodology used and key results of an economic appraisal which has been performed as part of this project (Section 6).
- **Conclusions:** (Section 7).
- **References:** (Section 8).

1.2. Appraisal Methods

The quality of the economic appraisal is of critical importance to this project so the following methods were used to ensure a rigorous and robust assessment was performed:

- staff experienced in economic appraisal methods were used;
- guidance from DfT WebTAG and Treasury Green Book for economic appraisal of schemes was followed;
- a tried and tested calculation spreadsheet was used;
- automatic validation was included wherever possible in our calculations, allowing cross-referencing of outputs calculated using different methods;
- a standard Atkins template was used for spreadsheet analysis with version control and colour-coding to make clear which cells should be modified;
- sensitivity testing was performed to check the impact of key areas of uncertainty, most importantly the benefits of eCall for which there is limited concrete evidence;
- all calculations were subjected to two independent checks by competent individuals;
- a thorough review of the evidence was performed, experts used in key areas and thorough checking and review by the project team;
- independent reviewers were employed to challenge the assumptions made by the team (internal reviewer Tamsin MacMillan and external peer reviewer Professor Neil Hoose).

2. Overview of 2011 EC IA

2.1. Background

Road safety is one of the major policy subjects within the transport policy of the European Union (EU). The EU is highly committed to reducing the number of road accidents and mitigating consequences when they occur. The 2011 EC IA aimed to find the most appropriate option for the implementation of the pan-European in-vehicle emergency call (eCall). The Commission has proposed, as a priority action to mitigate the consequences of road accidents, the introduction in all vehicles in Europe of eCall service based on 112 and on common pan-European standards (starting with certain categories of vehicles). The aim is to promote an affordable service which could work seamlessly and in an interoperable way across Europe, thus maximising its benefits.

The harmonised implementation of an interoperable EU-wide eCall service has been promoted by the European Commission since 2005. A number of studies have been conducted, and eCall has now become a priority action for the improvement of road safety and the development of Intelligent Transport Systems (ITS) in Europe.

2.2. Objectives

In line with the European Road Safety Action Programme, the initiative aims at reducing the number of road fatalities across the EU and the severity of injuries caused by road accidents. Specific objectives of the 2011 EC IA were:

- Improvement in the operation of the emergency services at the accident scene due to the information received; (getting more rapid medical treatment to improve casualty outcomes);
- Improvement of incident / road management and therefore:
  - Reduction of secondary accidents;
  - Reduction of congestion and subsequent pollution from road transport;
- Contribution to the deployment of Intelligent Transport Systems (ITS) services and applications applied to road transport, namely in-vehicle systems telematics applications and services, which could share the common technical resources with eCall.

2.3. Policy Options

The 2011 EC IA considered, assessed and compared three policy options:

2.3.1. Option 1: No EU action

Option 1 assumes no action is undertaken by the EU Member States, thus leaving the initiative to the market.

2.3.2. Option 2: Voluntary approach

Option 2 consists of supporting the development of common European standards, conducting eCall awareness campaigns and waiting for the Member States and relevant stakeholders to implement eCall voluntarily, relying on the eCall Memorandum of Understanding (MoU) and the common specifications to be approved within the Directive 2010/40/EU.

2.3.3. Option 3: Regulatory Measures

Option 3, a regulatory approach, would require eCall to be fitted as standard factory equipment in all new types of vehicles in Europe, starting with certain categories (cars and vans), as well as setting up the framework for handling eCalls in the telecommunication networks and emergency call handling centres, known as Public Safety Answering Points (PSAPs).

2.4. Economic Appraisal

To calculate the benefit-cost ratio (BCR), the 2011 EC Impact Assessment used a clustering methodology to group countries reflecting their road networks and emergency response infrastructure. Six clusters were

defined based on the density of the population of the country, accident typologies and road and emergency response infrastructure.

The UK was contained within Cluster 2 along with The Netherlands. The countries within Cluster 2 were identified as having high density of population, developed and centralised emergency call response systems and developed incident management. The clustering technique was used to extrapolate percentages of elements when they were not available in relevant studies.

The BCR analysis used the monetised factors associated with saving lives, preventing injuries and costs associated with the introduction of the eCall service. The analysis considered the outcomes of several studies that have analysed the costs and benefits of eCall in Europe, including the 2009 EC Study. A number of non-quantified costs and benefits were also discussed which could not be quantified with a valid estimation due to a lack of data or an inappropriate effort being required.

Table 2-1 shows the BCR results from the 2011 EC IA, assuming EU-wide coverage for all cars and vans, an Option 3 start date of 2015 and an appraisal period to 2033 (which is the year full penetration of eCall is expected to occur in Option 3). This leads to the preferred option being Policy Option 3, Regulatory Measures, shown as the most effective and efficient for the implementation of eCall in the EU.

Table 2-1 Accumulated BCR Results of the 2011 EC Impact Assessment

Accumulated BCR	Policy Option 1 No EU Action	Policy Option 2 Voluntary Approach	Policy Option 3 Regulatory Measures
2015 to 2033	0.29	0.68	1.74

The resultant Option 3 BCR of 1.74 compares with a BCR of 1.31 from the earlier 2009 EC Study, mainly due to higher benefits being assumed. The main reason for the Option 3 BCR being higher than Options 1 and 2 is that the in-vehicle system (IVS) costs are assumed to be significantly lower as a result of efficiencies due to far greater production volumes. Thus the assumptions about relative IVS costs of the three options are critical and any inaccuracy would have a high impact on the appraisal outcomes.

The 1.74 BCR is considered not to be representative of the impact of eCall in the UK as the highest benefits are obtained by the clusters which gain the most from the services provided by eCall e.g. those countries with limited or no traffic management techniques including use of ITS and limited road and emergency services infrastructure.

The 2011 EC IA acknowledges that achieving a BCR greater than 1 for the UK (and similar countries) may be particularly challenging, with low incident rates and high investment in traffic management technologies (Regional Control Centres, Close Circuit Television systems (CCTV), detection technology, etc). However when reviewing the 2011 EC IA's methodology and calculations, some aspects have been identified which suggest that the overall BCR for the EU might be lower than suggested in Table 2-1:

- It appears that the incremental costs of Option 3 over and above Option 1 have been used, but the absolute (total) values of benefits; a comparison of costs and benefits should either use incremental values of both, or (preferably) absolute values of both.
- It appears that prices have been used when calculating or discussing assumptions; for example for Option 1 IVS costs and Option 2&3 telecommunications costs. Costs should be used in economic appraisal because profit and tax are considered to be 'economic transfers'.
- It appears that casualty reduction and congestion savings have been applied to all EU vehicles, whereas the in-vehicle system costs have been assumed to apply only to cars and vans which are involved in approximately half of the collisions.
- It appears that the benefits have been cut off at 2033 although in-vehicle system costs in that year, and other years leading up to the cut-off point, would provide benefits for the remainder of their lifetime.
- It appears that the IVS replacement costs (for vehicles reaching the end of their life) have not been considered, and the benefits of each IVS were assumed to last indefinitely.

The IA report does not provide full visibility of the assumptions and methodology used, so it is not possible to be sure that the above items are correctly identified. The use of WebTAG compliant appraisal methods for this report will avoid these issues and thus provide a more robust result.

3. Review of Evidence for eCall Market Penetration Rate

3.1. Introduction

The rate at which IVS providing eCall are taken up in each of the three options has a significant impact on both costs and benefits. It does not substantially affect the BCR because of the very low capital costs and the fact that both costs and benefits are directly proportional to the number of equipped vehicles. So a doubling of IVS would double both costs and benefits, meaning the ratio remains the same. The assumptions from the 2011 EC IA and the UK values within the 2009 EC Study are presented in Sections 3.2 and 3.3. These assumptions as well as new evidence are discussed in Section 3.4.

3.2. 2011 EC Impact Assessment: Assumptions and Estimates

Table 3-1 shows the assumptions used for market penetration rates for private eCall in the 2011 EC IA. Annual percentage increases of vehicles are provided, for an initial period of 6 years and then the subsequent years. No real information is provided about how these percentage increases have been derived.

Table 3-1 2011 EC IA - Market Penetration Rate Estimates for Each Scenario

IVS Type	Initial Equipped Vehicles for Whole EU	Annual Increase of Vehicles Equipped with eCall	
		Initial Period Years 1-6 (%)	Second Period from Year 7 (%)
Private eCall (Options 1, 2 and 3)	Existing in 2008: 600,000 New in 2009: 120,000	11	18
Pan-EU eCall (Option 2)	New in 2015: 300,000	18	25
Pan-EU eCall (Option 3)	Matches new type approvals from 2015		

It is assumed that private eCall penetration rates continue at the same levels for all options. For Option 3, it is assumed that pan-EU eCall penetration rates match new type approvals introduction from 2015 onwards.

3.3. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study used the following assumptions, again with no real information about how the private eCall penetration rates were obtained:

- Private eCall: Only as high-end options fitted to 3% additional per year from 2010
- Pan-EU eCall: 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)
- Pan-EU plus aftermarket: Option (b) + 3% aftermarket additional to existing fleet

3.4. Discussion of Assumptions

OEM Private eCall

Generally, consumers have not been inclined to pay extra for additional safety devices on a new vehicle beyond what is already included as a standard fitment. However, it is likely that take up will increase if the eCall system is included within a package of standard options, for example, a premium infotainment system. Therefore although it is not possible to predict what the optional take-up of eCall will be over a period of time, it can be assumed that the rate will increase as levels of technology filter down through the market offering.

It should be noted that where eCall has already been included as an option on a new vehicle, currently 3% of all premium vehicles, it falls to a level of 0.3% after three years when service charges or subscriptions are applied [*A Rooke, personal comment*]. This reflects the consumers' lack of desire to pay for additional safety systems and the fact the vehicle is likely to have passed to its second owner by this point.

The 2011 EC IA assumes that private eCall penetration rates remain the same even with Option 3 regulatory measures. It might be expected that OEMs would stop promoting private eCall once pan-EU eCall is implemented. However the potential increase in nomadic devices might continue to cause additional aftermarket penetration, so this assumption is considered appropriate.

Mandatory Pan European eCall

The mandatory inclusion of eCall in new cars and light vans will initially be only on models which require a completely new type approval. It should be noted that many new models do not require type approval as they are simply an evolution of existing models; for example a current model may still use the type approval from the original model with some extensions to cover upgrades. Therefore, it is clear that the period of time that it will take for all models to require new type approvals cannot be known, as it is a function of vehicle manufacturers existing and new model programmes and is commercially sensitive. There is a small chance that some manufacturers may delay the introduction of new models to avoid the mandate to install eCall. However, following an introductory period it is possible that the mandate will increase to cover all newly registered cars and light vans.

Nomadic eCall

Nomadic eCall is any system which can be used in any vehicle. This could be a device purchased simply to perform the eCall function, a mobile phone application or part of a 'black box' provided by an insurance company to monitor driving time, mileage and style. Given the infancy of all of these nomadic devices, the advances in technology and lack of information about the future requirements of insurance companies to carry 'black box' devices or what functionality they would include, it is not possible to establish a robust estimate of the likely future take up of nomadic systems and therefore any potential impact on Option 1 and 2 penetration rates.

