Clarification Paper – *BC 1*

Overview of available studies on proven or assessed benefits of e-Call

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Chapter 1 - Introduction

1.1 Objectives

In order to assess and secure the socio-economic benefits of European e-Call, it is necessary to collect, compare and combine existing studies and test results.
These proven figures and acceptable assumptions shall support the business case analysis, and allow further discussions on how the stakeholders can balance efforts and benefits for a common willingness to roll out this program.
These figures shall also help to determine how the expected benefits are distributed between public and private sectors.

1.2 Stakeholders concerned

Benefits of e-Call are mostly demonstrated in reducing

- the medical consequences of a crash,
- the risk of further accidents on the scene,
- the impact of an accident on traffic,

and in improving the emergency operations (better information on the context, p/e airbag deployment information).

Most concerned stakeholders are then public actors (health, emergency, road and security sectors), and in a lesser extend private insurances and road/bridges infrastructures operators.

On the other end, it is obvious that customers / citizens will get benefits from EC e-Call roll out, but so far most if not all the existing attempts to sell such services turned in very limited success.
One can assume that raising customer awareness on personal benefits (own and family security) may prove a positive communication and raise political and involved industries image, by showing high level commitment to customer security. But willingness to pay shall keep low, as rescue is seen as a public duty. Then all ECDG group consider first step of e-Call as a citizen security approach.

Last all involved industries shall be concerned to confirm that expected and demonstrated benefits balance the roll-out costs, and that those who shall invest in equipping the vehicles, carrying the calls and upgrading the rescue chain, will get compensations from those who get benefits from this effort, and later from potential commercial services (to be confirmed by market pull).

Chapter 2 - Executive summary

e-Call, as defined by e-Safety and ECDG work group, has a clear positive impact in reducing the consequences of road accidents when they cannot be avoided, including the opportunity to warn surrounding vehicles faster, avoiding then further accidents.

e-Call shall also improve rescue efficiency (then reducing rescue cost per accident) and reduce consequences on traffic by a faster information for surrounding vehicles.

From all relevant studies and field test so far, we can assume that:

- Golden Hour concept is a universal and well known concept in rescue: survival rate and long term consequences of injuries are reduced for each minute gained to reach the scene. 80 % of injured people with serious trauma die within one hour if no adequate medical treatment. There is no discussion on this concept.
- Automatic alert and precise location will reduce by an average 10 minutes the rescue time in rural area (50% gain over existing alert), and by 3 to 4 minutes in urban accidents (40% gain). Knowing that most critical accidents occur by night in rural areas, e-call benefit in reducing rescue time is expected in the high of the bracket.

  This varies from country to country, but all studies (EC and US) raised the conclusion that e-Call has a direct socio-economic impact:
- 3 to 15 % of fatalities should be avoided (large bracket due to country related context, as current rescue efficiency, road and population distribution…)
- Up to 15% of serious injuries shall be avoided to slightly injuries (large bracket as well, then shall be further confirmed on country per country basis).

Last but not least, **all studies demonstrated that benefit to cost ratio should be between 1.3 and 8.5**, without taking into account side benefits as better related traffic management, and rescue productivity rising.

Public sector will get most of this benefit, then insurance sector and customer.

Non direct financial benefits as image building, social care and better road management, are not taken into account.

All studies confirm a socio-economic benefit beside of human life saving opportunity, and of positive communication this effort can bring to citizen and customers. Worst scenario is leading to 1.1 benefit-to-cost ratio, securing the collective effort to promote e-Call.

From existing studies and tests, a close cooperation among stakeholders could make a 3 ratio an acceptable target.

A large bracket of potential effect on death and injuries severity is linked with country related environment, but as most critical situations occur in rural areas and by night, it can be expected that e-Call benefits on operation shall be over the bottom figure in average.

Chapter 3 - Sector description

3.1 Introduction

e-Call is based on immediate alert by shock sensor in case of crash, together with precise location coordinate, vehicle identification and time. E-Call can bring further information on the context, occupants, map location, but this shall require more complexity and costs, and then is expected for a second step.
This document is focusing only on the benefits expected from first step, automatic trigger and location going directly to local Public Safety Answering Point as for mobile 112 calls.

Information sources:

EC : In the late 90's and early 00's, most Car Makers and some Service Providers launched in European countries automatic and manual e-Call, from a well accepted and somehow demonstrated customer benefit from shorter alert, localization and further filtering and information processing. Private tests where conducted in major European countries, some implying local Emergency Organizations. These tests results where not published, but one can expect that they shown rescue improvement as a group of offers reached the market. In this early European stage, most relevant study published was STORM[1].
Since e-Safety launched e-Call initiative, EC initiated in 2004 a specific study with SEISS[2], and Sweden with Stratega/transek[3].

US: In the North American market, private service providers rolled out even earlier e-Call commercial offers. OnStar (GM) and ATX are still operating private e-Call, but beside of testimony advertising and communication statistics, there is little robust information we can trust in. On the other end, NHTSA and ITS America produced public statistics and reports, giving a strong base for accident distribution and cost assessments, together with some coherent metrics on how immediate alert and location can speed up rescue and reduce socio-economic impacts.

In Japan, HelpNET is a cooperative e-Call approach allowing major telematics service providers to propose this service in commercial bundles. No statistic on efficiency is easily available so far.

[1] Stuttgart Transport Operation by Regional Management, 1999.

[2] Exploratory Study on the potential socio-economic impact of the introduction of ITS in road vehicles; VDI/VDE/IT/IfV Köln 2004.

[3] Short description of ITS safety applications and their potential safety benefits, Stratega/transek, 31/12/2003

Analysis:

1 – Effect of rescue time on death and injuries: The earlier and more precisely medical treatment can be given following an accident, the higher the chance to save lives and reduce injuries severity. In the field of accident and emergency medicine the "golden hour" is a worldwide well-accepted principle on the importance of early medical treatment. "Words of Experts" say that 80 per cent of injured people with serious traumas (head, breast, heavy bleeding etc.) die within an hour if they do not receive adequate medical treatment. The survival rate increases and the long-term consequences of serious injuries are reduced for each minute gained for the emergency services.

