Transport Research Laboratory

AEBS and LDWS exemptions study: final report

by B J Robinson, W Hulshof, T Robinson and I Knight

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Specific Contract SI2.555104

CLIENT PROJECT REPORT

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Executive summary

TRL has recently carried out cost benefit analyses on behalf of the European Commission concerning AEBS and LDWS. These studies considered the costs and benefits for vehicles of categories N2/N3 (goods vehicles >3.5t GVW) and M2/M3 (buses and coaches with more than 8 passenger seats), but did not consider the effect on different types of vehicles within these categories. For this reason, The Commission tasked TRL to carry out a more detailed investigation to refine and improve the analysis and to consider the different types of vehicle within the above categories.

Representatives of the EU commercial vehicle industry have also described some technical reasons why some vehicles and vehicle classes should be exempt from the AEBS/LDWS installation requirements. As part of this project, TRL has considered these arguments and undertaken a simple desk-based evaluation of them. The validity of these proposals has been assessed using publically available technical information and recognised engineering principles.

This report presents the results from the project. These include the target populations (the accidents that could potentially be mitigated by AEBS or LDWS fitted to N2, N3, M2 and/or M3 vehicles) in Great Britain, Germany and France and uses those data and data from other published sources to estimate the overall numbers of fatal, serious and slight injury casualties that could potentially be avoided across the EU27. The report also describes an evaluation of the technical exemption proposals and combines the findings with vehicle-specific cost/benefit analyses to identify vehicles or classes of vehicle where the cost benefit ratios differ substantially from those derived for trucks and buses considered as a single group.

Three EU27 estimate scenarios are used; the lower EU27 estimates are based on the numbers of reported accidents across the EU27 and reported casualties in the CARE database for EU16, while the mid estimates make some allowance for under-reporting by using the reported casualty severity proportions (fatal:serious:slight) for GB and Germany. Even GB and Germany, though, are known to have some under-reporting, so the upper EU27 estimates make use of the best available research to indicate what the true numbers of casualties in M2/M3/N2/N3 accidents might be.

The GB, German and French databases have been analysed in a logical sequence of disaggregation. First, groups of accidents and casualties have been defined in an identical manner to the most detailed level possible in CARE. This forms the reference group for the subsequent analyses. For AEBS the data have been analysed to identify the target population of accidents where the front of a heavy vehicle collided with the rear of another vehicle. For LDWS, the data have been analysed to identify three separate target populations, those where the heavy vehicle ran off the road as a result of lack of attention/fatigue etc and had a single vehicle accident and those that crossed the lane boundary to suffer either a head-on collision with an oncoming vehicle or a side to side collision with a passing vehicle. These target populations are equivalent to those used for GB in TRL's earlier research for the EC.

Target population estimates are combined with estimates of EU27 vehicle stocks and annual new registrations, systems costs and effectiveness to produce a cost-benefit analysis, with phased introduction to the fleet over a 15 year period. However, it should be noted that only limited information was available regarding the system costs and all of this related only to generic systems. System costs are thus assumed to be the same for all sub-categories of vehicles, which may not accurately reflect the economics of installing systems on vehicle models in small production volumes.

The cost-benefit analyses indicate that all but one of the vehicle types assessed (N2 tractor units under 7.5t GVW) have the potential to achieve a benefit-cost ratio of more than one for both types of AEBS (one designed to address all rear shunts into other vehicles and the other able to detect non stationary target vehicles only), and all do so for LDWS. This is generally true, though, only in the upper scenario involving a

combination of assumptions about, for example, lower implementation costs, higher effectiveness rates and higher overall target populations. In the opposite, lower, scenario, where target populations are based on reported accidents only, where effectiveness is assumed to be lower and where implementation costs are assumed to be higher, benefit-cost ratios are almost invariably estimated to be well below 1.

In the mid range scenario, which may represent a "best guess" of the true situation as it combines mid-point estimates of effectiveness, target populations and costs, LDWS ratios are almost invariably still above 1, and usually well above. For AEBS, the mid range ratios are usually very close to 1 (either just below or just above).

A range of possible technical grounds for exemption have also been assessed, via a desk-based study and stakeholder dialogue.

For AEBS, the main proposals stem from the view that it would be prohibitively difficult and expensive to install such systems in vehicles not equipped with EVSC and that, therefore, the same exemptions should apply to AEBS as already apply to EVSC. A full evaluation has not been possible because no evidence on the extra costs has been identified. It seems reasonable, however, to postulate that systems could be developed that do not rely on the presence of EVSC. The costs would depend on the functional complexities of the systems (e.g. if they simply use the ABS to provide stability under heavy braking) and the numbers of vehicles over which the development costs could be spread. An alternative approach may be to require forward collision warning systems to alert the driver to apply the brakes if full AEBS is not feasible or cost effective, or if there are concerns about the stability during the autonomous brake activation without EVSC.

For LDWS, the stakeholder view that systems designed only to operate at speeds over 60 km/h would be of little use to vehicles used mainly off-road or in urban areas is partly supported by the accident data, but not enough to suggest that such systems could not still provide a benefit-cost ratio of more than 1.

Decisions regarding the applicability of the cost-benefit analysis and technical evaluations to questions of possible exemption for specific vehicle types are, of course, a political matter for stakeholders and legislators to debate and decide upon. It is important, though, to remember that the technical assessments, benefit-cost ratios and break-even costs presented in this report are all based on a wide variety of assumptions and subject to a long list of limitations, which are explained in more detail elsewhere in this report but that can be summarised as:

- Past accident and casualty statistics are imperfect predictors of future patterns.
- The accident analyses were necessarily based on samples of data from, at best, three Member States and often from only one or two, giving a high level of uncertainty when making estimates for the EU27, particular where low numbers of vehicles and accidents combine. This inevitably leads to a high level of uncertainty in estimated benefit-cost ratios for these vehicle types. In such situations, however, the overall potential for casualty reduction is likely to be low, so absolute confidence in the benefit-cost ratios may be less important.
- The vehicle types assessed within the accident databases are, generally speaking, not exact matches to the vehicle types proposed by stakeholders for exemptions.
- The accident analyses include injury accidents only, or more accurately injury accidents reported to the police only. The mid and upper scenarios endeavour to make some allowance for under-reporting, but how accurately either of them do so is impossible to know for certain.
- Different AEBS and LDWS architectures will have different operational characteristics, costs and effectiveness in differing applications and accident scenarios. The analyses presented here are entirely generic and attempt to allow for these variations by using quite wide ranges of likely effectiveness and costs.

- The cost-benefit analyses have used a simplified model of the penetration of AEBS and LDWS into the vehicle fleet, do not take into account the time value of money (i.e. no discount rate is applied), and are based on a 15 year investment period (chosen as being close to the average life of M2/M3/N2/N3 vehicles).

An initial draft of this report was presented to the Motor Vehicles Working Group (MVWG) in Brussels on 5th July 2010. The authors' assessment of the comments made suggested that the original draft report may have encouraged a little too much emphasis to be placed on the calculated benefit-cost ratios, without a full and proper appreciation of the uncertainties inherent in the analyses and the possible alternative approaches to prioritising exemption decisions. In response, this final report includes a fuller discussion of these issues and presents the results in an alternative way, to aid prioritisation discussions and decisions.