Summary

It is very difficult to predict market penetration rates for Options 1 and 2 due to the problems of predicting driver choices and future developments which might affect them. Because the costs and benefits of eCall both increase approximately in proportion with the number of units, obtaining precise values is not critical to the appraisal. Therefore this study will use the 2011 EC IA's predictions for market penetration rather than try to identify new values.

4. Review of Evidence for eCall Costs

4.1. Introduction

This section summarises the cost assumptions and estimates presented in the 2011 EC IA and the UK values within the 2009 EC Study. Each of the identified cost assumptions and estimates have been reviewed and additional information and evidence highlighted.

Where this study has identified that UK costs are likely to be different to those predicted in the 2011 EC IA, the reasons are discussed in this section. The descriptions of cost assumptions used in the economic appraisal for this study are contained in Section 6.5.

Note that the cost assumptions from the two EC IAs are presented in euros but some of the information provided by stakeholders and presented in the discussion sections is provided in UK pounds.

4.2. In-Vehicle System Cost

4.2.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA provided equipment cost estimates for the IVS which includes the telematics unit and the communications (aerial and SIM card). The 2011 EC IA €800 Option 1 equipment cost was determined by assessing the cost of various OEM private eCall systems that were available on a number of vehicles supplied new by vehicle manufacturers. The private eCall option costs ranged between €290 and €1580 but it is not clear how the €800 initial cost was determined.

The equipment cost was assumed to reach maturity after a 6 year period meaning that the €800 initial cost is expected to reduce to €600 taking into account scale of introduction and telecommunication equipment improvements.

Table 4-1 2011 EC IA - IVS Cost Estimates

Option	Initial Period (€)	Second Period (€)	Comments
Option 1 No EU Action	€800	€600	Based on various costs, mainly automotive manufacturers' private emergency call systems bundled with other services.
Option 2 Voluntary Approach	€450	€350	Based on the estimates provided by different studies.
Option 3 Regulatory Measures	€180	€125	Estimated in the EC Impact Assessment to be a safe, conservative figure based on various assumptions, multiplication factor of 3.0 and taking into account the costs and the advantages of economy of scale.

Note: Initial period duration (until reaching maturity) for all scenarios: 6 years

4.2.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study presented the following cost estimates following discussions and estimates provided by stakeholders:

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

The study also recognised a number of factors including, a reduction of cost over time with costs generally being four times greater when first envisaged than when deployed, costs will be lower if eCall is implemented

voluntarily than mandatorily as manufacturers are able to manage costs to their best advantage and bundling eCall with other services could also reduce costs.

4.2.3. Discussion of Assumptions

The assumptions made in the previous studies have been reviewed and discussed with motor manufacturer representatives from the SMMT including Jaguar-Land Rover and General Motors / Vauxhall.

Private eCall

When estimating the IVS cost of private eCall, the EC IA quoted market prices, the cost to a consumer, as opposed to the manufacturers' costs for supplying the system. For an economic appraisal, the manufacturers' net costs should be used (as profits and taxes are economic transfers). The manufacturers' costs for private eCall are expected to be closer to the values predicted in the 2009 EC Study, for the following reasons:

- The lowest market price quoted by the EC IA was €290 which was for a standalone eCall system, suggesting that the cost of that system to the OEM should be less than €290. The much higher market prices are likely to be for integrated systems with additional functionality, rather than just for eCall costs to manufacturer.
- Private eCall is often offered as just one function of an integrated system, meaning the component costs are shared between several functions.

The SMMT representatives were not able to provide an estimate of manufacturers' costs for private eCall as it depends on the different business models used by different manufacturers. Secured by Design, an SME with contacts in the UK automotive industry who performed the study into eCall for the DfT in 2006, has provided the following information relating to cost estimates for a standalone eCall system:

- €80 for a basic 2G telematics control unit (TCU) bought from a supplier in a batch of 200,000 is considered the best market price;
- an additional €65 euros for 'shark's fin' aerial, switches, wiring, SIM card, etc.;
- additional €70 to cover instruction manual, training staff, warranty risk cost and profit, which would give a minimum retail price of €215;
- costs are clearly volume-related so could be significantly greater for OEMs producing lower numbers of IVS; the presence of eCall on high-volume vehicles could influence the rest of the market.

Pan-EU eCall

The vehicle manufacturers have advised that the 2011 EC IA cost of €180 per IVS for the mandatory option is a realistic estimate. They also advised that if eCall becomes mandatory then it may be that the manufacturers will use a different cost model and design which could potentially reduce costs.

Detailed cost estimates cannot be provided currently because the system specification is not final and vehicle manufacturers do not yet know how they might implement a mandatory system into their vehicles. If the final specification was available, it is likely that the cost to each manufacturer for providing it on all vehicles would remain commercially sensitive.

If regulatory measures were introduced, the requirement for GPS on every vehicle would be likely to mean services such as satellite navigation would be introduced on lower-price vehicles more quickly than if left to the market. So vehicle prices would increase due to eCall but the cost of just the eCall element would be diluted by being part of a bundle of services.

Nomadic eCall

As discussed in Section 3.4, nomadic eCall is an aftermarket product which could take a number of forms, including a mobile phone application or part of a 'black box' provided by an insurance company. Some are currently being developed or in some cases have already been introduced to the market. These aftermarket 'Nomadic' systems can be cheaper than OEM options and available at a relatively low cost to the user, potentially at €50 per IVS. For example, eCall expert Andy Rooke is aware of a near-production device by Geneva Micro which is expected to cost €50. These nomadic devices come equipped with all the necessary peripheral equipment (SIM card, speaker, microphone etc). Other devices connect via the on board display (OBD) port, providing the potential to add eCall although they do not currently offer it. For example www.Zuibie.co offer a product which has a consumer price of $99 so the cost price is probably close to €50.

The low cost of nomadic devices could give weight to the suggestion that IVS costs could be much lower than the EC estimates for all options. However, as they are not fully developed, the quality and functionality of such systems is not yet fully understood. Their performance is currently being reviewed by two EU projects; Harmonised eCall European Pilot (HeERO) and European eCall Implementation Platform (EeIP) which is due to conclude by the end of March 2014.

Forecasting Technology Costs Using the Experience Curve

The experience or learning curve is a well-known idea that has been found to hold true in many industries; the more experience an organisation has in producing a particular product, the lower its costs. The 'experience curve model' predicts that for each doubling of total production, the cost is reduced by a fixed percentage. The actual percentage varies in different industries but is generally between 5 and 30%.

Some analysis of potential costs has been performed in this study based on the experience curve model. Unfortunately no information has been found specific to automotive systems. Instead, a model has been reverse-engineered to the penetration rates for the various options based on the fact that there seems to be a general consensus from the various studies and conversations with stakeholders that the 2011 EC IA's Option 3 costs are a good estimate.

Using the expected penetration rates and predicted costs of Option 3 in Year 1 and Year 6, the percentage reduction per doubling of production can be estimated at 11.3%. Table 4-2 shows the resulting expected steps in cost based on number of equipped vehicles.

Table 4-2 Predicted Relationship between Penetration and IVS Cost

Equipped Vehicles	IVS Cost
250,000	£215 / €258
500,000	£191 / €229
1,000,000	£169 / €203
2,000,000	£150 / €180
4,000,000	£133 / €160
8,000,000	£118 / €142
16,000,000	£104 / €125

Using the predicted penetration rates for each option, this would lead to the IVS costs for the three options shown in Table 4-3. The resulting Option 1 costs are significantly lower than used in the 2011 EC IA and more in line with those from the 2009 EC Study and with the views of stakeholders.

Table 4-3 Predicted IVS Costs for Each Option Based on 11.3% Reduction Factor

Option	Cost in Initial 6 Years	Cost after 6 Years
Option 1 No EU Action	£215 / €258	£191 / €229
Option 2 Voluntary Approach	£215 / €258	£169 / €203
Option 3 Regulatory Measures	£150 / €180	£104 / €125

Summary

Various information sources including costs of after-market and OEM equipment, views of stakeholders, previous analysis from SBD and our analysis based on the experience curve model, suggest that the Option 1 costs used by the 2011 EC IA are too high.

4.3. PSAP Costs

There are two levels of PSAP:

- PSAP 1 provides the first point of call where emergency calls are first intercepted; they speak to the caller, assess their need, take details and direct them to the relevant PSAP 2;
- PSAP2 are the emergency services; ambulance, police, fire and coastguard.

PSAP 1 call centres will require system upgrades to provide the ability to decode the 112 eCall (Minimum Set of Data, MSD) information. Location information on the calls is then provided through a data server that is shared with the PSAP 2 emergency services.

Only Options 2 and 3 require a PSAP upgrade cost as Option 1, voluntary eCall, does not require a direct connection from the vehicle to the PSAP, generally relying instead on help lines provided by the manufacturer, or agreements direct with the PSAP.

4.3.1. 2011 EC Impact Assessment: Assumptions and Estimates

The EC IA estimated the UK cost to be €200,000 for PSAP upgrade in Options 2 and 3 (voluntary and mandatory respectively). The following attributes were included in the cost estimation.

- in-band modem server per PSAP (from €3,000 to €20,000, depending on the number of eCalls);
- training;
- software.

4.3.2. 2009 EC Study: UK Assumptions and Estimates

Costs included in the 2009 EC Study include:

- €220,000 investment in the PSAP1 system;
- €110,000 per year in operating the upgraded PSAP system.

4.3.3. Discussion of Assumptions

The cost of upgrading the PSAP 1 is expected to be relatively low and quite defined in terms of what will be required. The main physical upgrade required is the installation of an in-line modem capable of differentiating an eCall and handling it appropriately.

In the UK, virtually all calls come through the seven BT PSAPs. In consultation with John Medland from BT, he confirmed that a detailed feasibility study has not yet been undertaken to assess the exact requirements or cost but it is estimated at £200,000. The annual maintenance cost is estimated to be £40,000 on the same basis. These costs are therefore relatively similar to those identified by the previous studies.

Operator training will also be required but has not been quantified. There might be additional costs for call handling but this is difficult to estimate as it depends on the operational procedures, so again has not been quantified. It is assumed likely that eCalls will generally replace manual 999 calls. These costs are likely to be small and are currently not quantifiable therefore they have not been included in the updated economic model. (Although note that significant non-emergency calls might lead to higher call-handling costs, see Sections 4.5.2 and 4.5.4).

The implementation timeframe for PSAP upgrade is expected to be 18 – 24 months.

4.4. Call Centre Costs

For private eCall, automatically and manually triggered calls are made to call centres which are provided by by OEMs or aftermarket providers (some of whom subcontract these services to the BT PSAPs). These call centres will have call handling costs.

4.4.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA estimated call centre costs to be 2% of total costs for Option 1, 0.5% for Option 2, and 0.2% for Option 3.

4.4.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study did not consider call centre costs.

4.4.3. Discussion of Assumptions

As the call centre costs are likely to be very low compared to the IVS costs, they would have a low impact on the economic appraisal calculations. On this basis no additional information on call centre costs has been obtained in the scope of this study.