2 – time to the scene : Both American field trials and European studies indicate that the average time between accident occurrence and medical help reaching the scene has be reduced by 10 minutes (50%) in rural area, and by 4 to 6 minutes in urban area (40%).

This is an average performance, and there are obviously situations and places where the performance can be very limited (downtown, day time, near emergencies…) and other where it can be tremendously higher (remote country road, night time[4])

Nevertheless, these figures sort out as robust and confirmed statistical effect, and can be proposed as a very consistent base for benefits assumption.

Precise location is further avoiding search by rescue team, raising operational efficiency of these teams and then improving their productivity. No figures so far are allowing assessing this effect.

3 – Effects on death and medical severity: **ECDG** shared in 2004 a lot of US and some EC finding, through a document name "e-Call economic impact for society; contribution to rationale analysis on benefits". (Annex 1) This work drove to the conclusions that shorter reach will allow up to 15% death reduction and less severe injuries. This study is bringing a lot of US and EC reference documents and web-sites, together with interviews outputs with eminent US specialists.

E-Merge report reached the same level of potential effects on severity: According to E-Merge and, 5 % to 15 % of road fatalities can be reduced to severe injuries and 10 % to 15 % of severe injuries can be reduced to slight injuries. For slight injuries, no positive effect of eCall was foreseen (E-Merge 2004: 49).

SEISS study (annex 2) was ordered by EC late 2004 to further assess impact of ITS. Among them e-Call impact was assessed. SEISS took the same range of severity effects than E-Merge and ECDG, and added a 10 to 20% reduction of congestion time. SEISS extended these assumptions with relevant cost assumptions for vehicle and PSAP equipments and operation costs, and went to the conclusion that e-Call was granting a fair benefit-cost ratio, ranging from 1.3 up to 8.5:

"This gives us a range of attainable benefit-cost ratios of between 1.3 and 8.5, which represents the combined consideration of the "pessimistic view" and the "optimistic view" for

[4] According to figures from Germany's Federal Statistics Bureau, more than 40% of all automobile accidents resulting in death occur at night, when night traffic is 80% lower than day traffic.

final recommendations of eCall.
The "pessimistic view", with 1.3 as the benefit-cost ratio for eCall, shows that, even with a low success rate and high cost figures, the introduction of eCall is justified, because the resource savings exceed the costs. This means that eCall would, even under pessimistic assumptions and hypotheses, contribute to the welfare of the EU-25.
The "optimistic view" shows that in the best case, which means that system efficiency is reached and costs are minimized due to economies of scale, society can expect to see a benefit of 8.5 € for every 1 € spent on eCall."

Nevertheless, a specific Swedish study was made by Vägverket in 2003 (annex 3) suggest that the potential for Sweden is much lower, assumedly due to country specific elements. According to the study, balanced evaluation assumes that the potential in Sweden is between 10 and 20 lives saved per year with eCall, i.e. 2-4 per cent of the number of road fatalities. The proportion of seriously injured with permanent problems is expected to be reduced by 3-4 per cent. An overall assessment of the benefits also includes a small contribution for reduced delays for road users resulting from speedier road clearance mainly in urban areas. A total annual benefit in Sweden amounts to SEK 550-830 million.
This cost estimate includes an annual cost for investment and operation of emergency alarm centres (SEK 3.5 million) and an assessment of how much vehicle equipment (only the eCall function) will cost when prices have stabilised after a period of operation. The cost for equipping the entire vehicle fleet is estimated in the longer term to SEK 350-500 million per year, which gives a **benefit-cost ratio of between 1.1 and 4.2**. The system is therefore socio-economically profitable even using a pessimistic entry assessment on efficiency.

3.2 Open issues

It is always a matter of local context and existing organization, to clearly determine how much e-Call shall improve emergency action, then reducing consequences and costs. All studies are getting to the same conclusion that e-Call shall bring a positive cost-benefits ratio, but financial extrapolations could be further discussed with cost updates and more comprehensive benefits assumptions.
We propose to consider Golden Hour effect and time to the scene reduction as quite robust statistical inputs.
We also recommend to take 10 to 15% improvements (both on death and severity) as a valid assumption for average effect in Europe, as it is supported by a significant base of US and EU studies.

Chapter 4 - Conclusion

Late 1990's, e-Call was a promising approach to enhance alert and rescue in case of traffic accident.

A lot of private attempts to define, operate and sell e-call raised a significant knowledge base within the industry, but poor commercial success (for what turned out as an attractive but driving low willingness to pay) made most private players to stop or reduce their efforts. We can nevertheless consider that operational efficiency was observed in most of these private attempts.

On the other end, public and academic sectors, together with ITS stakeholders, made trials and analysis in US and EC. All these analysis bring to the same conclusion that e-Call is definitely bringing a better and shorter answer to road accidents, and promising in any scenario a positive cost-benefit ratio.

Draw-backs are very large bracket of potential gains, and some questions on how we can extract and secure economic benefits out of operation improvements.
Going through all available studies as listed in this document, we can assume that most tests and studies are supporting the upper middle range of results, and that 3.0 cost-benefits ratio could be a good common target for a pan-European e-Call. Economic benefits are already quite well supported by consistent US and EC statistics on cost which shall be directly affected by immediate alert and precise location, and by sound assumptions on side effects on traffic consequences of a crash.