1 Introduction

The General Safety Regulation (GSR), which is the instrument that will mandate fitment of AEBS (Advanced Emergency Braking Systems) and LDWS (Lane Departure Warning Systems) for all N2, N3, M2 and M3 vehicles, has been approved by the EU Parliament and the Council. To avoid a second reading in the Parliament, several compromises were agreed compared with the Commission's original proposal. One of these new clauses (article 14.3 (a)) allows for the European Commission to adopt implementing measures to exempt certain vehicles or classes of vehicle from the obligation to install these advanced safety systems, provided it can be demonstrated (through a cost/benefit analysis and taking into account all relevant safety aspects) that the application of those systems proves not to be appropriate to the vehicle or class of vehicle concerned.

TRL has recently carried out cost benefit analyses on behalf of the European Commission concerning AEBS[1] and LDWS[2]. These studies considered the costs and benefits for vehicles of categories N2/N3 (goods vehicles >3.5t GVW) and M2/M3 (buses and coaches with more than 8 passenger seats), but did not consider the effect on different types of vehicles within these categories. For this reason, The Commission tasked TRL to carry out a more detailed investigation to refine and improve the analysis and to consider the different types of vehicle within the above categories. This analysis aimed to divide the previous analyses into more detailed vehicle types in order to inform consideration of the vehicles and classes of vehicle which might be eligible for being exempted from the AEBS and/or LDWS installation requirements of the GSR.

Representatives of the EU commercial vehicle industry have also described some technical reasons why some vehicles and vehicle classes should be exempt from the AEBS/LDWS installation requirements of the GSR. For example, that all vehicles without rear air suspension should be exempt because changes in the chassis height between the unladen and laden conditions could mean that the target vehicle (for AEBS) is sometimes out of the field of view of the sensor. As part of this project, TRL has considered these arguments and undertaken a simple desk-based evaluation of them. The validity of these proposals has been assessed using publically available technical information and recognised engineering principles.

This report presents the results from the project. These include the target populations (the accidents that could potentially be mitigated by AEBS or LDWS fitted to N2, N3, M2 and/or M3 vehicles) in Great Britain, Germany and France and uses those data and data from other published sources to estimate the overall numbers of fatal, serious and slight injury casualties that could potentially be avoided across the EU27. The report also describes an evaluation of the technical exemption proposals and combines the findings with vehicle-specific cost/benefit analyses to identify vehicles or classes of vehicle where the cost benefit ratios differ substantially from those derived for trucks and buses considered as a single group.

[1] Grover et al (2008), Automated Emergency Brake Systems: technical requirements, costs and benefits. TRL Published Report: PPR 227.
[2] Visvikis et al (2008), Study on lane departure warning and lane change assistant systems. TRL Published Report: PPR 374.

2 Target populations

2.1 Vehicle types

2.1.1 N2 and N3 vehicles

Within the overall heavy commercial vehicle classes (all more than 3.5 tonnes GVW), various vehicle sub-sets have been analysed, based on a listing of vehicles types of interest (suggested by stakeholders) and the capabilities of the GB, German and French databases used. Generally speaking, the vehicles have been categorised by GVW and body type. Table 2-1 shows the vehicles types of interest and how they have been identified (or at least approximated) within the databases.

Table 2-1. N2/N3 vehicle types analysed

Vehicle Type	Comment
N2/N3	**Goods vehicles >3.5t and large vehicles classed as "other motor vehicles" such as refuse collectors, mobile cranes, recovery vehicles**
N2	**GVW ≤12t**
N3	**GVW>12t**
Off road	Rigid vehicles only where body types are tipper/concrete mixer
Special purpose	Rigid vehicles with body types such as breakdown truck, skip loader, street cleanser, road stripper etc.
>3.5, ≤5 tonnes	N2/N3 restricted by GVW
>5, ≤7.5 tonnes	
>7.5, ≤12 tonnes	
>12, ≤16 tonnes	
> 16 tonnes	
Tractor ≤ 7.5t	Vehicles with an articulated wheel-plan restricted by GVW
>3 axles	Rigid vehicles with more than 3 axles or articulated vehicles with a tow vehicle with more than 3 axles
Not intended to tow O3 or O4 trailer	Cannot identify vehicles not designed to tow, but can identify rigid vehicles that were not towing at the time of the accident – likely to result in over-estimate
Intended to tow O3 or O4 trailer with more than 3 axles and trailer for exceptional load transport and trailers with areas for standing passengers	Not possible to identify specific trailers, but possible to identify vehicles with GVW>44T which are likely to include some of these vehicles

2.1.2 M2 and M3 vehicles

Within the overall heavy bus and coach classes (all designed to carry more than 8 passengers in addition to the driver), various vehicle sub-sets have been analysed, also based on a listing of vehicles types of interest (suggested by stakeholders) and the capabilities of the GB, German and French databases used. Generally speaking, the vehicles have been categorised by seating capacity and body type. Table 2-2 shows the vehicles types of interest and how they have been identified (or at least approximated to) within the databases.

Table 2-2. M2/M3 vehicle types analysed

Vehicle Type	Comment
M2/M3	**Vehicles designed to carry more than 8 passengers in addition to the driver**
M2	**Passenger vehicles with 8 to 16 passenger seats in addition to the driver.**
	Could over-estimate because might include buses with 16 seats and room for standing passengers, subject to interpretation of the vehicle type by the police officer attending the accident scene (not necessarily a traffic officer)
M3	**Passenger vehicles with more than 16 seats in addition to the driver**
M3 Class A	Vehicles with more than 16 and less than 23 passenger seats, includes assumption that minibuses are less than 5 tonnes.
M3 Classes I, II and III	Not possible to differentiate between buses/coaches with seated/standing passengers so these classes are combined into all M3 with > 22 passenger seats.
M3>3 axles	Rigid vehicles with more than 3 axles or articulated vehicles with a tow vehicle with more than 3 axles
M3 articulated	Vehicles with >16 passenger seats and that are articulated

2.2 Accident statistics

The accident analyses have been undertaken using the methodology that was designed by TRL as part of a recent study on behalf of the UK Department for Transport (Smith et al, 2008). The methodology is intended to identify the most suitable and cost effective method of assessing the potential benefits of advanced safety systems, and to allow this assessment to be undertaken in a consistent and objective manner.

The analysis for the previous TRL study of AEBS was based on detailed accident data from Great Britain (GB). These figures were then extrapolated to provide an overall estimate for Europe. The study of LDWS used both GB and German National Statistics to undertake a similar analysis.

To further refine and update these analyses, to improve the overall reliability of the EU27 estimates and to allow a robust assessment of as many of the vehicle types of interest as possible, this project uses data from GB, Germany and France. Not all vehicle

types, however, can be identified by all three databases. Table 2-3 shows which vehicle types are identifiable by which databases.