4.5. Other Costs Not Quantified in the EC IA

4.5.1. MNO Upgrade Costs

The Mobile Network Operators (MNOs) will need to upgrade the Mobile Switches Centres (MSCs) to include an eCall discriminator or flag, allowing identification of manually or automatically generated eCalls and to enable the eCall to have priority above all other calls, similar to a traditional 112 call.

4.5.1.1. 2011 EC Impact Assessment: Assumptions and Estimates

The cost for implementing the eCall flag will vary between the countries and will depend on the complexity of the networks and on the decision of where to route the eCall. The 2011 EC IA did not consider it to be significant and it was not included in the cost estimate.

4.5.1.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study found that the cost for implementing the eCall flag might be substantial for some companies, but others may already have the required changes. Again the costs were not used in the economic appraisal.

4.5.1.3. Discussion of Assumption

Both the 2011 EC IA and 2009 EC Study have made some references for the need to upgrade MSC services to include an eCall flag but have not defined a cost within the cost benefit calculations. The MSC upgrade cost is likely to be very low compared to the IVS costs so will have a minimal impact on the BCR. Because of this and the uncertainty of the values, it has not been investigated further within the scope of this study.

4.5.2. Driver Education Costs

4.5.2.1. 2011 EC Impact Assessment: Assumptions and Estimates

It is unclear if driver education costs have been included within the 2011 EC IA.

4.5.2.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study recognised driver education as an important factor as it can maximise benefits when the system is called upon in an emergency and minimise inappropriate use of the system. The cost associated with providing driver education was estimated at £2 per new vehicle per year, amounting to £4m per year. The assessment also suggested that the cost would be expected to be borne by the Member States or the European Commission.

4.5.2.3. Discussion of Assumption

Driver education is important for maximising benefits when the system is required in an emergency and minimising inappropriate use of the system. The absence of a clear strategy may result in a greater number of false eCalls (manual calls) being generated. This would result in creating a greater workload for the PSAP1s, potentially increasing their costs.

Information on the use of eCall could be provided in the driver's manual for each new car; this can be considered to be included in the IVS cost. Additional education may be required but the cost of this would be low compared to IVS costs so it has not been quantified.

4.5.3. Telecommunications Costs

4.5.3.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA notes that 112 based eCalls are free for the user under the Universal Service Directive, and cross network roaming charges are not incurred for an emergency call. It does not consider the cost to the MNOs of emergency call transmission and does not quantify call costs.

4.5.3.2. 2009 EC Study: UK Assumptions and Estimates

The cost paid by the MNO to PSAP1s was estimated at £0.60 per 3 minute 112 call connected within the 2009 EC Study. The telecommunications costs were not included in the 2009 EC Study cost benefit analysis, presumably due to being low compared to IVS costs.

4.5.3.3. Discussion of Assumption

The telecommunications costs will be borne by the MNOs so they will allow for this in their cost to the OEM / eCall supplier of the dormant SIMs, which only become active when triggered either manually or automatically. Call costs can therefore be considered to be included in the IVS cost.

The cost of making individual eCalls is likely to be relatively similar to cost of making an emergency call through the traditional service number. Therefore if the total number of emergency calls resulting from accidents remains similar, there will be no change in call costs. However the cost of all eCalls will be variable depending on eCall trigger thresholds.

4.5.4. Costs of Non-emergency Calls

4.5.4.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA suggested that non-emergency calls are not an issue specific to the eCall service. Based on European PSAP practice, the processing of non-emergency calls (around 60% of the calls to the emergency numbers) is a normal operation within the protocols of PSAP operation.

4.5.4.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study provides reference to non-emergency calls advising that the PSAPs would need to have a system for filtering out non-emergency calls. The study does not provide a cost or detail of whether this cost is absorbed within the PSAP upgrade cost.

4.5.4.3. Discussion of Assumption

False eCalls are considered those from people that require assistance but do not need intervention from emergency services or unintentional calls to the emergency services.

Silent eCalls are situations where an eCall is automatically triggered following an incident and the occupants are unresponsive due them either being unconscious or as a result of exiting the vehicle. If a silent call is the result of an airbag deployment following which the occupants are uninjured and leave the vehicle, this could result in emergency response being sent out when not necessary.

The potential cost of non-emergency calls is very difficult to estimate. The reality is considered to depend upon a number of factors including trigger threshold and level of driver awareness. The trigger threshold determines when the eCall system would be activated depending on the force of impact and detonation of the vehicle airbag. The eCall system specification including trigger threshold has not yet been defined therefore it is not possible to provide estimates based on reliable parameters. The driver education and awareness strategy and methodology is also not available to allow for a judgement to be made.

Statistics provided by BT for the existing commercial eCall calls indicate that 30% are passed through to the emergency services. Of the 30%, 6% relate to caller requests and 24% are silent calls that are passed to the police. There is no information available on the outcome of the silent calls.

Based on the limited information available the cost of non-emergency calls has not been quantified; it could potentially be a relatively high although probably still not a significant proportion of the total costs, given the very high total IVS costs.

5. Review of Evidence for eCall Benefits

5.1. Introduction

This section summarises the benefits assumptions and estimates presented in the 2011 EC IA and the UK values within the 2009 EC Study. Each of the identified benefit assumptions and estimates has been reviewed and additional information and evidence highlighted.

Where this study has identified that UK benefits are likely to be different to those predicted in the 2011 EC IA, the reasons are discussed in this section. The descriptions of benefits assumptions used in the economic appraisal for this study are contained in Section 6.6.

Note that the cost assumptions from the two EC documents are presented in euros but some of the information provided by stakeholders and presented in the discussion sections is provided in UK pounds.

5.2. Reduction in Casualty Severity

There is potential for eCall to reduce casualty severity in some cases, but this is dependent on the emergency services being notified, locating and attending an accident sooner. A number of factors affect the ability for this to happen:

- improvement in response time, which depends on various sub-factors:
  - mobile network coverage;
  - existing emergency response infrastructure;
  - type of accident;
  - performance of eCall
- relationship between reduced response time and reduced severity; not all fatal accidents would be avoided if response time were reduced.

The overall benefits will also depend on values of casualty prevention and accident trends.

Unfortunately the data available is insufficient to produce a model which uses the various factors to precisely predict the casualty severity reduction. For example, there is very little evidence for the time taken to report an accident to the emergency services or the potential for a response time saving to reduce casualty severity. The 2011 EC IA and 2009 EC Study investigated the various factors and then produced their best estimates based on the limited evidence available.

This section will review the information used and discuss the assumptions. Mobile network coverage, emergency response time and performance of eCall are discussed in Sections 5.2.1, 5.2.2 and 5.2.3 respectively.

The 2011 EC IA and 2009 EC Study predictions for expected accident severity reductions are reviewed and discussed in Section 5.2.4. Values of casualty prevention are discussed in Section 5.2.5 and accident trends in Section 5.2.6.

5.2.1. Mobile Network Coverage

5.2.1.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA provides a reference to mobile network coverage for Option 3 only. It states that GSM Association Europe has declared GSM coverage of 99% of the EU territory with at least one operator. This statement has not been used further within the cost and benefit calculations.

5.2.1.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study provided an overview of mobile network coverage and presented the areas with at least 75% area coverage. The areas that showed no, or limited, coverage included Northern England, Scotland and parts of Wales.

The 2009 EC Study assumed an estimate at slightly above 90% as an overall average figure for coverage following comments from stakeholders and project teams. The 2009 EC Study also identified that coverage would generally be worst in remote rural areas where eCall would provide the most benefit.

5.2.1.3. Discussion of Assumption

It is understood that neither the 2011 EC IA nor 2009 EC Study took into account the impact of areas where there is limited or no mobile network coverage.

The 2013 OFCOM UK Infrastructure Report investigated the mobile network coverage on roads. Figure 5-1 presents a summary of the findings which suggest that the UK motorways are well served by 2G networks whereas A&B roads in Scotland, Wales and Northern Ireland have areas which are not covered by any MNO. For example, 8% of A&B roads in Scotland have no signal from any operator. Coverage of unclassified roads is likely to be even lower. This suggests that poor signal coverage in the UK could impact on the performance of eCall.

Figure 5-1 Mobile Coverage on Roads

Mobile Coverage on Roads

	2G				3G			
	Motorways		A&B Roads		Motorways		A&B Roads	
	no signal from any operator	signal from all operators	no signal from any operator	signal from all operators	no signal from any operator	signal from all operators	no signal from any operator	signal from all operators
England	0%	99%	1%	88%	0%	78%	3%	50%
Scotland	0%	99%	8%	65%	0%	58%	28%	15%
Northern Ireland[51]	N/A	N/A	6%	63%	N/A	N/A	10%	21%
Wales	0%	97%	7%	66%	0%	79%	11%	20%
UK	0%	99%	4%	77%	0%	76%	9%	35%

Source: Ofcom/Operators

5.2.2. Emergency Response Time

5.2.2.1. 2011 EC Impact Assessment: Assumptions and Estimates

Two sources have been used to estimate the impact of eCall on the reduction in emergency services response times. Firstly, the German 'Storm' Study (Stuttgart Transport Operation by Regional Management) which has been used to suggest that with eCall, emergency services response times would be reduced by 50% in rural areas and by 40% in urban areas. This equated to a net gain of approximately 10 minutes and 5 minutes respectively. Secondly, consultation with the PSAP Experts Group within the eCall Driving Group has suggested that the net gain in time could go up to 17 minutes in rural areas.

5.2.2.2. 2009 EC Study: UK Assumptions and Estimates

A 10 minute saving in response time (5 minute saving due to automatic call and 5 minutes due to saving from improved location information), ascertained from previous studies were presented to various emergency services stakeholders including police and ambulance/medical services for consultation. The general consensus from the stakeholders was that the time savings were too optimistic due to existing service provisions. On the basis of these consultations the estimate had been revised down to 2 minutes per accident.

The most significant saving in response times would be obtained for accidents in remote locations where all vehicle occupants are unconscious. The report referenced a Hungarian study which found less than1% of accidents have a notification time of more than one hour, however there is no equivalent data available for the UK.

5.2.2.3. Discussion of Assumption

The 2011 EC IA assumption does not accurately reflect the potential reduction in emergency response time savings for UK and a value of 10 minutes can be considered as an over optimistic estimate. This is due to a number of factors associated with UK accident and emergency response including:

- It is likely to be only in rare cases that the response time could be improved, most notably in rural areas at night time for single vehicle accidents where the occupants are unconscious.
- A large proportion of the UK Strategic Road Network is monitored by CCTV, detection loops etc. which feed information back to either the National or Regional Control Centres (NCC or RCC) which have monitoring capabilities. The operators are capable of notifying emergency services (PSAPs) of emergencies. Also the motorways and trunk roads are supported by Highways Agency Traffic Officer units, which conduct patrols and can assist in accidents providing services to help clear incident scenes to allow normal traffic to resume.
- In the UK, once the accident is reported to a PSAP, an emergency response team is dispatched almost immediately to the area of the accident, with more detailed location information being fed along the journey so there is less likely to be a delay finding the scene of the accident due to inaccurate location information; this means that in many cases the immediate accurate location information provided by eCall would not reduce the response time.
- Currently PSAPs are able to identify a location of the emergency call made on a mobile phone through triangulation, which traces the approximate location of the mobile phone using surrounding telephone towers and assessing the signal strength.
- Accidents on motorways, trunk roads and other roads which are heavily trafficked will be witnessed by several members of the public who are likely to make emergency calls. This is even the case on rural roads during times of the day when traffic flows are higher.