Chapter 5 - References

Annex 1: ECDG "e-Call economic impact for society: contribution tot rational analysis on benfits", September 2004

Annex 2: SEISS final report "Exploratory Study on the potential socio-economic impact of he introduction of Intelligent Safety Systems in Road Vehicles", January 2005

Annex 3: Swedish study by Vägverket in 2003

Other sources :

NHTSA annual report 2000 (http://www.nhtsa.dot.gov/people/economic/EconImpact 2000)

Recommendations for ITS Technology in Technology in Emergency Medical Services, August 2003, William T. Baker, ITS America, (202) 484-4540. *www.itsa.org*

US Department of Transportation – ACN Field Operational Test, Western New York area, 2000, Ref DOT HS 809 303,
www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/ACN%20Final/index.htm#toc

Intelligent Transportation Systems Benefits and Costs, update 2003
Mitretek System for Fedral Highway Administration, Report N° FHWA-OP-03-075;
http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/13772.html

ACN Field Operational Test, Erie County, New York, 2001 *Ref DOT HS 809 304,*
http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13830.html

OECD report **Road Safety** impact of New Technologies ***http://www.escope.info/index.html?file=224***

Annex 1 :

e-call economic impact for society
Contribution to rational analysis on benefits

1 – Objectives of this document

From European Commission goal to reduce road fatality by 50% in 2010 (compared to 2000), and e-Safety Forum recommendation to raise e-Call as first priority within vehicle innovation contributing to this objective, a private and public workgroup "ECDG" raised several recommendations on the best way to operate e-Call trough Europe, and is now focusing on business rational and roll out scenario.

At this stage, it has been recommended and agreed that gradually each vehicle will be fitted with a device allowing automatic trigger of a call (voice+data) directly to e112 selected PSAP, together with precise location, identification, time stamp, and server coordinates offering extra relevant information when available. This first step[5] is the only focus of this analysis.

This approach is in line with several trials and existing products, in Europe and USA. This is allowing identifying benefits related with time saved in alerting and routing rescue, together with side effects on global efficiency and incident management.

Key questions raised in this document are:

1. What are the impacts of automatic trigger and precise location in rescue time, and incident management ;
2. How these impacts turns into better efficiency / lower consequences
3. How better efficiency brings economic impacts beside of human care,and how much could be saved by equipped car,
4. and who shall benefit from this effort

2 – Context: Global economic impact of vehicle's crashes

[5] A further step shall allow to collect and manage extra data in order to deliver as much information as PSAP can use to improve rescue operation, and to allow third parties to act beside emergency response to service the distressed people or warn surroundings.

A car crash has a global cost for society, beside of human drama and political issue.

This economic impact is a shared burden, with emergency operation costs, insurance costs, health costs and lost workplace / productivity costs.

A very strong report is available at NHTSA (http://www.nhtsa.dot.gov/people/economic/EconImpact2000), and is used as reference for this analysis paper. Such figures exist in Europe but they are not available in such a format that a rapid analysis can be done on e-Call case.
We can nevertheless assert that figures are in the same range, as global markets are quite similar:
We then propose to use NHTSA report as a reference document, and to challenge major assumptions with European known situations and figures.

Year 2000 commonly agreed figures	**USA**	**Europe (source : EU COM 311 Final.)**
Total registered cars	217 028 000	200 000 000
Total new cars sold/year	17 000 000	16 000 000
Total casualties	3 189 000	1 700 000
Total fatalities	41 821	More than 40 000
Estimated total cost of crashes (k$)	230 600 000	Est 160 000 000

Source : NHTSA report "the economic impact of motor vehicle crashes 2000", may 2002.
Economic Impact of Crashes

> The cost of motor vehicle crashes that occurred in 2000 totaled $230.6 billion. This is equal to approximately $820 for every person living in the United States and 2.3 percent of the U.S. Gross Domestic Product.
> The lifetime economic cost to society for each fatality is over $977,000. Over 80 percent of this amount is attributable to lost workplace and household productivity.
> Each critically injured survivor cost an average of $1.1 million. Medical costs and lost productivity accounted for 84 percent of the cost for this most serious level of non-fatal injury.
> Lost workplace productivity costs totaled $61 billion, which equaled 26 percent of the total costs. Lost household productivity totaled $20.2 billion, representing 9 percent of the total costs.
> Total property damage costs for all crash types (fatal, injury, and property damage only) totaled $59 billion and accounted for 26 percent of all costs.
> Property damage only crashes (in which vehicles were damaged but nobody was injured) were the most costly type of crash, due to their very high rate of occurrence. Their costs totaled $59.8 billion and accounted for 26 percent of total motor vehicle crash costs.
> Present and future medical costs due to injuries occurring in 2000 were $32.6 billion, representing 14 percent of the total costs. Medical costs accounted for 26 percent of costs from non-fatal injuries.
> Travel delay cost $25.6 billion or 11 percent of total crash costs.
> Approximately 9 percent of all motor vehicle crash costs are paid from public revenues. Federal revenues accounted for 6 percent and states and localities paid for approximately 3 percent.
Private insurers pay approximately 50 percent of all costs. Individual crash victims pay approximately 26 percent while third parties such as uninvolved motorists delayed in traffic, charities, and health care providers pay about 14 percent. Overall, those not directly involved in crashes pay for nearly three-quarters of all crash costs, primarily through insurance premiums, taxes and travel delay. In 2000 these costs, borne by society rather than by crash victims, totaled over $170 billion.

3 – Impact analysis from existing materials

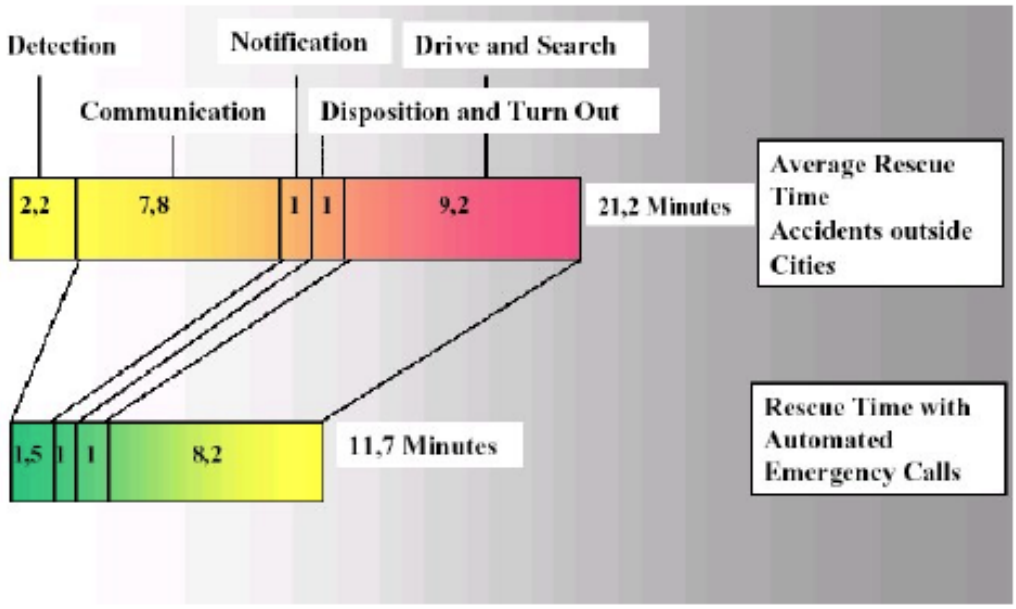
3.1 – Impact of automatic trigger, precise location and identification in rescue time and incident management