Table 2-3. Availability of vehicle types within GB, German and French databases

Vehicle Type	GB	DE	FR
All vehicle types	✔	✔	✔
N2/N3	✔	✔	✔
N2	✔	✔	✔
N2 Off road	✔		
N2 Special purpose	✔		
N2 > 3 axles	✔		
N2 <5T	✔	✔	
N2 >5T <7.5T	✔	✔	
N2 > 7.5T	✔	✔	
N2 Tractor <7.5T	✔		
N3	✔	✔	✔
N3 <=16t	✔	✔	
N3 <=16t off road	✔		
N3 <=16t special purpose	✔		
N3 <=16t >3axles	✔		
N3 <=16t rigid (not towing at time)	✔		
N3 >16t	✔	✔	
N3 >16t off road	✔		
N3>16t special purpose	✔		
N3 >16t >3axles	✔		
N3 >16t rigid (not towing at time)	✔		
N3 >44t exceptional load	✔		
M2/M3	✔	✔	✔
M2	✔	✔	
M3	✔	✔	
M3<= 23 seats	✔		
M3>23 seats	✔		
M3>3 axles	✔		
M3 articulated	✔		

2.2.1 GB databases

Great Britain collects detailed data on road traffic accidents in the STATS19 database. It provides information on all personal injury road accidents that occur on the public highway in Great Britain which are notified to the police within 30 days of occurrence, and in which one or more vehicles are involved.

The STATS19 database is used to provide the GB input to the EU's CARE database (Community database of Accidents on the Roads in Europe), but contains more details in most of the fields and many more fields than are available in CARE. For example, the

CARE database has single categories for a bus/coach and an HGV with a gross vehicle weight (GVW) over 3.5t. The STATS19 database can further identify if the bus/coach was a minibus (with 8-16 passenger seats) or a bus/coach (with 17 or more passenger seats). Similarly, STATS19 can identify if the HGV had a GVW of between 3.5t and 7.5t or more than 7.5t, and if it was a rigid or an articulated vehicle and/or towing another vehicle or trailer. The STATS19 database is compiled by the reporting police officer a matter of days after the initial incident and often before any in-depth expert investigations of more serious accidents have occurred. This means that the data is exposed to a risk of technical errors. In addition to this, there is an acknowledged level of under-reporting, particularly of low severity accidents. Despite this, STATS 19 is generally regarded as being one of the most comprehensive and reliable national accident databases in Europe.

In order to help identify more detailed vehicle types, further analysis of GB data using the Enhanced STATS19 database has been carried out. This database covers approximately two-thirds of the accidents in STATS19 and provides more detail on the vehicle(s) involved in an accident by cross referencing the registration mark of the vehicle to the UK Driver and Vehicle Licensing Agency (DVLA) vehicle registration database. This allows different types of vehicle within categories M2, M3, N2 and N3 to be identified. Table 2-4 shows a selection of the vehicle classifications that the data can be separated into using the Enhanced STATS19 database. In addition to this criteria such as wheel-plan (number of axles), gross vehicle weight and seating capacity are available.

Table 2-4. Vehicle types that can be identified in Enhanced STATS19 database.

Selection of vehicle types within Enhanced STATS19 database		
Luton van	Solid bulk carrier	Road surfacer
Insulated van	Concrete mixer	Road tester
Livestock carrier	Car transporter	Ambulance
Milk float	Refuse lorry	Fire engine
Flat lorry	Skip loader	Street cleaning
Dropside lorry	Special mobile unit	Gritting vehicle
Tipper	Single deck bus/coach	Snow plough
Low loader	Double-deck bus/coach	
Breakdown truck	Half-deck bus/coach	
Tanker	Minibus	

The main limitation of this database is that for some accidents the registration mark of the vehicle is either not included in the STATS19 accident record or has been written down, processed or entered incorrectly. This means that some accident records do not successfully link to vehicle records and typically the detailed information is only available for a sample of approximately two-thirds of the national totals.

Each target population in the main STATS19 database has been re-created using the enhanced data. For each target population, the distribution of vehicle types has been expressed as a percentage of all vehicle types. Assuming that the enhanced data is representative of the GB total (which is reasonable – there is no reason for registration mark errors to introduce systematic bias) allows the number of casualties from relevant accidents involving these vehicle types to be estimated for the whole of GB.

For context, Table 2-5 shows the overall numbers of casualties in all accidents and all those involving an N2/N3 or M2/M3 vehicle for the years 2005-2008.

Table 2-5. GB national casualty data, 2005-2008.

	2005	2006	2007	2008	05-08 Annual Average
All Casualties					
Fatal	3,201	3,172	2,946	2,538	2,964.25
Serious	28,954	28,673	27,774	26,034	27,858.75
Slight	238,862	226,559	217,060	202,333	221,203.5
Total	271,017	258,404	247,780	230,905	252,026.5
All involving an N2 or N3 vehicle					
Fatal	510	459	465	433	466.75
Serious	2,044	2,017	1,993	1,797	1,962.75
Slight	15,824	14,564	14,998	13,649	14,758.75
Total	18,378	17,040	17,456	15,879	17,188.25
All involving an M2 or M3 vehicle					
Fatal	136	160	148	117	140.25
Serious	1,300	1,297	1,369	1,228	1,298.5
Slight	14,278	12,623	12,116	11,770	12,696.75
Total	15,714	14,080	13,633	13,115	14,135.5

2.2.2 German databases

The National Statistics for Germany contain quite a large number of parameters that allow, amongst other things, the road type, manoeuvre and type of carriageway to be identified for each accident.

For AEBS and LDWS the relevant types of manoeuvres are likely to be:

- Going straight, decelerating or accelerating in traffic lane;
- Stopped in traffic lane;
- Starting in traffic lane;
- Passing or overtaking another vehicle
- Changing lanes

Similarly to the UK STATS 19 database, there are some limitations to the German National Statistics database. For example, it is possible to identify category N1 vehicles, but HGVs cannot be separated into categories N2 and N3 because the database only contains categories for HGVs with a mass either more or less than 7.5t. TRL have subcontracted VUFO to perform analyses using the German national data and their more detailed accident database, GIDAS. GIDAS can identify N2 and N3 vehicles by GVW and M2/M3 vehicles by seating capacity. VUFO have analysed the GIDAS database for accidents happening in the period 1999-2009 and have then weighted the results to be representative of German national accident statistics for 2008.

For context, Table 2-6 shows the overall numbers of casualties in all accidents and all those involving an N2/N3 or M2/M3 vehicle for the years 2005-2008 (CARE).

Table 2-6. German national casualty data, 2005-2008.

	2005	2006	2007	2008	05-08 Annual Average
All Casualties					
Fatal	5,361	5,091	4,949	4,477	4,969.5
Serious	76,951	74,502	75,443	70,644	74,385
Slight	356,479	347,820	355,976	338,403	349,669.5
Total	438,791	427,413	436,368	413,524	429,024
All involving an N2 or N3 vehicle					
Fatal	756	719	687	625	696.75
Serious	5,269	4,253	4,110	3,787	4,354.75
Slight	20,218	15,604	15,327	14,751	16,475
Total	26,243	20,576	20,124	19,163	21,526.5
All involving an M2 or M3 vehicle					
Fatal	140	86	94	75	98.75
Serious	1,570	1,031	1,016	879	1,124
Slight	9,377	7,231	7,279	6,859	7,686.5
Total	11,087	8,348	8,389	7,813	8,909.25

2.2.3 France database

TRL have subcontracted CEESAR to analyse the French national accident database. This database can identify the relevant types of LDWS and AEBS accidents, based on vehicle manoeuvres and locations, but cannot identify vehicle types beyond the basic N2, N3 and M2/M3 groupings. To ensure proper identification of the vehicles involved, the analyses have been restricted to two vehicle impacts only. This will tend to underestimate overall target populations in France, but it should also be noted that no contributory factors are recorded in the database (e.g. driver behaviour factors) which may lead to a risk of overestimating.