Discussions with representatives responsible for the provision of ambulance services confirmed that eCall was unlikely to provide significant benefits. The Ambulance Service would not respond to a silent eCall as they require confirmation that there has been an injury. In these cases the police would need to attend first and assess the situation. Savings in response times for silent eCalls would therefore be minimal.

It would be very difficult to quantify the time savings that could be offered by eCall due to the limited availability of data associated with the accident time line factors.

5.2.3. Performance of eCall

5.2.3.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA did not make any specific assumptions or estimates on the performance of eCall.

5.2.3.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study estimated the chances of an eCall system functioning successfully following an accident would be between 95% and 98%, on the basis that good hardware standards are implemented and industry ensures development of the system is robust enough to operate after a severe crash or under extreme temperatures.

5.2.3.3. Discussion of Assumption

The likelihood of an eCall system operating after an accident has been discussed with vehicle manufacturers including Jaguar Land Rover, Vauxhall and General Motors. The vehicle manufacturers have assumed that a high proportion of OEM systems would continue to function following an accident on the basis that OEM systems would need to be robustly built according to requirements, thoroughly tested and include back up/ redundancies. Vehicle manufacturers are currently not in a position to provide estimates as build and test requirements have not been specified.

There are some concerns that some low price nomadic solutions may not meet the same quality standards and for example, a mobile phone-based solution might suffer from being thrown around the vehicle in the event of an accident.

5.2.4. Casualty Reduction

5.2.4.1. 2011 EC Impact Assessment: Assumptions and Estimates

A number of European research and studies had been used as the basis for this assumption, giving a percentage reduction in severity of between 1% and 7.5%, depending on the country cluster, to the total figure of all accidents. The UK-specific estimates are detailed in Table 5-1 and cover all UK accidents, not just those involving cars and vans.

The assessment acknowledges the fact that it is extremely difficult to estimate the benefits of an eCall system in terms of reduction of fatalities and mitigation of serious injuries. This is due to the fact that there are no reliable statistics on the precise time when an incident took place or the delay before emergency services or PSAPs were notified.

Table 5-1 2011 EC IA - Predicted Casualty Reductions

Casualty Severity	Reduction Assumed for UK (%)
Fatal	2%
Serious	1.5%
Slight	0%

The report references the 'golden hour' principle, which suggests the first five minutes are the most critical for recovery and reduction of the severity of injuries. It also references other studies which show that approximately 50% of fatalities occur within minutes, 30% within a couple of hours and 20% during the following days and weeks.

5.2.4.2. 2009 EC Study: UK Assumptions and Estimates

The impact of eCall on casualty reduction for both fatal and serious injuries for the UK (assuming full take up of eCall) are:

- Reduction in fatalities – 1% of all UK fatalities estimated to be saved, and reduced to serious injuries (i.e. 29 per year, value per year €48m).
- Reduction in serious injuries – 0.5% of all UK serious injuries estimated to be reduced to slight injuries (i.e. 67 per year, value per year €26.5m).

These values are lower than the corresponding estimates detailed within the 2011 EC IA. The estimates in the 2009 EC Study were derived and refined through a number of methods, including consultations with UK stakeholders and examination of accident case studies (sample set totalling 27) by a specialist medical examiner (air ambulance doctor). The result of the assessment suggested that eCall would only have been of benefit in one of the case studies through shortening of the response time to avoid a fatality.

A representative from the ambulance service suggested fatality reductions of less than 0.5% would be provided by eCall.

The reduction in serious injuries was explained as likely to occur where improvement in response time meant that an overnight stay in hospital could be avoided (an overnight stay is one of the reasons for categorising an injury as serious).

In addition to the serious injuries reduced to slight, it is likely that there would be a reduction in injury severity within the 'serious' category which covers a wide range from severe permanent disability to those requiring an overnight stay for observation. However this would not provide a quantifiable benefit because average values are used for all serious casualties.

5.2.4.3. Discussion of Assumption

Based on all the information reviewed, the EC IA assumption of 2% of all fatalities reduced to serious injuries as a result of eCall (equivalent to approximately 4% of car and van occupant fatalities) seems optimistic. Applying a reduction to all casualties including motorcyclists, cyclists and pedestrians, based on only cars and vans being equipped, is not considered an appropriate analysis method.

The value of 1% of all fatalities used in the 2009 EC Study (equivalent to approximately 2% of car and van occupant fatalities) seems more realistic.

As part of the current UK review, the investigation into types of accident performed as part of the 2006 UK Study has been repeated. Accident data from 2008[2] has been analysed and split into the following categories:

- single vehicle accidents on rural non-motorway roads at night;
- single vehicle accidents on rural non-motorway roads in the daytime;
- single vehicle accidents on urban non-motorway roads at night;
- multiple vehicle accidents on rural non-motorway roads at night;
- multiple vehicle accidents on rural non-motorway roads in the daytime;
- single vehicle accidents on motorways at night.

The potential reduction in casualty severity has been suggested for each category and the total reduction used to calculate the percentage reductions for all casualties if all vehicles were equipped. The results are shown in Table 5-2. Taking the example of 189 fatalities in single vehicle accidents on rural roads at night, the category in which the benefits of eCall could be expected to be greatest:

- At least 4% of these accidents would have occurred in areas where there is no phone signal and therefore an eCall could not be made.
- Half would have resulted in an immediate fatality.
- In cases where the accident has been survived, a significant proportion of casualties would have not sustained injuries which would prevent them from making a mobile phone call to the emergency services. Some would be found by other vehicles within minutes. (Remembering that the Hungarian study found that only 1% of accidents were not found after an hour.)
- In some rural areas, the response time could be 20 minutes or more, so a saving of one or two minutes in response time might not be sufficient to change the outcome from a fatality to a serious injury.

Table 5-2 Estimated Reduction in Casualty Severity for Different Accident Scenarios

Scenario	Day / Night	Motorway	Urban / Rural	Single / Multiple Vehicle	Fatalities	Serious Injuries	Assumed impact	Assumed Reduction in Fatalities	Assumed Reduction in Serious Injuries
1	Night	No	Rural	Single	189	975	2.0%	3.78	19.5
2	Day	No	Rural	Single	233	2075	1.0%	2.33	20.75
3	Night	No	Urban	Single	129	1155	1.0%	1.29	11.55
4	Night	No	Rural	Multiple	146	572	0.5%	0.73	2.86
5	Day	No	Rural	Multiple	772	5829	0.5%	3.86	29.15
6	Night	Yes	Both	Single	13	85	0.5%	0.065	0.425
7	All other accident types				1056	15343	0.1%	1.056	15.343
TOTALS					**2538**	**26034**		**13.111**	**99.573**
							Overall Percentage Reduction:	**0.5%**	**0.4%**

[2] NB. The year 2008 was chosen because it was the base year for the EC IA but the choice of year is not important. While the precise casualty numbers vary each year the proportions in each category will remain similar. The results do not feed directly into the economic model but are used to provide an indication of the potential casualty reduction due to eCall, for comparison with the values provided by the EC IA and the 2009 EC Study.

Taking into account these factors it is suggested that of the 189 fatalities, a maximum of 2% would benefit from reduced severity by eCall. Other categories of accident would have less chance of being improved by eCall due to higher probability of being witnessed or found relatively soon after collision. Assumed impacts of 2%, 1%, 0.5% and 0.1% have therefore been allocated to the various other categories.

As mentioned in the other studies, insufficient data makes it very difficult to objectively estimate potential accident reduction and the above analysis is purely intended to give an indication. The results show an estimated reduction of 0.5% of fatalities and 0.4% of serious injuries. This low figure is supported anecdotally by the 2009 EC Study's discussion with the UK ambulance authority representative who suggested they would expect eCall to save less than 0.5% of fatalities.

Summary

In summary, it is our conclusion that the UK casualty reduction is likely to be at most 2% of fatalities and 1.5% of serious injuries involving car and van occupants only, not all casualties. This equates to approximately 1% of all fatalities and 0.75% of all serious injuries, i.e. closer to the values assumed by the 2009 EC Study rather than the 2011 EC IA. This is due to the following key reasons:

- eCall would be of significant benefit only to those accidents that occur where detection and notification from other services or road users may not occur;
- fatalities and serious injuries within those scenarios are only likely to benefit in a very small percentage of cases.

The potential for UK citizens to benefit from eCall while driving in the EU has been considered; however some of the accidents included in the UK statistics would have involved non-UK citizens driving in the UK (including some from other EU Member States) and in the absence of any detailed information it is assumed that the impacts cancel out. The potential for manual eCall to provide benefits for other road users (pedestrians, cyclists, etc.) or drivers who become ill but are not involved in an accident has also been considered but we consider it to be relatively marginal.

Potential to Increase Benefits

eCall could provide additional benefits if various systems were enhanced to maximise the potential of the system. An eCall system in the Netherlands automatically points the CCTV cameras towards the accident so that that control centre operators can immediately find it.

Private eCall provides the Vehicle Identification Number (VIN) which might provide additional information to the emergency services such as vehicle type and data on specific vehicle characteristics. However a representative responsible for National Resilience that covers the Fire and Rescue Service suggested that VIN information would not be that useful to them because the Fire and Rescue Service carries all the necessary equipment in their vehicles, rather than equipping their vehicles in response to specific incidents.

Young male drivers, for example, have a greater risk of being involved in a serious collision but are more likely to drive older, and hence more affordable, vehicles. Take up rate of eCall within this demographic would hence be slow, and there is an additional risk that a more expensive eCall-equipped car would further discourage these drivers from buying newer cars with their other associated safety features. Initiatives to increase eCall penetration rates for higher risk drivers would be beneficial.

5.2.5. Value of Casualty Prevention

5.2.5.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA has used the average monetary values recommended by the European Road Safety Observatory, adjusted to the actual years, as shown in Table 5-3.

Table 5-3 2011 EC IA - Monetary Values per Casualty (Baseline 2008 Estimates)

Casualty Severity	Monetary Value per Casualty (€)
Fatal	1,361,262
Serious	214,074
Slight	16,428

5.2.5.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study does not specify what values were used in the economic appraisal.

5.2.5.3. Discussion of Assumption

The values used for casualty costs are averages compiled from various cost types. The UK Impact Assessment performed as part of this project uses the WebTAG current average monetary values of prevention per casualty, increased in line with Real GDP per capita index. Table 5-4 shows the values, which are slightly higher than those used by the 2011 EC IA.