Automatic triggered emergency call with precise location & direction shows a clear improvement in reducing rescue time at the crash scene.

Quite robust assumptions can be shared from European and US trials and reports, as they were made in various places and times and reached the same levels:

Europe:

E-merge project used a German study "STORM" (Stuttgart Transport Operation by Regional Management), showing almost 50% rescue time improvement in rural area, with a net gain of almost 10 minutes:



Source: E-merge WP2

When the average time in urban areas decreased from 13 minutes down to 8 minutes.

PSA and Renault were also involved with French "Préfecture de Paris" for a live test in Paris (summer 2000), and its nearby rural area. This test proved the same kind of positive effect on rescue time, and rescue coordination enhanced efficiency. It also shown the opportunity to rise alert to the environment, and then to avoid over-accident and route congestion.

USA:

These figures and information have been collected on several US federal websites, as recommended by Dr. Ricardo Martinez, former NHTSA Administrator (94/99) and current CEO of Safety Intelligence System. Phone interviews and mail exchanges with Dr Martinez secured these elements.

✓ Average times without Automatic Crash Notification (ACN) in USA are in line with STORM report, regardless of differences in road infrastructures, cars and driving behavior[6]:

Area type	*Average notification*	*Average time to scene*	***Total***
Rural	*9,6 min*	*11 min*	***20,6 min***
Urban	*5,2 min*	*3,4 min*	***8,6 min***

✓ Emergency efficiency: *ACN allow a strong average 2 minutes. notification time when an average rural 7 minutes was going up to hours* [7]: to compare with 11 minutes down to 2.5 minutes in Storm study. Rural crashes account for most of the fatalities (60%), and single rural crashes for almost 1/3 of US fatalities. This is likely to be at same levels in Europe, when e-Call is proving maximal impact in rural areas.

✓*PSAP efficiency: ACN reliability to avoid false alarms was proven in a 700 ACN system pilot 3 where a low 3.5% false alarm was observed. 27% of received calls were originated by mobile phones at time of the report. This share is still growing, bringing multiple call for a same incident (80 to 100 calls per crash in urban area, to compare with an average of 6 call from fixed lines!), together with loose or no location. ACN can help to filter calls thanks to automatic trigger and*

[6] Recommendations for ITS Technology in Technology in Emergency Medical Services, August 2003, William T. Baker, ITS America, (202) 484-4540. www.itsa.org

[7] US Department of Transportation – ACN Field Operational Test, Western New York area, 2000
Ref DOT HS 809 303, www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/ACN%20Final/index.htm#toc

precise location. Public Safety Community able to successfully use ACN; can help to adapt resources to the case (FSD) 3

✓ Side effects: *Fast notification of an incident for surrounding traffic allowed 2,8% new crash reduction (San Antonio, Texas) and reduced average incident duration by more that 55% (Maryland)*[8]

Conclusions:

- STORM figures are viable assumptions, from US bench and "words of experts". Regardless the time and place, same level of results were observed in US and Europe.
- E-Call shall allow almost 50% shorter reach (about 10 minutes saved) to the scene in rural area, where alert can be very late and location hard to find, and up to 40% shorter reach in urban areas (4 to 5 minutes).
- Moreover, US tests proved impacts on surrounding warning, then reducing risks of new crashes and dropping average incident duration by more than 50%.
- Last, e-Call brought a better PSAP resources efficiency by reducing false alerts and allowing better resources fit to the scene.

3.2 – How these impacts turn into better efficiency and lower severity

Emergency Organizations are well aware of the "Golden Hour" concept, stating that the first tens on minutes following a crash are critical for survival or reduced injuries.

A good presentation of this concept is available on an US ITS report.
US Department of Transportation – ACN Field Operational Test, Erie County, New York, 2001[9] :
"The time dependence of trauma is commonly accepted. For example, Reference 21 states for traumatic brain injury, "All neurological damage does not occur at the moment of impact (primary injury), but rather evolves over the ensuing minutes, hours, and days. This secondary brain injury can result in increased mortality and more disabling injuries." What remains in question is the exact quantification of this variable. Contemporary literature in this field (References 20 - 24) often refers to a "golden hour" where the first 60 minutes of care after a multiple trauma injury is described as "crucial." Furthermore, within this first hour, care seeking to correct the underlying problem causing the patient's condition to worsen must be administered. This type of care can best be administered in a suitable facility such as an emergency room or, even better, a

[8] Intelligent Transportation Systems Benefits and Costs, update 2003
Mitretek System for Fedral Highway Administration, Report N° FHWA-OP-03-075; *http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/13772.html*

[9] *Ref DOT HS 809 304, http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13830.html*

dedicated trauma center. Thus, transport of the victim to such a facility needs to be accomplished within this time frame. Administration of fluids and other simple, supportive care treatments, while not enough in critical situations, should be started within the "Golden Ten Minutes" (Reference 25). This offers a loose bound of 10 minutes on the time from the occurrence of the motor vehicle crash to the arrival of medical aid in severe cases. "…"The change in the time distribution of deaths resulting from trauma is significant due to the likely causes of these changes. The "early deaths" peak likely has been reduced due to a better understanding of trauma and improved facilities and thus more quickly administered medical aid. A study reported in 1998 in Portland, Oregon (Reference 29) further bolsters the importance of the time-dependence of trauma. The researchers found, after examining 848 trauma cases, that the response time was significantly shorter (3.5 ± 1.2 minutes) for unexpected survivors compared to unexpected fatalities (5.4 ± 4.3 minutes). Simply put, a shorter response time resulted in a greater likelihood of survival. "

Even if we can hardly turn that common understanding into robust statistics, it is obvious that saving average 10 minutes in rural area, where almost 2/3 of crashes and 1/3 of fatalities occur (and securing an alert when no witness can give a good Samaritan call within minutes), will have a dramatic positive impact in saving people and reducing severity of wounds. A very conservative assumption would be a 10% average reduction of severity; a more realistic view could be up to 20%.