French national statistics from 2007 have been analysed and then weighted to represent the average of 2005-2008 (from CARE). It is noticeable that the French national statistics (as reported in CARE) involve a much lower proportion of slight injury accidents and casualties than is true for GB and Germany. It is likely that this indicates a high degree of under-reporting of these casualties in France.

For context, Table 2-7 shows the overall numbers of casualties in all accidents and all those involving an N2/N3 or M2/M3 vehicle for the years 2005-2008 (CARE).

Table 2-7. French national casualty data, 2005-2008.

	2005	2006	2007	2008	05-08 Annual Average
All Casualties					
Fatal	5,318	4,709	4,620	4,275	4,730.5
Serious	39,811	40,662	38,615	34,965	38,513.25
Slight	68,265	61,463	64,586	58,833	63,286.75
Total	113,394	106,834	107,821	98,073	106,530.5
All involving an N2 or N3 vehicle					
Fatal	726	683	658	596	665.75
Serious	2,109	2,835	2,131	1,957	2,258
Slight	3,186	3,189	2,964	2,628	2,991.75
Total	6,021	6,707	5,753	5,181	5,915.5
All involving an M2 or M3 vehicle					
Fatal	91	76	110	80	89.25
Serious	563	659	544	534	575
Slight	1,482	1,334	1,375	1,307	1,374.5
Total	2,136	2,069	2,029	1,921	2,038.75

2.2.4 CARE Statistics and lower, mid and upper EU27 estimates

2.2.4.1 Lower EU27 estimates

Factoring up the data from GB, GB and Germany, or GB, Germany and France (depending on the vehicle type of interest) to estimate target populations for the EU27 has been carried out using a two stage process. The first stage involves factoring to an EU16 level according to the reported numbers of fatal, serious and slight casualties in accidents involving N2/N3 or M2/M3 vehicles. These data are not available at an EU27 level, so to factor up to that level, the EU16 numbers are factored up by the published numbers of fatalities and all injury accidents in EU27 (relative to the equivalent numbers for EU16). Table 2-8 and Table 2-9 respectively show the DG-TREN Pocketbook 2010 statistics for EU27 and the CARE statistics for EU16 (Austria, Belgium, Czech Republic, Germany, Denmark, Spain, France, United Kingdom, Greece, Hungary, Malta, Netherlands, Portugal, Romania, Sweden and Slovenia).

Table 2-8. Reported EU27 accidents and fatalities.

Measure	2005	2006	2007	2008	2005-08 Annual Average
Accidents – all severities	1,321,450	1,299,245	1,296,928	1,232,211	1,287,459
Fatalities	45,300	43,062	42,496	38,875	42,433

Table 2-9. EU16 N2/N3 and M2/M3 casualties by severity.

Accident type	Annual average number of casualties (EU16, 2005-07)		
	Fatal	**Serious**	**Slight**
All	28,828	226,450	1,051,960
Involving N2/N3*	4,803	16,597	63,669
Involving M2/M3	822	4,945	33,602

* Data for other motor vehicles (OMV) only available for 14 of the 16 Member States. OMVs for GB include agricultural and have been updated using Stats19 data to remove the agricultural vehicles.

Table 2-10 shows the EU27 estimates, arrived at using the data in Table 2-8 and Table 2-9. As stated, these estimates are based wholly on reported casualties, across the EU16 (CARE) and reported accidents across the EU27 (Pocketbook). It is widely recognised that there is a significant degree of under-reporting of accidents, the extent of which varies by country but which is most prevalent amongst slight injury and other less severe accident types. The estimates shown in Table 2-10 make no allowance for this and are thus considered as the lower estimates. The following sections describe how mid and upper estimates for EU27 casualty numbers, that endeavour to make some allowance for under-reporting, have been arrived at.

Table 2-10. Lower EU27 estimates of N2/N3 and M2/M3 casualties by severity.

Accident type	Annual average number of casualties (EU27, 2005-07)		
	Fatal	**Serious**	**Slight**
All	42,433	299,484	1,391,234
Involving N2/N3	7,070	21,950	84,203
Involving M2/M3	1,210	6,540	44,439

2.2.4.2 Mid EU27 estimates

A good indicator of the propensity for under-reporting is the variability of the relative numbers of fatal, serious and slight casualties in otherwise similar accident scenarios. For EU16 (from CARE), for example, there are reported to be just over 13 slight casualties for every one N2/N3 fatality, and about 3.5 seriously injured casualties (from Table 2-9). Table 2-5 and Table 2-6, however, indicate that in GB and Germany (countries generally thought to have quite low levels of under-reporting), the equivalent factors are 24-32 slight casualties per fatality (i.e. about twice the CARE EU16 rate) and 4-6 serious casualties (about 1.5 times the CARE EU16 rate). The M2/M3 numbers are about 78-91 slights per fatality and 9-11 serious injuries (compared to 41 and 6 from CARE). It is reasonable to assume that the degree of under-reporting of fatalities is zero, or very close to it, so the mid EU27 estimates take the same fatality numbers from the lower estimates but then estimate the true numbers of serious and slight casualties by multiplying by averaged factors based on the GB and Germany data (5 serious casualties and 30 slight casualties for every one N2/N3 fatality, 10 serious injuries and 85 slights for every one M2/M3 fatality). Table 2-11 shows the resulting EU27 casualty estimates.

Table 2-11. Mid EU27 estimates of N2/N3 and M2/M3 casualties by severity.

Accident type	Annual average number of casualties (EU27, 2005-07)		
	Fatal	**Serious**	**Slight**
Involving N2/N3	7,070	35,352	212,109
Involving M2/M3	1,210	12,102	102,869

2.2.4.3 Upper EU27 estimates

As described above, the lower EU27 estimates are based on the numbers of reported accidents across the EU27 and reported casualties in the CARE database for EU16, while the mid estimates make some allowance for under-reporting by using the reported casualty severity proportions (fatal:serious:slight) for GB and Germany. Even GB and Germany, though, are known to have some under-reporting, so the upper EU27 estimates make use of the best available research to indicate what the true numbers of casualties in M2/M3/N2/N3 accidents might be.

The most recent and comprehensive analysis of under-reporting across the EU was reported as part of the FP6 HEATCo project (HEATCo, 2006a). Research from 6 countries was reviewed (Sweden, Denmark, Norway, Switzerland, Germany and the UK), usually involving a comparison between police records and hospital admission data. Average correction factors for under-reporting of serious injuries were found to vary between 1.1 (the UK study) and 3.19 (Sweden), while the German study suggested a factor of 2.24. For slight injuries, the correction factors ranged from 1.22 (the UK) to 10.38 (Denmark), with a German rate of 2.88. Various studies showed that these factors vary for different vehicle and casualty types (and are generally highest for pedal cyclists) but only one study (from Switzerland) looked specifically at HGVs and buses, where the correction factors for average injury severities were found to be 8.44 for buses and 3.78 for HGVs. The overall recommendations from the HEATCo work were that European averaged correction factors for under-reporting should be 1.5 for serious injuries, 3.0 for slight injuries and 2.25 for all casualties. The project also recommended that a very small correction be made to official fatality estimates (a factor of 1.02) to allow for the numbers of road accident casualties who die just over 30 days after the accident and that thus get misleadingly coded as serious injuries in official statistics.