Table 5-4 Summary of WebTAG Values of Prevention per Casualty (2010 Values)

Injury Severity	Lost Output (£)	Human Fctors (£)	Medical and Ambulance (£)	Total (£)
Fatal	565,777	1,079,073	971	1,645,821
Serious	21,797	149,942	13,205	184,944
Slight	2,304	10,976	977	14,257
Average, all casualties	9,648	36,906	2,417	48,971

5.2.6. Accident Trends

5.2.6.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA assumed a 3.5% annual reduction in fatal accidents and 1.5% annual reduction in serious injury accidents each year as a baseline resulting from improved road and vehicle safety. Little information is provided on how these values have been chosen.

5.2.6.2. 2009 EC Study: UK Assumptions and Estimates

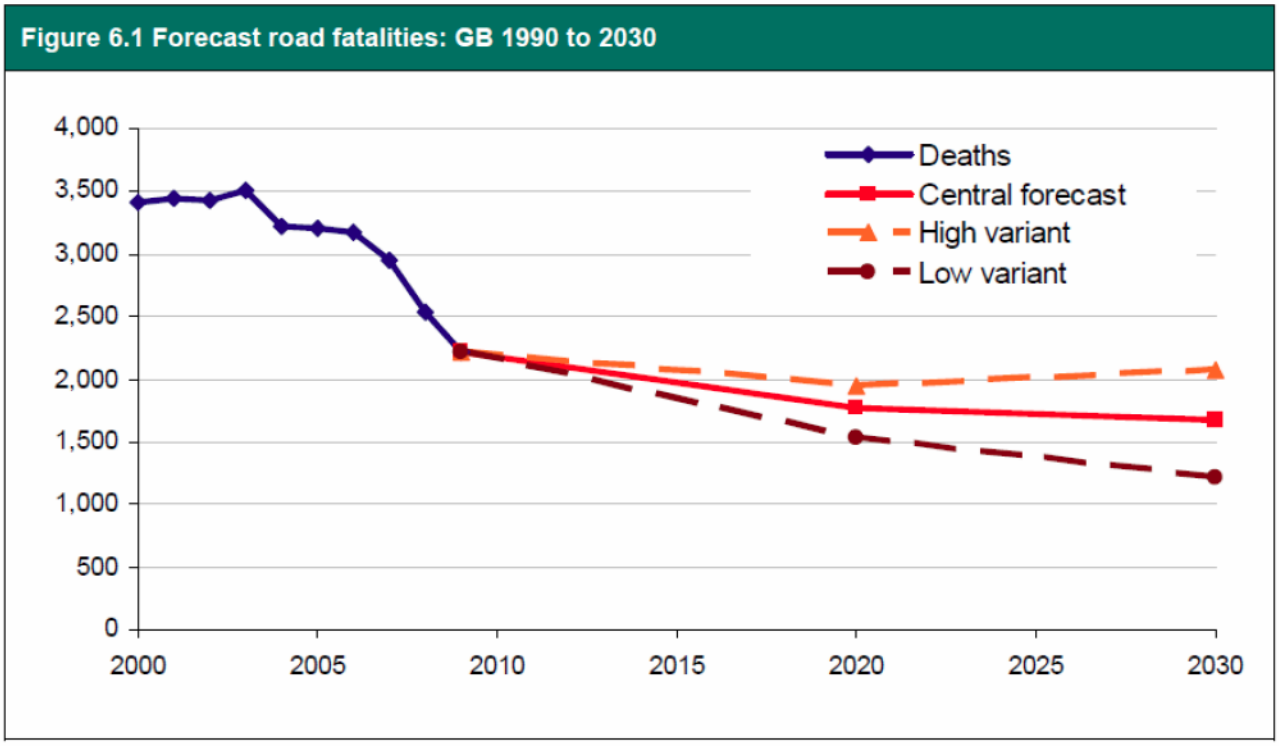
The 2009 EC Study does not make it clear whether any accident trends were included in the economic analysis.

5.2.6.3. Discussion of Assumption

Because accident cost savings form the largest benefit of eCall, the assumptions about future accident trends could have a significant impact on the economic calculations. Various factors affect future accident rates, including vehicle and infrastructure safety improvements; number of vehicles on the road; and driver behaviour. In the UK accident rates have been dropping for several years with, for example, 38% fewer fatalities in 2012 compared to a 2005-9 baseline period. However this situation is not predicted to continue indefinitely; forecasts in the DfT's 'Strategic Framework for Road Safety, May 2011 updated 2013', predict the trend becoming flatter as shown in Figure 5-2.

If accident rates reduce at a slower rate or increase, then the benefits of eCall could be higher. The UK Impact Assessment performed as part of this project uses figures calculated using WebTAG guidance which are less than the 3.5% (fatal) and 1.5% (serious) used by the 2011 EC IA. In fact they show accident numbers increasing slightly, due to forecast traffic increases offsetting reduced accident rates.

Figure 5-2 Forecast Road Fatalities Data Produced by DfT



5.3. Reduction in Incident-Related Congestion

5.3.1.1. 2011 EC Impact Assessment: Assumptions and Estimates

The reduction of congestion costs caused by traffic accidents is described as being achieved through providing an improvement of accident management. This includes notifying traffic management centres which can help facilitate the management of incidents through dispatching maintenance/clear up teams and set warning/strategic signs to inform other road users.

The estimates of percentage congestion saving were included in the cost-benefit ratio calculation, with the range varying between 3% and 17% depending upon the cluster analysis. The UK was in Cluster 2 which was identified as having the lowest percentage congestion saving of 3%, equivalent to a cost saving of approximately €196M for the 2008 baseline year. Baseline UK congestion costs were identified as €6.5billion and estimated to reduce by 1% each year.

5.3.1.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study based its incident related congestion savings assumptions through the reduction in journey time delays (full take up only) based on 2 minute time saving per accident (1 minute in call out and 1 minute in ascertaining the location) which results in an estimated annual reduction in traffic delay of 2.26m vehicle hours (approximately 0.7% of total hours spent in congestion or 3% of the congestion related to accidents). Using €8.6 per hour as the average value of time the saving is equivalent to approximately €19.5m per year, of which €6.1m are on the motorway and trunk roads. This is only one-tenth of the 2011 EC IA estimate.

5.3.1.3. Discussion of Assumption

The 2011 EC IA assumed a 3% reduction of all UK congestion but we believe that taking a percentage of all congestion rather than just incident-related congestion is not a suitable analysis method. The 2009 EC Study looked more closely at purely incident related congestion and applied an assumption of two minutes reduced response time for all incidents. This is a more appropriate method; however we consider the value of 2 minutes to be higher than is likely to be achieved in reality.

Significant congestion benefits can only occur during incidents which take place on busy roads at busy times of day. For example on motorways during the peak, the high flows (up to 6000 vehicles per hour or 100 per minute) would quickly cause congestion if an accident blocked one or more lanes. However the same high flows mean that an accident would be reported quickly without eCall, either by the people involved in the collision or others witnessing it. So the saving in response time would be one or two minutes at the most.

Other busy roads where congestion might occur as a result of an accident, such as urban areas and busy roads off the motorway, would have lower flows (up to 2000 vehicles per hour for a single lane) and there would be more potential for diversion routes, so congestion costs would be lower. The same principle applies; on a busy road any accidents would be reported quickly without eCall, so there is unlikely to be more than one or two minutes saving in response time.

Many accidents do not cause any congestion at all; either they do not block any lanes so traffic continues to move freely past the accident, or the flows are low such that no congestion is caused, or only an insignificant number of vehicles are delayed.

Table 5-5 summarises the above discussion of the various scenarios for incident-related congestion.

Table 5-5 Estimated Reduction in Congestion for Different Scenarios

Accident Scenario	Flow	Likely Congestion?	Likely Response Time Saving?	Likely eCall Benefit?
Motorway, peak time, lane blocked	High	Yes	1 or 2 minutes	Low
Motorway, peak time, no lane blocked	High	No	1 or 2 minutes	None
Busy non-motorway, peak time, lane blocked	Medium	Some	1 or 2 minutes	Low
Busy non-motorway, peak time, no lane blocked	Medium	No	1 or 2 minutes	None
ALL OTHER SCENARIOS	Low	No	1 or 2 minutes	None

The 2011 EC IA also assumed that baseline congestion costs would reduce by 1% per year, however it seems more reasonable to assume that incident-related costs would follow the same trend as number of incidents.

Summary
Where there is enough traffic for an incident to cause congestion, the incident is likely to be reported very quickly without eCall. This means that eCall is likely to provide no significant improvement to response time and therefore no incident-related congestion savings.

5.4. Other Benefits Not Quantified in the EC IA

5.4.1. Emissions

5.4.1.1. 2011 EC Impact Assessment: Assumptions and Estimates

A small note advising of additional benefits includes emission savings from the use of eCall, although specific emission savings are not detailed within the 2011 EC IA.

5.4.1.2. 2009 EC Study: UK Assumptions and Estimates

The reduction in emissions was estimated to be less than 0.0002% (element not used in principal factors cost benefit analysis)

5.4.1.3. Discussion of Assumption

Emission savings may potentially arise from the reduction in incident related congestion, however this is considered to be marginal.

5.4.2. Secondary Accidents

5.4.2.1. 2011 EC Impact Assessment: Assumptions and Estimates

The 2011 EC IA includes reduction in secondary accidents due to improved incident management as a specific objective, however it does not quantify the benefits.

5.4.2.2. 2009 EC Study: UK Assumptions and Estimates

The 2009 EC Study did not consider potential reduction in secondary accidents.

5.4.2.3. Discussion of Assumption

A reduction in secondary accidents would be most likely to occur as a result of faster notification on motorways, allowing driver information signs to be set. As we estimate the likely response time reduction to be less than 2 minutes, this benefit is considered to be marginal.

6. UK Economic Appraisal

6.1. Introduction

Based on the review of the assumptions from the 2011 EC IA and 2009 EC Study and other new evidence, an economic appraisal of the costs and benefits of introducing eCall in the UK was performed. This section describes:

- the options that were considered;
- the evaluation approach;
- the assumptions made about quantified costs and benefits;
- the non-quantified costs and benefits; and
- the results of the appraisal including sensitivity testing.

6.2. Options under Consideration

Table 6-1 shows the three options under consideration, which have been chosen to match the options used in the 2011 EC IA to allow a comparison to be made.

Table 6-1 Options under Consideration for UK Economic Appraisal

Option Number	Description
1	No EU action: Private eCall services provided in high-end vehicles which may trickle down to all models or as applications on nomadic devices. This is the Baseline Scenario. Includes costs for private eCall and call centres.
2	Voluntary approach: Member States and relevant stakeholders implement eCall voluntarily. This is the EU's current approach. Includes costs for private eCall and call centres; also for member states to upgrade PSAPs and MNOs, and manufacturers installing pan-EU eCall in some vehicles on a market-led basis.
3	Regulatory measures: EU legislation would require PSAPs, MNOs and automotive suppliers to implement measures leading to full take-up of eCall on cars and vans. This is the approach being recommended by the Commission's IA.

6.3. Evaluation Approach and Key Assumptions

The economic appraisal has been performed in accordance with the DfT's WebTAG guidance. The overarching principles applied are described below.