US Department of Transportation – ACN Field Operational Test, Erie County, New York, 2001[10] :

An ACN system should reduce the length of time between traumas and needed restorative medical care. Extrapolating from the findings of air transport fatality reduction studies (References 30 and 31), the ACN system could offer an approximate 20% reduction in fatalities from motor vehicle collisions. This estimate assumes that adequate medical facilities would be available. Unfortunately, no studies have been found to assess the time dependence of injury severity caused by motor vehicle trauma. Thus, any estimate of the affect of ACN on reducing injury severity would be little more than a guess. This area requires further study. However, an NHTSA-sponsored multidisciplinary research team has produced a computer program (References 2, 4, and 5) which attempts to produce an easily understood probability of serious injury estimate making use of data which would be available from an ACN system.

To further support this assumption, another US study (non identified but quoted in [2]) came down to the conclusion that ACN could save a yearly 1676 life (6%) and have "even more far reaching" effect on severity of highways injuries.

[10] *Ref DOT HS 809 304, http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13830.html*

Side effects on incident management and improved rescue efficiency (false call filtering, better resources fit to the situation) can hardly be estimated, but can be seen as bonuses securing the 10% assumption.

Conclusion:

e-Call shall allow a conservative 10 to 15% average gain on severity brackets (as used in MHTSA reference report), together with improved rescue costs and reduced incident impact on the traffic.

3.3 – Financial Benefits of e-Call

A key pending question is now, from confirmed benefits of e-Call (reduction on rescue time on European accidents, improved PSAP efficiency, better surroundings warning), to evaluate the global economic benefits from existing statistics and costs split.

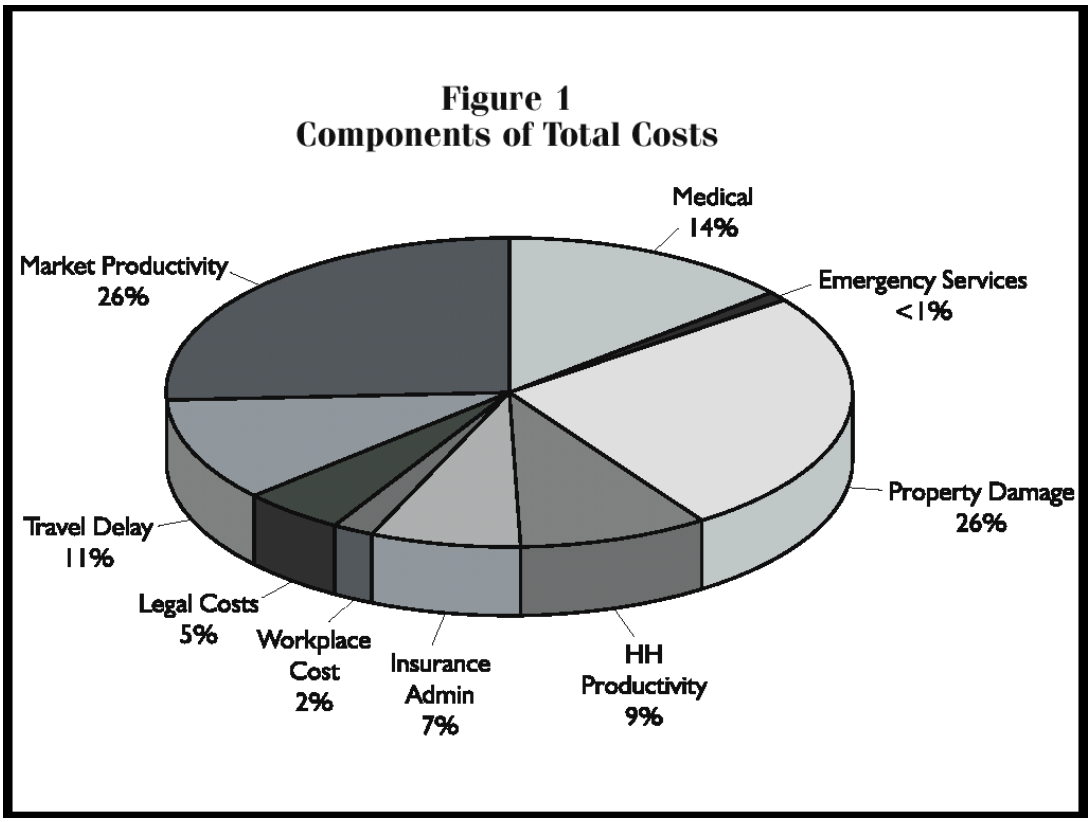
- E-call benefits are mostly expected to reduce fatality and injury level, with a direct impact in health costs (public sector & insurances) and insurance costs (insurances).
- It should also reduce emergency services costs (public sector) and travel delay (speeding access to the crash and information to road users: public sector)
- Legal costs should as well be reduced according with crash severity reduction, and using data received from the crash scene to better solve legal disputes.
- Last, market productivity and household work loss are less directly linked with identified players, but must be a political concern and by the way, drive attention from state organization as well as insurance companies.
- The main field where e-call has a marginal impact (if any) is on Property Damages.

High level assumptions

From NHTSA figures, and not diving into details, we can already bring some assumptions and estimate the economic effect.

✓ First high-level assumption is that reduced time to the crash should bring up to 15% of the victims to the lower category.