Other research, not analysed by HEATCo, suggests that the UK figures used (which were based on one UK report not specifically looking at under-reporting as an issue) may well have been overly optimistic about the accuracy of existing UK statistics. Other UK studies (summarised by Ward et al, 2006) suggest correction factors of about 1.6-1.9 are likely to be more appropriate than the 1.1-1.4 range used by the HEATCo project.

It is clear from a wide range of studies that there is significant under-reporting associated with official statistics, but it is less clear exactly what correction factor would allow for it. UK and German studies indicate correction factors of 1.1 - 2.76 for serious injuries and 1.22 - 2.88 for slight injuries. The only applicable recent study (Switzerland) indicates factors of between 3.78 and 8.44 are appropriate for bus and HGV accidents respectively. Many studies do agree, however, that a small correction is needed for fatalities to allow for deaths more than 30 days after the accident.

For the purposes of making upper EU27 estimates for this project, it has been assumed that the mid estimates (based principally on official statistics in GB and Germany) should be corrected by the factors of 1.02 for fatalities, 1.25 for serious injuries and 1.75 for slight injuries. These have been chosen as being conservatively representative of the ranges quoted in the research literature. Table 2-12 shows the resulting estimates.

Table 2-12. Upper EU27 estimates of N2/N3 and M2/M3 casualties by severity.

Accident type	Annual average number of casualties (EU27, 2005-07)		
	Fatal	Serious	Slight
Involving N2/N3	7,212	44,189	371,191
Involving M2/M3	1,234	15,128	180,021

It is worth noting that despite the quite wide variations in overall casualty number estimates between the lower, mid and upper values, the overall valuations will be much less varied. This is because most of the differences are for the slight casualties, which have a much lower valuation than the fatal and serious injuries. The overall effects on the cost-benefit analysis are therefore less pronounced than might be suggested from the variation in casualty numbers alone.

2.3 Identification of target populations

TRL, VUFO and CEESAR have analysed the STATS19/GIDAS and French databases in a logical sequence of disaggregation. First, groups of accidents and casualties have been defined in an identical manner to the most detailed level possible in CARE. This forms the reference group for the subsequent analyses. For AEBS the data have been analysed to identify the target population of accidents where the front of a heavy vehicle collided with the rear of another vehicle. For LDWS, the data have been analysed to identify three separate target populations, those where the heavy vehicle ran off the road as a result of lack of attention/fatigue etc and had a single vehicle accident and those that crossed the lane boundary to suffer either a head-on collision with an oncoming vehicle or a side to side collision with a passing vehicle. These target populations are equivalent to those used for GB in TRL's earlier research for the EC, Table 2-13, updated with the newest data that is available up to 2008 inclusive.

Table 2-13. Description of target populations.

Target population reference	System	Description
#1	AEBS	Front to Rear Shunt – the vehicle of interest fails to react to the slower moving or stationary traffic ahead and collides with the rear of another vehicle.
#2	LDWS	Head-on collisions - The vehicle of interest leaves its lane unintentionally and collides head-on with oncoming vehicle. These accidents are most likely to occur on single carriageway roads.
#3	LDWS	Leaving roadway collisions – the vehicle of interest drifts out of the travel lane. These accidents are often single vehicle (can include pedestrians) and may involve impacts with roadside furniture. Other vehicles may be involved, however, because they have been required to react to the lane departure of the vehicle of interest.
#4	LDWS	Side-swipe collisions – when the vehicle of interest unintentionally leaves the lane in which they are travelling on a road with multiple lanes, the side of the vehicle of interest could collide with the side of a vehicle that is travelling in an adjacent lane. There is also a possibility of an impact between the front of one vehicle and the rear of the other.

2.3.1 LDWS target populations

The three accident scenarios described in Table 2-13 are mutually exclusive, so the total casualties (fatal, serious and slight) in each are added together to arrive at the overall target population for each vehicle type. To further breakdown the data into sub-sets of interest, the GB and Germany databases have been analysed to separately identify the numbers of casualties in accidents on motorways, in built-up areas (not motorways) and in non built-up (rural) areas (also not motorways). The French national database can only identify LDWS accidents on all road types. The identification of LDWS target populations is shown pictorially in Figure 2-1.

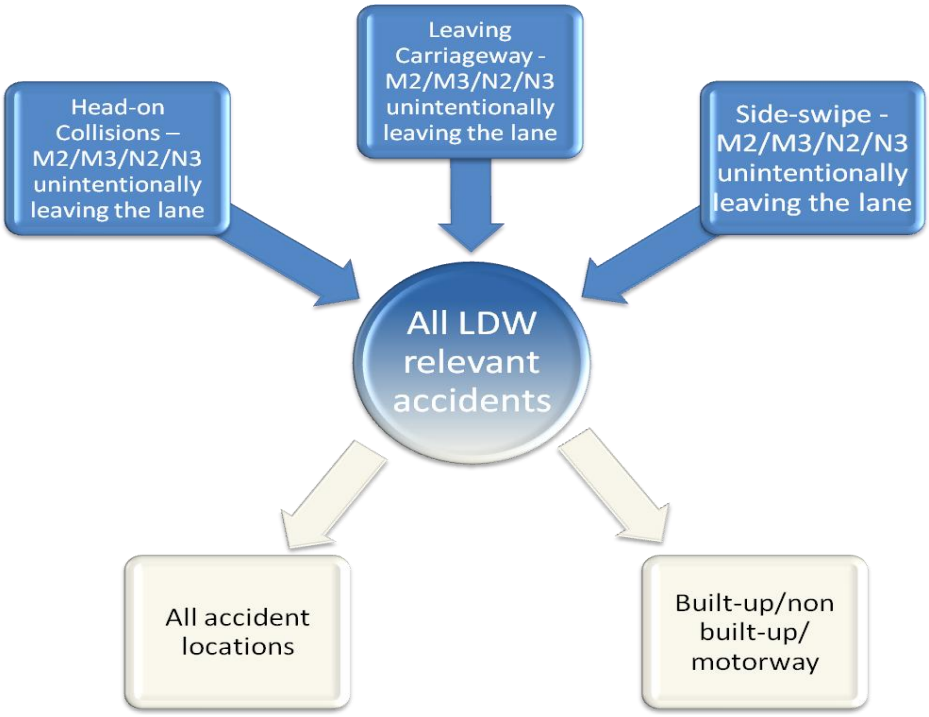

Figure 2-1. Identification of LDWS target populations

2.3.2 AEBS target populations

Two sets of AEBS target populations have been identified, as shown in Figure 2-2. The first is for "all rear shunts" which are accidents involving a vehicle type of interest impacting into the rear of another vehicle that is not a "vulnerable road user" (VRU, i.e. no pedestrian, bicycle or powered two-wheeler impacts). The second defines the sub-set of those accidents that involve impacting a vehicle that is moving at the point of impact, by excluding accidents where the impacted vehicle was known (or at least likely) to be stationary, e.g. when "held-up", "waiting" or "parked". This was to separately identify the casualties that systems only capable of avoiding impacts with vehicles that they have been able to track while following and moving may affect from those for a more advanced system that can recognise any (non VRU) vehicle directly in its path, regardless of whether or not it has been following it for some time prior to a likely impact. However, it should be noted that this is an approximation because it is possible that a system could be tracking a moving vehicle some distance ahead that brakes sufficiently quickly to be stationary, and coded as "held-up", by the time of the impact. Both AEBS accident types have also been split by motorway/built-up/non built-up, for the GB and German data.