Appraisal Period

The appraisal period has been chosen with a start year of 2008 and IVS costs from 2015 to 2033 have been included; 2015 is the first year for which there will be any difference between the options due to the start of pan-EU eCall. This evaluation period matches the 2011 EC IA to allow easy comparison between the two. The EC chose a final year of 2033 because that was when full penetration of eCall is expected to occur in Option 3. This gives a relatively long appraisal period; 10 or 15 years is commonly used for technology projects because the appraisal period should ideally cover the lifetime of the technology. Advances in technology might be expected to lead to the functionality of eCall changing or being superseded over a longer period. However most of the costs are annual (IVS costs) so the length of appraisal period does not significantly impact on results.

To allow the benefits of IVS fitted towards the end of the period to be included in the evaluation, the benefits of IVS systems still in the vehicle fleet are evaluated until 2044 when the number of vehicles equipped before 2033 remaining in the fleet drops to zero (assuming an average vehicle life of 12 years).

Discounting and Optimism Bias

Both costs and benefits have been discounted over the appraisal period, in accordance with WebTAG guidance using a discount rate of 3.5% per year to a 2010 base year.

Optimism bias is not applicable for this appraisal due to the lack of capital costs.

Appraisal Metrics

Net present values (NPV) of total costs and savings have been calculated using a base year of 2010. The net benefits (i.e. benefits minus costs) and BCRs have been calculated for each option and compared with Option 1, the 'Do Nothing'. Note that information about the assumptions has been presented in UK pounds but the key results (summary of costs, summary of benefits and key economic results in Table 6-4, Table 6-9 and Table 6-11 respectively) have been presented in both euros and UK pounds, assuming a conversion rate of 1.2 euros per pound.

Sensitivity Tests

Sensitivity tests have been performed on key variables to understand the impact of any potential inaccuracy on the appraisal results. The area with the most uncertainty is the benefit calculations. Therefore tests of 'low' and 'high' benefits were performed and compared to the central forecast (the assumptions documented in Section 6.6). In addition, the main cost and benefit assumptions used in the EC 2011 IA have been tested in the WebTAG-compliant model to compare the results.

6.4. In-vehicle Systems Penetration Rate

The key assumptions from the 2011 EC IA for private eCall have been used in the UK economic appraisal, in the absence of any significant new evidence relating to likely penetration rates.

Table 6-2 Private eCall Market Penetration Rate UK Estimates for each Option

	Initial Equipped Vehicles (Calculated as UK fleet Pro Rata to Whole EU Fgures)	Annual Increase of Vehicles Equipped with eCall	
		Initial Period Years 1-6 (%)	Second Period from Year 7 (%)
Private eCall (Options 1, 2 and 3)	Existing in 2008: 76,255 New in 2009: 15,251	11	18
Pan EU eCall (Option 2)	New in 2015: 38,127	18	25
Pan EU eCall (Option 3)	Matches DfT's forecast of new UK vehicle registrations from 2015		

For Option 3 pan-EU eCall, the increase in take up is assumed to match the DfT's forecast of new UK vehicle (car and van) registration rates from 2015 onwards. This is the most optimistic timeframe expectation for eCall to be implemented in all new vehicles from 2015. The average car life-time is assumed to be 12 years in line with information provided by the DfT. The equipped vehicle rate for each year is calculated by summing the predicted numbers of private and pan-EU eCall equipped vehicles and calculating as a proportion of the total UK vehicle fleet. In each year, eCall equipped vehicles coming to the end of their lives are assumed to be replaced – contributing to equipment costs for that year.

The total UK vehicle fleet of cars and vans was 34,457,011 in 2008 and has been increased in line with actual figures until 2013 and in line with DfT predictions after that.

Appendix A.1 contains the resulting annual percentage equipped vehicles for each option.

6.5. Costs

6.5.1. IVS Costs

The Option 3 IVS cost values used in the UK economic appraisal (Table 6-3) are very similar to those used in the 2011 EC IA, because there is a general consensus that these figures are appropriate. The Option 1 and 2 costs have been calculated based on the experience curve model with an 11.3% reduction factor, as described in Section 4.2.3.

Table 6-3 IVS Costs for Each Option Based on 11.3% Reduction Factor

Option	Cost in Initial 6 Years	Cost after 6 Years
Option 1 No EU Action	£215	£191
Option 2 Voluntary Approach	£215	£169
Option 3 Regulatory Measures	£150	£104

6.5.2. PSAP Costs

The cost of the PSAP upgrade is estimated at £200,000 for Options 2 and 3 only, based on information provided by BT. The annual maintenance cost is estimated to be £40,000 for Options 2 and 3 only. These costs are similar to those assumed by the 2011 EC IA.

6.5.3. Call Centre Costs

The call centre costs have been calculated as a proportion of the 2011 EC IA's estimates based on the ratio of UK to EU vehicles in 2008. This gives a cost of approximately £123,000 in 2015, increasing to £474,000 in 2033.

6.5.4. Summary of Quantified Costs

Appendix A.2 contains the annual costs for each option. Table 6-4 shows the total (undiscounted) costs over the appraisal period (2015-2044) for each option. As discussed, the IVS costs are assumed to be incurred until 2032 but the benefits of those systems are evaluated until their end of life, meaning ongoing PSAP and Call Centre Costs are assumed to continue until 2044.

Table 6-4 Summary of Costs for Each Option

	Option 1 No EU Action		Option 2 Voluntary Approach		Option 3 Regulatory Measures	
	£M	€M	£M	€M	£M	€M
IVS Costs (to 2032)	1070	1284	2385	2862	7222	8666
PSAP Costs (to 2044)	0	0	1.4	1.6	1.4	1.6
Call Centre Costs (to 2044)	10	12	10	12	10	12
Total costs	1080	1296	2396	2876	7233	8680

6.5.5. Non-Quantified Costs

Table 6-5 describes the costs which have not been quantified in this economic appraisal, including the reason for not quantifying them.

Table 6-5 Non-Quantified Costs

Cost	Description
MNO upgrade	The MNOs will need to upgrade the Mobile Switches Centres (MSCs) to include an eCall discriminator or flag, allowing identification of manually or automatically generated eCalls and to enable the eCall to have priority above all other calls, similar to a traditional 112 call. The MSC upgrade cost is likely to be low compared to the IVS costs; it was not quantified in either 2011 EC IA or 2009 EC Study and has not been investigated further or quantified within the scope of this study.
Telecommunications	The telecommunications costs are attributed to dormant SIMs, so can be considered to be included in the IVS cost. The cost of making individual eCalls is borne by the MNO and is likely to be relatively similar to costs relating to making an emergency call through the traditional 999 service number. It has not been quantified in 2011 EC IA or 2009 EC Study or this study as it is expected to be low compared to IVS costs.
Non-emergency calls	False eCalls are considered those from people that require assistance but do not need intervention from emergency services or unintentional calls to the emergency services. Silent eCalls are situations where an eCall is automatically triggered following an incident and the occupants are unresponsive due them either being unconscious or as a result of exiting the vehicle. The potential cost of non-emergency calls is very difficult to estimate. Based on the limited information available the cost of non-emergency calls has not been quantified; it could potentially be a relatively high although probably still not a significant proportion of the total costs, given the very high total IVS costs.
Driver education	Driver education is important for maximising benefits when the system is required in an emergency and minimising inappropriate use of the system. The absence of a clear strategy may result in a greater number of false manually-triggered eCalls being generated. Information on the use of eCall could be provided in the drivers manual for each new car; this can be considered to be included in the IVS cost. Additional education may be required but the cost of this would be low compared to IVS costs so it has not been quantified.
Type approval changes	For pan-EU eCall, the type approval process will need to be changed to check the performance of each OEM's eCall systems. This cost is expected to be relatively low so has not been quantified,
MOT changes	For pan-EU eCall, the MOT test might need to be changed, probably to check that the dashboard light functions properly. This would be a relatively low-cost change so has not been quantified.
Insurance and repair costs	There would be a small increase in insurance costs required for the repair of the IVS; this would be low so has not been quantified.
Competition within the industry	Though likely to be slight, additional requirements on car manufacturers may raise industry costs, reducing the ability of smaller and foreign car manufacturers to compete effectively against larger ones. Reduced industry competition traditionally leads to higher prices and a corresponding lower quantity of cars supplied, thus hurting economic welfare.
Effects on equity	The greatest benefit from regulatory measures will be enjoyed by drivers who currently opt for eCall, in the form of reduced eCall prices industry-wide. The least benefit would accrue to those who place the lowest values on eCall. Under the EC's proposed policy, the additional price of the eCall product will either fall on these drivers entirely, or it will be offset by drivers buying a cheaper car, buying a second-hand car, refraining from replacing their cars, or by not having car.

6.6. Benefits

6.6.1. Reduction in Severity of Casualties

The assumed reductions in casualty severity as a result of eCall, assuming 100% penetration rate, is shown in Table 6-6. These values are applied only to casualties involving equipped vehicle occupants (i.e. car and van occupants), for the reasons described in Section 5.2.4.3.

Table 6-6 Estimated Reductions in Casualty Severity

Casualty Severity	Reduction Assumed for UK (%)
Fatal reduced to serious casualties	2%
Serious reduced to slight casualties	1.5%

The actual casualty reduction in each year is calculated by scaling the above percentages in accordance with total eCall penetration rate.

Table 6-7 contains the WebTAG values for casualties in 2010, which are slightly higher than those used by the 2011 EC IA. These are trended assuming that the real value of accident grows in line with the real GDP per capita index (as per the WebTAG databook).

Table 6-7 Summary of WebTAG Values of Prevention per Casualty (2010 Values)

Injury severity	Lost output (£)	Human factors (£)	Medical and ambulance (£)	Total (£)
Fatal	565,777	1,079,073	971	1,645,821
Serious	21,797	149,942	13,205	184,944
Slight	2,304	10,976	977	14,257
Average, all casualties	9,648	36,906	2,417	48,971

WebTAG guidelines on accident trend forecasts have been used in the economic appraisal. Using COBA guidance (paragraph 4.8), it is assumed that the severity split of accidents is maintained. In other words, the model applies the same underlying accident trend to both “fatality” and “seriously injured” figures. In addition, it has been assumed that current casualty figures are unaffected by the existing but negligible private eCall penetration rate.

The underlying number of people killed or seriously injured is modelled as linearly related to traffic in billion vehicle kilometres (data from the Road Transport Forecasts 2013) and to the trend change in accident rates per billion vehicle kilometres a year (using factors from COBA Table 4/1). As per COBA, the casualty rate per accident is assumed to be unchanged.

Because data on traffic forecasts and current accident numbers were not consistently available in the format and full granularity needed to apply COBA factors in full detail to forecast accident trends, two proxy approaches were used (relying on different assumptions for missing data) and the average was used. The two approaches provided similar results and their predictions of the number of casualties are consistently within 2% of each other between 2010 and 2040.

Using the average of the two forecasts, the resulting accident trend values are shown in Table 6-8. It can be seen that accidents are predicted to reduce until 2015 but then increase due to increased traffic volumes.