✓ Second assumption from NHTSA split of total cost, is that e-call shall impact at least 50% of this total cost, with lower perceived benefit on Productivity issues and Property Damages as insurance ability to recover on these cost is not yet proven.



Part of this amount impacted by shorter rescue time	
Medical	14%
Rescue cost	1%
Market productivity	26%
Household Productivity	9%
Workplace Cost	2%
Travel delay	11%
Insurance administration	7%
	70%

✓ Third assumption is that European crash figures are the same than US, and that 1 USD = 1 EUR

From these three high level assumptions and NHTSA figures, and as a discussion basis, we can bring complementary following analyses:

<u>1 – First assumption from US current cost split by severity:</u>

To support this way of computing the possible savings due to an e-Call system, it may be worth to mention again a US study (US Department of Transportation – ACN Field Operational Test, Erie County, New York, 2001[11]):

To compute the possible cost savings that could result due to an ACN system, several assumptions need to be made. The dollar amounts shown in the preceding paragraph have to be averaged over the number of people injured or killed. This assumes that each person injured or killed caused an equivalent financial loss, or, that the inexpensive ones exactly balance the expensive cases. Next, it is assumed that the total number of people killed or injured would remain the same. Although there could be a substantial reduction in the number of people injured due to the ACN, this is not taken into account. Thus, if usage of the ACN system reduced the number of fatalities, the number injured would increase by approximately the same amount. Those who originally would have been fatalities but survive due to earlier medical intervention might be considered to become injured at the "average" financial level. Although this may seem counterintuitive at first, two factors support this assumption. First, neurological traumas in automobile crashes can result in severe and expensive permanent disabilities. However, many of the fatalities caused by severe neurological trauma would be virtually impossible to prevent. Secondly, those people who could be saved by earlier medical intervention often die from loss of blood or difficulties breathing. If these injuries can be stabilized, many times a full recovery can be expected as opposed to an extremely expensive and permanent handicap.

This is quite in line with existing analysis shared by e-Call Driving group, as hereafter:

Year 2000	Total cost	Population	Unit average cost
Fatalities	40 859 117 000	41 821	$ 977 000
Very severe injury (MAIS 5)	10 372 971 543	9 463	$ 1 096 161
Severe injury (MAIS 4)	12 709 987 697	36 509	$ 348 133
MAIS 3	23 430 170 591	125 903	$ 186 097
MAIS 2	29 133 987 740	436 007	$ 66 820
MAIS 1	49 214 536 770	4 659 585	$ 10 562
MAIS 0	5 000 074 596	2 548 458	$ 1 962
	170 720 845 937		

This is already removing Property Damage Crashes (about 60 billion USD), as they show no clear benefit from e-call (except over-accident avoiding).

[11] *Ref DOT HS 809 304, http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13830.html*

In order to reduce interpretation on severity of injury and bracket effects, we propose to reduce number of severity levels by half:

Year 2000, EU=US	Population	average Per Person Costs
Fatalities	41 821	$ 977 000
Severe injury (MAIS 4+5)	45 972	$ 502 109
Medium injury (MAIS 2+3)	561 910	$ 93 546
Light injury (MAIS 0+1)	7 208 043	$ 7 521

Then, to consider that a fairly conservative 15% of crashes victims will fall in lower category thanks to e-call reduced time to the scene:

	Initial Population	Improved population
Fatalities	41 821	35 548
Severe injury (MAIS 4+5)	45 972	45 349
Medium injury (MAIS 2+3)	561 910	484 519
Light injury (MAIS 0+1)	7 208 043	6 211 123

We can of course consider that light injuries will not benefit in the same extend of reduced emergency arrival time, but the risk of waiting beside of a car in a crash situation may prove some benefits as well.

Economic outlook would then be:

	Improved population	average Costs Per Person	Improved costs
Fatalities	35 548	$ 977 000	$ 34 730 249 450
Severe injury (MAIS 4+5)	45 349	$ 502 109	$ 22 770 321 013
Medium injury (MAIS 2+3)	484 519	$ 93 546	$ 45 324 605 719
Light injury (MAIS 0+1)	6 211 123	$ 7 521	$ 46 716 372 572
		Total	**$149 541 548 754**

Estimated total economic benefit for all players should then be around 21,180 million €,

This first estimate does not take into account operation efficiency improvements, nor reduced congestion and further accident avoiding.

From the above calculation, and the new cars sold each year in Europe (16 000 000), we can identify a 662 € statistic saving opportunity per new car sold.

2 – From estimated average risk per vehicle & per year

A simpler way to compute a rough estimate would be to identify average yearly risk per vehicle from global costs, then to focus on the ratio impacted by shorter alert and reach to the scene, and finally, to assume an average global risk reduction thanks to e-Call.

An estimated 10% risk reduction is assumed from former discussion, knowing that this figure is highly hypothetical and shall need further test and analysis.

Such rough analysis would bring a European average risk of 800 € per year (160 billions € divided by 200 billions motor vehicles), from wich 70% are impacted by shorter rescue time.
This average 560€ impacted risk would then be reduced by 10%, allowing a 56€ gain per vehicle per year.

For a 12 years average vehicle lifetime, total potential saving per vehicle would be in the range of 600 to 700€, quite coherent with former more detailed analysis.

3.4 – Who shall benefit from this effort

Final customer is obviously among the main stakeholders benefiting e-Call, as this can save their life as well as protect their family and friends. They could appreciate enhanced peace of mind, and later enjoy accident management as well as further value added services from the same technical platform. But …

Final customers are not willing to pay for e-call, as they mostly consider this as a public duty. On the other end, they are aware of the benefits of an automatic and located call…

Public sector and insurance companies should prove a rational benefit, both on economic and social effect of crashes, but also on positive communication opportunity.
As a matter of fact, from NHTSA split of road accidents cost, they appear to be by far the main stakeholders supporting the impacted costs :

Share of this amount impacted by shorter rescue time		
Medical	Public Sector ; Insurance	14%
Rescue cost	Public Sector	1%
Market productivity	Public Sector ; Insurance	26%
Household Productivity	Public Sector , global economy	9%
Workplace Cost	Public Sector ; industry	2%
Travel delay	Public Sector , global economy	11%
Insurance administration	Insurance industry	7%
		70%

We can assume than far more that 50% of potential savings will directly or non-directly benefit these two stakeholders. Public sector is also concerned by global economy and competitiveness, where e-Call can support a local industry and protect household productivity.