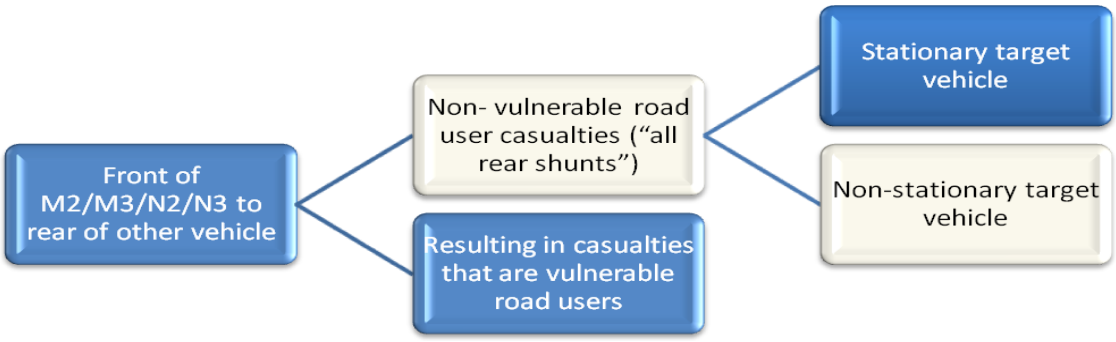

Figure 2-2. identification of AEBS target populations

2.4 Making EU27 target population estimates and dealing with small numbers

In general, target population estimates for EU27 have been based on the proportions found in the GB, German and French databases, using as many countries' data as are available.

For the major vehicle groups (N2, N3 and M2/M3), data from all three countries is available and thus the numbers of fatalities, serious and slight injuries for each country are combined and divided by the overall numbers of such casualties from all N2/N3 or M2/M3 accidents in those three countries to produce percentages. These percentages are then applied to the overall lower, mid and upper EU27 estimates to give target populations for each system (AEBS all rear shunts, AEBS non stationary targets and LDWS).

Some vehicle types have data available from GB and Germany, but not France and several others have data from GB only. EU27 estimates for these vehicle types are made in very similar ways, but with some important differences:

- EU27 estimates are made for all casualty severities combined, not by individual severity category. This is to compensate for the significant variations in the proportions of fatal, serious and slight casualty estimates that arise when factoring up from small numbers in the individual country samples, and that would adversely affect the casualty valuations and cost-benefit analyses;
- The estimates for specific vehicle types are set to combine in total to give the same numbers as for the major groups, where appropriate, even if based on different countries' data. For example, the populations for N3<=16t and N3>16t (based on GB and Germany data) are derived so that they sum to the same numbers as estimated for all N3 vehicles (based on GB, German and French data). This is achieved by applying the proportions found in the specific countries to the relevant major vehicle group estimates. Again for illustration, if 10% of the N3 casualties in LDWS accidents in GB and Germany were in vehicles <=16t, then it is assumed that the EU27 target population for N3 <=16t is also 10% of the EU27 estimate for N3s. This ensures data consistency and prioritises estimates according to the number of countries' data used to produce them;
- For GB-only vehicle types where the overall number of casualties estimated for GB is very low, or zero[3], two separate approaches are used. The first is applied to the lower EU27 estimates and follows exactly the same processes as described above. The second, though, makes mid and upper EU27 estimates by assuming that the GB target population is in the same proportion of all casualties involving

[3] A GB target population estimate of less than 6 casualties per year is the actual threshold value used.

those vehicles as applies to the relevant major vehicle group (N2/N3 or M2/M3). This is particularly useful when the GB data has no casualties, as is the case for some vehicle types. Whilst this may indicate that there really are no target population casualties from these vehicles, either in GB or across the EU27, and hence a zero lower estimate is appropriate, it is unreasonable to conclude that zero is also an appropriate upper estimate. The small sample size and possible differences in vehicle usage and accident patterns across the EU could combine to mean that in reality there really are some GB casualties, but they were missed by the data sampling, and/or that such vehicles are more prominently involved in accidents elsewhere. This technique allows assessments to be made based on the reasonable assumption that the same proportion of casualties from all accidents involving these vehicles applies to the target population of interest as is known to be the case for other vehicles of a similar size and type. For example, if 10% of all N2/N3 casualties happen in AEBS relevant accidents then if a specific vehicle type was found to have zero GB target population casualties but, say, 2 casualties per year from all accident types, then EU27 mid and upper estimates are based on a revised GB target population estimate of 0.2 casualties per year.

3 Estimating costs and benefits

3.1 Casualty valuations

Putting a financial value on a human life or the prevention of a serious injury is notoriously difficult and controversial. Whilst no EU27 wide figures are currently available, each Member State necessarily uses its own figures for assessing the benefits of proposed safety measures. Methods of doing this vary, and there is as a result substantial variation in the figures used. In 2002, for example, the FP6 HEATCo project found fatality valuations ranging from €275,000 to €2.9million (HEATCO, 2006b).

The generally accepted method of valuing casualties combines the actual costs and lost output with a societal Willingness to Pay (WTP) amount, reflecting how much people generally would be willing to pay to avoid the pain, grief and suffering of a bereavement or injury. Fatality valuations performed in this way tend to be at the upper end of the range quoted above, the UK fatality valuation in 2002, for example, was €1.8million. For the purposes of this project, the UK valuations are considered to represent reasonable EU estimates. The most recent UK casualty valuations are shown in Table 3-1.

Table 3-1. UK casualty valuations, 2008 (DfT, 2009)

Casualty severity	Cost per casualty (£)
Killed	1,683,800
Serious	189,200
Slight	14,600

With the ongoing turmoil in financial markets across the world, the Pound:Euro exchange rate has been subject to quite significant variability over recent years. At the time of writing this report, the rate was about €1.20 to the £1, but had in the preceding three years been as low as €1.07 and as high as €1.45 (a value that was its steady-state for about 4 years prior to the start of the turmoil in 2007). Assuming a future long-term trend rate of €1.25 to £1 seems reasonable and produces the € casualty valuations shown in Table 3-2.

Table 3-2. Estimated EU casualty valuations

Casualty severity	Cost per casualty (€)
Killed	2,105,000
Serious	236,500
Slight	18,250

These are thus the figures used to quantify the EU27 casualty prevention benefits and target population valuations. They fall comfortably within the wider range of valuations used in other individual Member States, albeit towards the top end of that range.