Appendix A.3 contains the annual total number of fatal and serious casualties and the number saved by each option.

Table 6-8 Accident Trends based on WebTAG and COBA Guidance

Years	Annual Percentage Change in Accidents
2011-2015	-0.200%
2016-2020	0.845%
2021-2025	1.295%
2026-2030	0.673%
2031-2035	0.972%
2036-2040	0.804%
2041-2045	0.804%

6.6.2. Summary of Quantified Benefits

Appendix A.4 contains the annual benefits for each option. Table 6-9 shows the total (undiscounted) benefits over the appraisal period (2015-2044) for each option.

Table 6-9 Summary of Benefits for Each Option

	Option 1 No EU Action		Option 2 Voluntary Approach		Option 3 Regulatory Measures	
	£M	€M	£M	€M	£M	€M
Fatality Savings	70	84	174	209	760	912
Serious Injury Savings	62	75	154	184	672	807
Total Benefits	132	159	328	393	1432	1719

6.6.3. Non-Quantified Benefits

Table 6-10 describes the benefits which have not been quantified in this economic appraisal, including the reasons for not quantifying them.

Table 6-10 Non-Quantified Benefits

Benefit	Description
Reduction in incident-related congestion	There may be a small reduction in incident-related congestion due to faster reporting of incidents with eCall. This is considered to be insignificant so has not been included in the quantified benefits of this appraisal. However because it was quantified by the EC 2011 IA and EC 2009 Study, it has been included in the sensitivity testing in Section 6.8.1.
Reduction in emissions	Emission savings may potentially arise from the reduction in incident related congestion, however this is considered to be marginal so has not been quantified.
Reduction in fuel consumption	Fuel consumption savings may potentially arise from the reduction in incident related congestion, however this is considered to be marginal so has not been quantified.
Reduction in secondary incidents	A reduction in secondary accidents would be most likely to occur as a result of faster notification on motorways, allowing driver information signs to be set. Our investigations suggest that the likely response time reduction is less than 2 minutes, this benefit is considered to be marginal so has not been quantified.

Benefit	Description
Improved response to medical emergency due to manual eCall	Vehicle occupants who suffer a medical emergency which is not related to an accident can use the manual eCall button to contact emergency services; the location data provided could potentially improve response times as for automatic eCall. This could result in reductions in casualty severity for additional people to those identified in the economic appraisal from accident statistics. This effect has not been quantified because: the number of people suffering from a medical emergency in a vehicle will be relatively low; those able to press a manual button but not make a normal voice call to provide location information will be a small proportion of these; the proportion for which casualty severity is reduced as a result will be small.
Improved response for accidents involving non-equipped vehicles	Occupants of non-equipped vehicles involved in collisions with eCall-equipped vehicles could benefit from improved response times. Additionally, someone with an eCall system who witnessed a collision involving non-equipped vehicles could use the manual eCall button to report it, potentially providing improved response times. These benefits are potentially useful but very difficult to quantify and are expected to be low compared to the quantified casualty reduction savings, so they have not been quantified.
Language barrier issues	Occupants of equipped vehicles who do not speak the local language (either visitors from other countries or residents) would benefit from the improved location information provided. This would be a relatively small benefit and difficult to identify so has not been quantified.
UK residents travelling overseas	The UK accident statistics used for the quantified casualty reduction savings cover UK residents and visitors from other countries, but UK residents who are involved in collisions in the EU would benefit from eCall, again particularly if they did not speak the local language. This would be a relatively small benefit and does not apply to a UK analysis so has not been quantified.
Resource savings in incident response	The response time improvement would reduce resources required for incident response, for emergency services and Highways Agency control room operators and traffic officers. This is a relatively marginal benefit so has not been quantified.
Availability of additional data on incidents	Some private eCall services provide additional information including the Vehicle Identification Number (VIN), data on crash severity, number of occupants and even whether they are still breathing. It is likely that additional improvements would be made in future, meaning a wealth of additional information which could be useful to emergency services. (Note it is unlikely that pan-EU eCall will require any of this data to be provided.) The benefits of this data would be relatively small and very difficult to predict and quantify, so have not been quantified.
Security of lone workers and vulnerable road users	Improved location data and faster emergency response would potentially provide disproportionately higher benefits for lone workers and vulnerable road users. This benefit would be relatively small and very difficult to quantify, so has not been quantified.
Reduction of insurance fraud	Improved location data and faster emergency response would potentially reduce the opportunities for vehicle occupants to make false insurance claims. The insurance industry sees this as a potentially high benefit for them and market solutions are being pioneered such as insurethebox and ingenie. The benefit is likely to be relatively low compared to casualty reduction savings and very difficult to quantify so has not been quantified.

6.7. Results of Economic Appraisal

Table 6-11 shows the key results of the economic appraisal; the net present values (NPV) of total costs, savings, net and BCR for each option and comparison with Option 1, the 'Do Nothing'.

The results show that none of the options has a positive net value or BCR of more than 1. For all options, the majority of both benefits and costs increase in proportion with IVS penetration rates, which is why the BCRs are relatively similar.

Option 2 shows a very slight improvement over Option 1, due to the slightly lower IVS costs. Option 3 is approximately twice as effective as Option 1, due to the significantly lower IVS costs. The BCRs for all options are far lower than those calculated by the 2011 EC IA; this is mainly for the following reasons:

- The casualty severity reductions are assumed to be 2% and 1.5% respectively of casualties from accidents involving cars and vans if all were equipped with eCall (rather than 2% and 1.5% of all accidents involving all vehicles).
- No congestion saving is assumed to be gained.
- The economic appraisal has been performed in accordance with WebTAG guidelines.

Table 6-11 Key Results of Economic Appraisal

Metric	Option 1 No EU Action		Option 2 Voluntary Approach		Option 3 Regulatory Measures	
	£M	€M	£M	€M	£M	€M
Present Value Costs	583	700	1271	1525	4554	5465
Average PV Annual Cost	29	35	64	77	228	274
Present Value Benefits	60	72	144	173	728	874
Average PV Annual Benefit	3	4	7	8	36	43
Net Present Value 2015-2044	-523	-628	-1127	-1352	-3825	-4590
BCR	0.10	0.10	0.11	0.11	0.16	0.16
Average IVS Cost per Vehicle	£193	€232	£172	€206	£116	€139

6.8. Results of Sensitivity Analysis

6.8.1. Test 1: Range of Benefits Assumptions

Tests of 'low' and 'high' benefits were performed and compared to the central forecast (the assumptions documented in Section 6.6). The 'low' benefits tests assumes that the casualty saving is half that of the main assumption. The 'high' benefits test assumes that the casualty saving is applied to all vehicle types (as per the EC IA 2011 and EC 2009 Study) rather than just cars and vans which are equipped. It also tests the possibility that congestion savings are actually gained, contrary to the findings of this study, using the EC 2009 Study assumption of a 3% reduction in incident-related congestion, a saving valued at €19.5M or £16.3M in the first year if all vehicles were equipped. Table 6-12 summarises these assumptions.

Table 6-12 Benefit Assumptions for Sensitivity Test 1

Assumption	Low	Central	High
Fatalities Reduced to Serious	1% car & van	2% car & van	2% all fatalities
Serious Reduced to Slight	0.75% car & van	1.5% car & van	1.5% all fatalities
Incident-Related Congestion Savings	0%	0%	3%

The results for Options 2 and 3 are shown in Table 6-13 and Table 6-14. It can be seen that with the high benefits forecast the BCR is still only 0.31 for Option 2 and 0.44 for Option 3.

Table 6-13 Results of Sensitivity Test 1 for Option 2 Voluntary Approach

Metric	Low	Central	High
Present Value Costs (£M)	1,271	1271	1,271
Average PV Annual Cost (£M)	64	64	64
Present Value Benefits (£M)	72	144	395
Average PV Annual Benefit (£M)	4	7	20
Net Present Value 2015-2044 (£M)	-1,199	-1127	-876
BCR	0.06	0.11	0.31
Average IVS Cost per Vehicle (£)	172	172	172

Table 6-14 Results of Sensitivity Test 1 for Option 3 Regulatory Measures

Metric	Low	Central	High
Present Value Costs (£M)	4,554	4554	4,554
Average PV Annual Cost (£M)	228	228	228
Present Value Benefits (£M)	364	728	1,992
Average PV Annual Benefit (£M)	18	36	100
Net Present Value 2015-2044 (£M)	-4,190	-3825	-2,562
BCR	0.08	0.16	0.44
Average IVS Cost per Vehicle (£)	116	116	116

6.8.2. Test 2: Main EC Assumptions in WebTAG-Compliant Model

The main cost and benefit assumptions used in the EC 2011 IA have been tested in the WebTAG-compliant model to compare the results. These are shown in Table 6-15 and Table 6-16.

Table 6-15 Changes to Costs Assumptions for Sensitivity Test 2

Option	Cost in Initial 6 Years	Cost after 6 Years
Option 1	£667 / €800	£500 / €600
Option 2	£375 / €450	£292 / €350
Option 3	£150 / €180	£104 / €125

Table 6-16 Changes to Benefits Assumptions for Sensitivity Test 2

Assumption	Assumed Reduction	Assumed Baseline Annual Trend
Fatalities reduced to serious	2% all fatalities	3.5% reduction per year without eCall
Serious reduced to slight	1.5% all fatalities	1.46% reduction per year without eCall
Congestion savings	3% all congestion costs (valued by EC at ~£5.5 billion in Yr 1)	1.02% reduction per year without eCall

Table 6-17 shows the results of this sensitivity test for the three options.

Table 6-17 Results of Sensitivity Test 2

Metric	Option 1 No EU Action	Option 2 Voluntary Approach	Option 3 Regulatory Measures
Present Value Costs (£M)	1556	2190	4558
Average PV Annual Cost (£M)	78	110	228
Present Value Benefits (£M)	174	402	2379
Average PV Annual Benefit (£M)	9	20	119
Net Present Value 2015-2044 (£M)	-1382	-1788	-2179
BCR	0.11	0.18	0.52
Average IVS Cost per Vehicle (£)	513	296	116

Even when the 2011 EC IA assumptions are used, the resulting Option 3 BCR of 0.52 using a WebTAG compliant method is much lower than the 1.74 calculated for whole of EU by the EC 2011 IA, for the following reasons:

- our analysis included replacement IVS costs at the end of each vehicle's 12 year life, whereas the 2011 EC IA assumes that benefits continue indefinitely without any need for IVS to be replaced;
- our analysis calculated total costs and total benefits for each option, rather than using incremental costs over Option 1 but assuming total benefits achieved;
- the UK is in the lowest benefits cluster used in the 2011 EC IA so the BCR is expected to be lower than that for the whole of the EU.

7. Conclusions

The EC has proposed the introduction of eCall based on 112 and on common pan-European standards (starting with certain categories of vehicles). It is proposed as a priority action to mitigate the consequences of road accidents, the EC's justification being that there has been a significant market failure in the provision of eCall, and only the implementation of regulatory measures can result in an effective solution.