Car industry unsuccessfully tried to promote e-call. Carmakers have a clear view of technical environment, relevant data and operations cost, and cannot, in a competitive market, support alone the cost of such effort, when this effort brings a clear benefit for most players on the market and end-user/citizen.

4 - Conclusions :

The ECDG sub-group in charge of benefits assumptions can consider:

1. That an average 10 minutes (50%) time reduction is a sound figure in rural areas in most European areas
2. That a 4 to 5 minutes (40%) time reduction is also quite robust in Urban areas
3. That rural crash are bringing more risk of late alert and late arrival of rescues, when rural crashes are bringing around 2/3 of road statistics and 1/3 of fatalities. E-Call being even more efficient in rural areas, we can assume that the positive effects will prove substantial.
4. That side benefits in rescue operations, false alarms filtering, and better scene management will bring extra benefits which should secure current economic assumptions
5. That this shorter time to the scene has a substantial impact on death and severity reduction, which shall turn in lower global cost for society. 10 to 20% involved people moving to lower severity bracket is seen as realistic.
6. That from these elements, and although this would need further analysis and trials, a 500 to 700 € average saving per equipped vehicle, is likely.

ANNEX 2:

http://www.escope.info/index.html?file=237

ANNEX 3:

http://www.escope.info/index.html?file=223

Ekonomisk värdering av eCall i Sverige

Ett par internationella projekt[12] har genomfört beräkningar av de samhällsekonomiska effekterna av eCall för Europa. Det använda tillvägagångssättet har nedan använts med svensk statistik och med de värderingar av döda och skadade i vägtrafiken som tillämpas i Vägverkets samhällsekonomiska modeller.

Enligt de internationella studierna (E-MERGE, E-Safety Driving Group och SEISS) räknar man med att ett utbyggt eCall med i princip alla fordon utrustade medför att

- 5 – 15% av antalet trafikdödade kan reduceras till svårt skadade
- 10 – 15% av antalet svårt skadade kan reduceras till lätt skadade
- Inga förändringar uppkommer för lätt skadade

Ovannämnda siffror utgör antaganden som bygger på amerikanska erfarenheter, men också på tidsmätningar av räddningsinsatser i Stuttgart (STORM-projektet) och i Paris. Studierna innefattar också konsekvensanalyser av tidig medicinsk behandling av olycksoffer.[13]

Antalet skadade av olika svårighetsgrad från polisrapporterade olyckor i Sverige 2003 är

Antal personer		
Dödade	**Svårt skadade**	**Lindrigt skadade**
529	4 664	22 439

Med ovannämnda ansatser erhålles potentialen

[12] E-MERGE Final report; ERTICO-ITS Europe, juni 2004 och eSafety Driving Group 2004
Exploratory Study on the potential socio-economic impact of the introduction of Intelligent Safety Systems in Road Vehicles, VDI/VDE/IT/IfV Köln 2004

[13] E-call economic impact for society. Contribution to rational analysis on benefits. eSafety Driving Group 2004
US Department of Transportation – ACN Field Operational Test, Erie County, New York, 2001 m fl

Effekt på olyckskonsekvens	Låg påverkan av eCall	Hög påverkan av eCall
Dödsfall ändras till svårt skadade	26	79
Svårt skadade ändras till lätt skadade	466	700

De värden som användes i Vägverkets samhällsekonomiska kalkyler visas i nedan. Här framgår också den besparing som kan erhållas vid övergång från dödsfall till svårt skadad respektive från svårt till lätt skadad, dvs enhetskostnaden för dödsfall minskat med motsvarande för svårt skadad resp för svårt skadad minskat med lätt skadad.

Typ av konsekvens	Enhetskostnad (MSEK)	Besparing per typ (MSEK)
Dödsfall	17,5	14,4
Svårt skadad	3,1	2,9
Lätt skadad	0,175	-

Med ovannämnda kalkylunderlag erhålles

Nytta	Låg påverkan av eCall (MSEK)	Hög påverkan av eCall (MSEK)
Besparing av liv och lidande	1 725	3170

I en svensk rapport[14] har bl a olika trafiksäkerhetsåtgärder inom ITS-området analyserats och bedömts. En bedömning har gjorts av hur många olyckor med dödlig utgång som över huvud taget skulle kunna vara möjliga att påverka med en snabbare räddningsinsats. 8% av dödsfallen (dvs ca 40 personer) bedömdes initialt vara av karaktären att räddningsinsatsen skulle kunna ha betydelse för utgången av skadan. En vidare analys pekade på ytterligare minskningar av potentialen till följd av organisatoriska begränsningar avseende t ex möjligheterna att snabbare sätta in relevanta medicinska resurser. Dessa och andra faktorer bedöms reducera potentialen till 20 personer vars liv skulle kunna räddas med snabbare räddningsinsats. eCall är härvid en av flera viktiga komponenter. 40 % av potentialen, dvs 8 personer per år, bedöms kunna överleva med ett fullt utbyggd eCall.

Här skall tilläggas att i ett seminarium med svenska säkerhetsexperter, då resultaten från studien diskuterades, var den allmänna uppfattningen att även potentialen 8 personer per år bedömdes ligga i överkant.