No allowance is made for the future effects of inflation or GDP growth (a society tends to be willing to pay more for casualty prevention as its overall wealth increases). Such uncertainties and limitations with the casualty saving calculations are considered to be beyond the scope of this project. It is worth noting, however, that in attempting to allow for such uncertainties and approximations, the HEATCo project recommends that casualty benefits calculations are subjected to a sensitivity analysis by applying valuations in the range v/3 to 3v, where v is the central estimate. Whilst this recommendation is also considered outside of the scope of this project, it would mean

that the true benefits calculated could be as high as 200% higher than the central estimates quoted (equivalent to a fatality valuation of about €6million), and as low as 67% lower (€700,000 fatality valuation).

3.2 EU27 stock and new registration estimates

3.2.1 M2/M3 estimates

The 2010 Pocketbook reports that there were about 817,000 buses and coaches in use across the EU27 in 2008. This figure includes 114,000 for the UK, whereas the UK's national vehicle licensing database puts the figure at about 180,000, a discrepancy of some 66,000 vehicles. Data from other national sources and provided by stakeholders suggests that the Pocketbook figures for other Member States are reasonably accurate, so it is estimated that the true total stock of buses and coaches (i.e. M2 and M3 vehicles) is about 883,000 (817,000 + 66,000).

The published stock data does not break down the overall numbers into specific categories (e.g. M2 and M3) or vehicle types. New registration data in the Pocketbook, however, does break down the numbers by vehicle weight. The weight categories used do not, though, correspond to the 5t limit that defines an M2 vehicle. Instead weight limits of 3.5t and 16t are used. Between 2006 and 2008, about 22% of all new registrations were for vehicles <3.5t, which would all be M2, and a further 28% were >3.5t and <16t. Assuming that about 10% of those are M2 would suggest that about 25% of all buses and coaches registered are M2, and thus this figure is used to estimate the number of M2 vehicles in use in the EU27 (0.25 x 883,000 = 221,000), leaving 662,000 M3 vehicles.

In the absence of detailed stock data from any other country, estimates of the numbers of specific vehicle types are based on the known proportions of such types in UK, e.g. if x% of M3 vehicles in UK are known to be articulated, then x% of the estimated 662,000 M3 vehicles in the EU27 are assumed to be articulated.

The annual numbers of new registrations of M2 and M3 vehicles are estimated in a similar way, with 25% of the 57,000 EU27 new registrations per year (2006-2008 average, from Pocketbook[4]) assumed to be M2, 75% assumed to be M3 and specific types estimated using known UK new registration proportions.

3.2.2 N2/N3 estimates

The 2010 Pocketbook reports that there were about 34 million goods vehicles (N1, N2 and N3) in use across the EU27 in 2008. This figure includes 2.5 million for Germany, whereas the German national statistics (DESTATIS) put the figure at about 4.2 million, a discrepancy of some 1.7 million vehicles. Data from other national sources and provided by stakeholders suggests that the Pocketbook figures for other Member States are reasonably accurate, so it is estimated that the true total stock of goods vehicles is about 35.7 million.

The published stock data does not break down the overall numbers into specific categories (e.g. N2 and N3) or vehicle types. New registration data in the Pocketbook, however, does break down the numbers by vehicle weight. The weight categories used do not, though, correspond perfectly to the 3.5t and 12t limits that define an N2 vehicle. Instead weight limits of 3.5t and 16t are used.

Between 2006 and 2008, about 17% of all new EU27 registrations were for vehicles >3.5t, which would all be N2/N3. Data provided by stakeholders suggests that about 15-16% of all goods vehicle in use in the EU15 are >3.5t. Assuming that the mid-range

[4] Pocketbook figures do not include Bulgaria, so an EU27 estimate is made based on the known EU26 and an estimate for Bulgaria. 2009 data is not used due to the effects of the economic downturn – new registration numbers were much lower in 2009 than in other recent years but this is assumed to be a temporary effect.

figure of 16% applies on average across the EU27 produces an estimate of 5.7 million N2/N3 vehicles in use (=0.16 x 35.7).

Stakeholder data, Pocketbook new registration data and UK and German national data have also been combined to suggest that about 48% of all N2/N3 vehicles are <16t and that about 92% of those (44% overall) are N2 (i.e <12t). This gives an estimated N2 stock of 2.5 million (5.7 x 0.44), and 3.2 million N3 vehicles.

In the absence of detailed stock data from any other countries, estimates of the numbers of specific vehicle types are based on the known proportions of such types in UK, e.g. if x% of N3 vehicles in UK are known to have >3 axles, then x% of the estimated 3.2 million N3 vehicles in the EU27 are assumed to have >3 axles.

The annual numbers of new registrations of N2 and N3 vehicles are estimated in a similar way, with 423,000 N2/N3 EU27 new registrations per year (2006-2008 average, from Pocketbook[5]), 116,000 of those being <16t and 307,000 being >16t. Specific types are estimated using known UK new registration proportions of these major groups.

3.3 System cost and effectiveness estimates

3.3.1 AEBS costs and effectiveness

The earlier TRL research identified a lack of robust quantitative evidence of the cost of AEBS, with long-term, mass production costs at that time expected to be less than €100 per vehicle but other industry estimates for more sophisticated and specialist systems ranging up to as high as €6000 per vehicle. It is likely that this wide variation in cost estimates was partly due to differing assumptions, e.g. about functionality, development costs and production volumes, and partly due to commercial interests, i.e. system suppliers will tend to make optimistic assumptions to encourage wide-scale application, whereas vehicle manufacturers will tend to be much more pessimistic to avoid added vehicle costs.

Despite a request for additional information on system costs from stakeholders, no new information has been forthcoming for this project. For the purposes of the cost-benefit analyses, it has therefore been necessary to base the cost estimates on the earlier research. For current system that can mitigate rear shunts involving a non stationary target only, a cost range of between €150 and €1000 is assumed. For more sophisticated systems that can avoid all rear shunts involving a four wheel vehicle or rigid fixed object, a cost range of between €250 and €1500 is assumed.

These numbers are comfortably within the overall ranges identified by the earlier research and are considered to be realistic estimates, based on the assumption that mandatory fitment of the systems would mean that production volumes are high and thus development costs could be spread over a large number of vehicles. However, it should be noted that some of the vehicle classes assessed in this research are specialist vehicles with low production numbers for each variant, which can have the opposite effect of providing few vehicle sales to spread the development costs of tailoring the system for specific application.

The earlier research also reviewed various studies into the effectiveness of AEBS, combined with a detailed accident analysis exercise. The conclusion was that system effectiveness in the range 25-75% was appropriate for heavy vehicles, i.e. that somewhere between 25% and 75% of the overall target population fatal and serious casualty valuation would actually be mitigated by current AEBS fitted to all such vehicles. The systems were assumed to mainly reduce injury severity (from fatal to serious and

[5] Pocketbook figures do not fully include Bulgaria, Hungary, Cyprus and Malta so an EU27 estimate is made based on the known EU23 and estimates for these four countries. 2009 data is not used due to the effects of the economic downturn.

serious to slight), rather than prevent accidents altogether, so for slight injuries an effectiveness range of 0-10% was used.