This report contains the findings of a review of key reports and new evidence as well as consultations with stakeholders. The economic appraisal for the UK has been updated, comparing the three options from the 2011 EC IA:

- **Option 1: No EU action**, which assumes no action is undertaken by the EU Member States, thus leaving the initiative to the market. This is the baseline, 'Do nothing' scenario.
- **Option 2: Voluntary Approach**, which consists of supporting the development of common European standards, conducting eCall awareness campaigns and waiting for the Member States and relevant stakeholders to implement eCall voluntarily, relying on the eCall Memorandum of Understanding (MoU) and the common specifications to be approved within the Directive 2010/40/EU.
- **Option 3: Regulatory Measures**, which would require eCall to be fitted as standard factory equipment in all new vehicles in Europe, starting with certain categories, as well as setting up the framework for handling eCall in the telecommunication networks and PSAPs.

The 2011 EC IA found that the benefit-cost ratio (BCR) for Option 3 being taken forward on all cars and vans across the whole of the European Union (EU) would be 1.74. This is a relatively low return on investment and we have identified some aspects of the economic appraisal method applied by the 2011 EC IA which suggest that the BCR calculated using best practice methods could be even lower.

The 2011 EC IA assessed 'clusters' of countries with different predicted benefits and acknowledged that the benefits in some countries would be higher than others. This means some countries, including the UK, are likely to suffer a net loss as a result of implementing eCall.

The conclusions of this study about the economic appraisal of eCall in the UK are as follows:

- The key benefit will be due to casualty severity reduction but this will be lower in the UK than elsewhere due to a good national road safety and emergency response infrastructure.
- Incident-related congestion savings will be very low, mainly because if there are sufficient vehicles for congestion to result from a collision, there will be minimal delay in reporting it so the benefit of eCall will be very low.
- IVS costs will make up the vast majority of quantified costs and will be borne by vehicle buyers.
- For both the voluntary approach and regulatory measures, using the assumptions documented in this report, the costs far outweigh the benefits with BCRs of 0.11 and 0.16 for Options 2 and 3 respectively for the UK.
- The BCR values for the UK are lower than the 1.74 predicted by the 2011 EC IA due to a combination of factors: the lower benefits expected in the UK compared to elsewhere mean that the BCR for the UK will be lower than that for the whole of the EU; our analysis has led us to believe that the UK casualty severity and congestion savings are likely to be lower than those assumed by the EC; and a more rigorous appraisal methodology has been used (WebTAG). A sensitivity test in which casualty severity savings were approximately doubled and congestion savings were added still only provided a very low Option 3 BCR of 0.44.
- A further sensitivity test using the 2011 EC IA assumptions of UK casualty severity and congestion reductions in the WebTAG-compliant model resulted in an Option 3 BCR of 0.52 which is still much lower than the EC's estimate for the whole of the EU. This is likely to be only partly due to the UK benefits being lower than elsewhere and at least partly due to the more rigorous appraisal method.
- These results suggest that the BCR for the implementation across the EU might be lower than the 1.74 predicted by the 2011 EC IA.

In summary, while eCall might be beneficial in some countries, no clear business case has been established at a UK or a European level.

8. References

[1] *Commission Staff Working Paper: Impact Assessment accompanying the document "Commission Recommendation on support for an EU-wide eCall service in electronic communication networks for the transmission of in-vehicle emergency calls based on 112 (eCalls)"*, 2011, European Commission, ref SEC(2011)1019 final.

[2] *Impact assessment on the introduction of the eCall service in all new type-approved vehicles in Europe, including liability / legal issues: Final Report*, 2009, European Commission, ref SMART 2008/55.

[3] *UK eCall Impact Assessment*, 2010, TRL, ref PPR470.

[4] *eCall – The Case for Deployment in the UK: Final Report*, 2006, Secured By Design (SBD), ref SBD/TEL/1100a

[5] *Transport analysis guidance - WebTAG*, updated 2014, Department for Transport, https://www.gov.uk/transport-analysis-guidance-webtag

[6] *The Green Book: appraisal and evaluation in central government*, 2003 (updated 2011), HM Treasury, https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

Appendices

Appendix A. Details of Economic Calculations

A.1. Annual Percentage Equipped Vehicles for Each Option

NB. To allow the benefits of IVS fitted towards the end of the period to be included in the evaluation, the benefits of IVS systems still in the vehicle fleet are evaluated until 2044 when the number of vehicles equipped before 2033 remaining in the fleet drops to zero (assuming an average vehicle life of 12 years). This means the IVS costs until 2032 are calculated but the appraisal period continues until 2044.

Year	Option 1	Option 2	Option 3
2015	1%	1%	9%
2016	1%	1%	18%
2017	1%	2%	28%
2018	1%	2%	37%
2019	2%	3%	47%
2020	2%	3%	55%
2021	2%	4%	63%
2022	3%	4%	71%
2023	3%	5%	78%
2024	3%	6%	86%
2025	4%	7%	93%
2026	4%	9%	100%
2027	5%	11%	100%
2028	6%	13%	100%
2029	7%	15%	100%
2030	8%	18%	100%
2031	9%	21%	100%
2032	10%	25%	100%
2033	12%	30%	100%
2034	11%	29%	90%
2035	10%	27%	81%
2036	10%	26%	72%
2037	9%	24%	63%
2038	8%	22%	55%
2039	7%	20%	46%
2040	6%	18%	38%
2041	5%	15%	30%
2042	4%	12%	22%
2043	3%	9%	15%
2044	2%	5%	7%
2045	0%	0%	0%

A.2. Annual Costs for Each Option

Year	Option 1 IVS Costs (£M)	Option 2 IVS Costs (£M)	Option 3 IVS Costs (£M)	Call Centre Costs (All Options) (£M)	PSAP Costs (Option 2&3) (£M)
2015	8	17	387	0.1	0.20
2016	10	19	399	0.1	0.04
2017	12	23	410	0.1	0.04
2018	14	27	422	0.1	0.04
2019	16	32	433	0.2	0.04
2020	35	54	445	0.2	0.04
2021	23	39	314	0.2	0.04
2022	27	47	320	0.2	0.04
2023	32	57	326	0.2	0.04
2024	37	69	332	0.2	0.04
2025	44	84	338	0.2	0.04
2026	52	102	349	0.3	0.04
2027	61	131	360	0.3	0.04
2028	72	160	371	0.3	0.04
2029	85	195	381	0.3	0.04
2030	101	237	392	0.4	0.04
2031	119	290	403	0.4	0.04
2032	155	367	414	0.4	0.04
2033	168	436	424	0.5	0.04
2034	-	-	-	0.5	0.04
2035	-	-	-	0.5	0.04
2036	-	-	-	0.5	0.04
2037	-	-	-	0.5	0.04
2038	-	-	-	0.5	0.04
2039	-	-	-	0.5	0.04
2040	-	-	-	0.5	0.04
2041	-	-	-	0.5	0.04
2042	-	-	-	0.5	0.04
2043	-	-	-	0.5	0.04
2044	-	-	-	0.5	0.04

A.3. Total Number of Fatal and Serious Casualties and the Number Saved by Each Option

Year	Fatal Accidents	Number Reduced to Serious Injuries		
		Option 1	Option 2	Option 3
2015	863	0	0	2
2016	870	0	0	3
2017	877	0	0	5
2018	885	0	0	7
2019	892	0	0	8
2020	900	0	1	10
2021	911	0	1	12
2022	923	0	1	13
2023	935	1	1	15
2024	947	1	1	16
2025	960	1	1	18
2026	966	1	2	19
2027	973	1	2	19
2028	979	1	2	20
2029	986	1	3	20
2030	992	2	4	20
2031	1002	2	4	20
2032	1012	2	5	20
2033	1022	2	6	20
2034	1031	2	6	19
2035	1041	2	6	17
2036	1050	2	5	15
2037	1058	2	5	13
2038	1067	2	5	12
2039	1075	2	4	10
2040	1084	1	4	8
2041	1093	1	3	7
2042	1102	1	3	5
2043	1110	1	2	3
2044	1119	0	1	2

Year	Serious Accidents	Number Reduced to Slight Injuries		
		Option 1	Option 2	Option 3
2015	8704	1	1	12
2016	8777	1	2	24
2017	8852	2	2	37
2018	8926	2	3	50
2019	9002	2	3	63
2020	9078	3	4	75
2021	9195	3	5	87
2022	9315	4	6	99
2023	9435	4	7	111
2024	9557	5	9	123
2025	9681	6	11	135
2026	9746	6	13	146
2027	9812	7	16	147
2028	9878	9	19	148
2029	9945	10	22	149
2030	10012	12	27	150
2031	10109	13	32	152
2032	10207	16	39	153
2033	10306	18	47	155
2034	10406	17	45	141
2035	10508	17	43	128
2036	10592	16	41	114
2037	10677	14	39	101
2038	10763	13	36	88
2039	10849	12	33	75
2040	10937	11	29	63
2041	11025	9	25	50
2042	11113	7	20	37
2043	11202	5	15	25
2044	11293	3	8	12

A.4. Annual Benefits for Each Option

Year	Savings due to Reduced Fatalities (£M)			Savings due to Reduced Serious Injuries (£M)		
	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
2015	0.2	0.3	2.4	0.2	0.2	2.1
2016	0.3	0.3	4.9	0.2	0.3	4.3
2017	0.3	0.5	7.6	0.3	0.4	6.7
2018	0.4	0.6	10.4	0.3	0.5	9.2
2019	0.5	0.7	13.5	0.4	0.7	12.0
2020	0.6	0.9	16.5	0.5	0.8	14.6
2021	0.7	1.1	19.5	0.6	1.0	17.3
2022	0.8	1.4	22.7	0.7	1.2	20.0
2023	0.9	1.7	25.8	0.8	1.5	22.8
2024	1.1	2.1	29.0	1.0	1.9	25.7
2025	1.3	2.6	32.6	1.2	2.3	28.8
2026	1.6	3.2	36.0	1.4	2.8	31.8
2027	1.9	3.9	37.0	1.7	3.4	32.7
2028	2.2	4.8	38.0	2.0	4.2	33.6
2029	2.6	5.8	39.0	2.3	5.2	34.5
2030	3.1	7.1	40.1	2.7	6.3	35.4
2031	3.7	8.8	41.3	3.2	7.8	36.5
2032	4.3	10.8	42.5	3.8	9.5	37.6
2033	5.2	13.3	43.8	4.6	11.7	38.7
2034	5.0	13.0	40.7	4.4	11.5	36.0
2035	4.9	12.7	37.6	4.3	11.2	33.2
2036	4.7	12.3	34.3	4.1	10.9	30.4
2037	4.4	11.8	31.0	3.9	10.4	27.4
2038	4.2	11.2	27.6	3.7	9.9	24.4
2039	3.8	10.4	24.0	3.4	9.2	21.2
2040	3.5	9.5	20.4	3.1	8.4	18.0
2041	3.0	8.3	16.6	2.7	7.3	14.7
2042	2.5	6.9	12.7	2.2	6.1	11.2
2043	1.8	5.1	8.6	1.6	4.5	7.6
2044	0.9	2.8	4.4	0.8	2.5	3.9

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