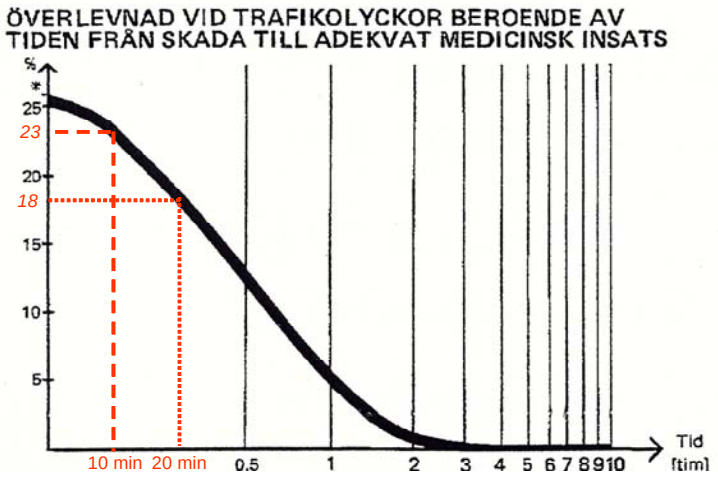
I en rapport om Ambulanshelikopterverksamheten i Sverige[15] refereras till ett diagram om överlevnad vid trafikolyckor beroende på tiden från skada till medicinsk hjälp. Här framgår att

[14] Potentialen hos ITS att öka trafiksäkerheten på kort och lång sikt, Stratega och Transek på uppdrag av Vägverket 2003-12-31

[15] Handell & Dahl, Ambulanshelikopterverksamheten i Sverige, Vägverket Publ nr 1996:6

26% av alla trafikdödade skulle kunna räddas med omedelbar medicinsk insats. Denna siffra sjunker successivt och efter en timme är endast 5% fortfarande vid liv (gyllene timmen).

Med stöd av bl a mätningarna i i USA och STORM-projektet kan eCall bidraga till att en första medicinsk insats på olycksplatsen kan sättas efter i genomsnitt 10 min i stället för 20 min i tätbebyggda områden och efter 5 i stället för 9 min utanför tätort. Om detta appliceras på diagrammet erhålles en möjlig reducering av antalet döda med 5 % i tätort och 2% utanför tätort. Detta förutsätter att adekvat medicinsk behandling kan sättas in. Se diagram nedan!



Figur:
Överlevnadspotentialen mht tid från skada till medicinsk behandling. Inbesparad tid med eCall och effekterna på potentialen visas med röda (streckade) linjer för tätort
Källa: Helikopter inför 80-talet, Tiden/Folksam 1982

I en sammanvägd värdering där hänsyn tagits till såväl de internationella uppgifterna som till den svenska värderingen och studien av ambulanshelikopterverksamheten görs en bedömning att potentialen för Sverige ligger i intervallet 10 – 20 räddade liv per år med eCall, dvs **2 - 4%** av antalet trafikdödade. Andelen svårt skadade antages minska med **3 - 4%**.

Fördröjning vid olyckor

I de internationella studierna finns även en ansats till bedömning av hur snabbare räddningsinsats kan bidraga till att minska fördröjningen för trafiken. Generellt för Europa anges att den totala kötiden vid olyckor kan minska med 10 – 20% med fullt utbyggt system. Denna uppgift kan förmodas variera stort beroende på trafikintensiteten i respektive land och är inte direkt tillämpbar för Sverige.

Effekter av minskad kötid kan möjligen uppkomma på sträckor där trafikflödet är relativt stort och många kan beröras. Den förkortning av larmtiden som eCall kan åstadkomma på sådana sträckor bedöms dock vara marginell bl a på grund av den höga mobiltelefonpenetrationen i Sverige. Uppröjningsarbetet kan endast marginellt påverkas av ett eCall-system. Ofta behövs rapport från platsen för att kunna bedöma och sätta in de rätta upprensningsinsatserna. En

försiktig gissning är att eCall möjligen kan bidraga till att reducera kötiden motsvarande en nytta på 5 – 10 MSEK årligen.

Totalvärdering av nyttan

Med de värden över potentialen räddade liv (2-4%) respektive minskade skadekonsekvenser (3-4%) som angivits ovan erhålles att nyttan vid ett fullt utbyggt och 100-ligt implementerat system är i mellan 550 - 830 MSEK.

Här kan tilläggas att Finland baserat sin bedömning främst på beräkningarna i EU-projektet E-MERGE. Finland har något färre dödade i trafiken än Sverige (415 per år) men flera svårt skadade (8 156 per år). Man har angivit nyttopotentialen till 91 M€ per år dvs ca 830 MSEK

Kostnad

Nyttan måste ställas mot kostnaden som uppträder i form av investeringskostnader för system, utrustning, utbildning och drift hos larmcentral.

Men en utrustningspenetration på 100% måste ca 4,9 miljoner fordon (personbilar, MC, bussar och lastbilar 2004) förses med eCall-utrustning. Kostnaden för denna utrustning uppskattas till 1 000 – 1 500 SEK per enhet. Detta är en uppskattning av vad en ren eCall-utrustning kan kosta. Om utrustningen har tilläggstjänster som tillhandahålls av privata tjänsteleverantörer blir de dyrare. En gissning är att kostnaden för utrustningen på sikt kan komma att sjunka till runt hälften om fordonstillverkarna inför eCall som standard i nya fordon, dvs 500 – 750 SEK per enhet. Med ett antagande om 8 års livslängd och 3% ränta blir annuitetsfaktorn 0,14. Med den lägre prisnivån ger detta en årlig total kostnad på mellan 350 och 500 MSEK.

SOS Alarm AB har lämnat en kostnadsindikation på 3,5 MSEK årligen. Denna innefattar utvecklings- och införandeaktiviteter för ett landstäckande system.

Sammantagen nytta/kostnadsbedömning

Med ovannämnda grova samhällsekonomiska värdering bedöms den årliga nyttan uppgå till mellan 550 och 830 MSEK medan kostnaderna ligger på mellan 350 och 500 MSEK. Larmcentralernas investerings- och driftkostnader har beaktats i bedömningen men är marginella i sammanhanget.

Med de antaganden som gjorts hamnar nytto-kostnadskvoten i spannet 1,1 – 4,2. För den lägre nivån i intervallet har den låga nyttan ställts i relation till den höga kostnaden och vice versa. Med en pessimistisk syn visar beräkningen alltså att trots låg framgångsfaktor och höga kostnader kan det vara berättigat att införa konceptet. Med en optimistisk syn kan man räkna med att konceptet blir klart lönsamt. Nyttan är nästan fyra gånger så stor som kostnaderna.