No new relevant research has been identified by this project, and no new information on effectiveness has been provided by stakeholders, so the benefit calculations are based on the 25-75% range for fatalities and serious injuries, and 0-10% for slight injuries. Applying these ranges to the major vehicle group target populations (only these groups were broken down by fatalities, serious and slight injuries) indicates that the equivalent overall effectiveness (the proportion of the overall target population valuation that is saved by AEBS) is in the range 20-50%. This range is thus used for the other vehicle types where the valuations are based on a target population number of casualties (all severities combined), rather than a breakdown by fatal, serious and slight injury.

3.3.2 LDWS costs and effectiveness

The earlier TRL research into LDWS for the EC identified and used a range of system costs from €200-€448. The lower figure came from a research study and stakeholder input and relates to the target cost for systems by 2020. The upper figure is based on the high point of information on the retail costs of current systems available at the time from manufacturers. A recent US study (US Dept of Transportation, 2009) identified system costs (for the operator) for HGVs to lie somewhere in the range $US765 to $US866 (about €600-€700), depending on how the (voluntary) purchase was financed. For the purposes of this project a cost range of €200-€600 is used.

The earlier research also reviewed the evidence available on LDWS effectiveness. The range used, based on this evidence, was 7-48%, with generally higher effectiveness in avoiding higher severity accidents and lower effectiveness in the less severe (slight injury) accidents. The effectiveness was also assumed to vary between the three specific accident scenarios which combined to form the overall target population (head-on, leaving carriageway and side-swipe). With the distribution of injury severities and scenarios identified, this range was equivalent to an overall effectiveness range, for all casualties, of about 20-40%.

The 2009 US study used Field Operational Trial data and feedback from operators to suggest that an efficacy range of 23-53% was appropriate. Another US study (Tradingmarkets.com, 2010) reports a 62% reduction in lane departure related accidents from a fleet of 4,000 LDWS equipped trucks compared to a matched fleet of non-equipped vehicles. Neither of these studies broke down the efficacy rates by injury severity, but both applied to all accident types, including damage-only.

For the purposes of this project, an efficacy range of 20-60% is used.

3.4 Cost-Benefit Analysis methodology

The two earlier TRL analyses used two quite different cost-benefit analysis (CBA) techniques. The lack of robust cost data forced the AEBS study to adopt a break-even analysis that simply calculated what the system costs would have to be less than to achieve a benefit:cost ratio of more than 1. The LDWS study took a much more sophisticated approach, e.g. by considering the effects of the gradual introduction of the systems into the vehicle fleet, initially on a voluntary basis and then on a mandatory fitment to all new vehicles basis. The assessment period was 10 years, with mandatory fitment only applying to the last 7 of those years.

Both analyses also attempted to factor in the effects of savings in congestion costs through accident avoidance or involvement in less-severe accidents. The monetary effects, though, were very small (about 1% of the casualty benefits), so congestion effects are not considered further.

For the purposes of this project and consistency between the analyses for LDWS and AEBS, two approaches are followed. The first is a simple break-even analysis similar

(though not identical) to that carried out for the earlier AEBS study and the second is a phased implementation calculation based on the methodology applied to the earlier LDWS study. Both methods are described more fully in the following sections.

3.4.1 Simple break-even analysis

As an initial indicator, the simple break-even cost, C_s, is calculated by taking the full EU27 target population casualty valuation estimates and dividing them by the estimated number of new registrations of each vehicle type. This calculation gives an upper bound of the break-even cost under steady state conditions. The steady-state conditions arise through the assumption that all the benefits are obtained each year (i.e. the systems are fitted to all vehicles in use) but that the fitting costs only apply to new registrations. It is only relevant, therefore, after sufficient time has passed following introduction of the mandatory fitment requirement for (near enough) all vehicles in use to have been fitted. It is also very much an upper bound because it makes no allowance for system effectiveness, but instead assumes all the target population casualties are avoided.

To summarise,

$C_s = T/R$,

where T is the target population valuation (€) and R is the number of new registrations per annum.

3.4.2 Phased break-even analysis and benefit-cost ratios

The second, more refined method first converts the simple break-even costs into phased break-even costs, C_p, by both considering the effects of the gradual introduction of equipped vehicles into the overall fleet and the effectiveness of the systems in actually preventing only a proportion of the casualties defined by the target populations.

For simplicity, the calculations are based on assuming that 100% mandatory fitment applies to each vehicle type considered from the outset, that the vehicles are fitted at the start of each year considered (so those vehicles achieve their full potential benefits in their first year of use and in all subsequent years), and that an evaluation period of 15 years is appropriate (the ratio of EU27 stock estimates to new registration figures suggest average lives for heavy vehicles of somewhere between 12 and 16 years). It is also assumed that no equipped vehicles subsequently leave the fleet during the evaluation period until they reach the average life for that vehicle type (defined as the ratio of stock to new registrations), so that full penetration of the fleet is achieved after the average life number of years. No discount rate is applied, which is reasonable because the costs and benefits are both occurring throughout the evaluation period.

For some vehicle types, the ratio of stock to new registrations is more than 15, so full penetration is not achieved during the evaluation period. For others, the average life is less than 15 years. These two scenarios dictate two slightly different calculation methodologies, described fully in Appendix A.

3.4.2.1 Benefit:cost ratios

Having calculated the break even costs according to the average vehicle life and whether it is more or less than 15 years, calculation of the benefit-cost ratios for a specific system cost is a straightforward matter of dividing the phased break-even cost, C_p, by the system cost, c. So for example, if the phased break-even cost is calculated to be €2000, then a system cost of €600 would have a benefit-cost ratio of 3.33:1.

4 Results

The target population and simple break-even results are presented in full in the Appendices B, C and D. All the results tables follow the same basic format, as follows, and as shown in Figure 4-1:

- the estimated national target populations for GB, Germany and France are shown in the left hand columns;
- the central columns show the totals for the (up to) three countries and convert those totals into proportions of all casualties in accidents involving N2/N3 or M2/M3 vehicles in the (up to) three countries. If one or two countries data only are available, then the percentages relate to the figures for those one or two countries only;
- The right hand columns present the lower, mid and upper EU27 casualty estimates;
- The lower rows show the numbers of subject registered vehicles in GB and (where appropriate) Germany, along with an EU27 stock estimate;
- The next row divides the overall estimates of casualty numbers by the stock estimates to produce an estimated casualty rate, in terms of casualties per annum per 1000 registered vehicles. These data are referenced to the overall N2/N3 or M2/M3 estimates in the next row;
- The final block of four rows starts with the known GB and estimated EU27 new registrations per year, followed by EU27 casualty valuations. The final two rows present the simple break-even costs (for a 100% effective system).

Table 4-1, Table 4-2 and Table 4-3 present a summary of the results for AEBS (all rear shunts), AEBS (non stationary targets) and LDWS respectively, in descending order of overall target population estimate (for EU27). The main vehicle groups (M2, M3, M2/M3, N2, N3 and N2/N3) are shown in bold to ease identification of the main categories.

These Tables provide a simple overview of the results in a format that could be used, for example, to highlight vehicle types having consistently low (< 1) benefit-cost ratios in all scenarios, which may be strong candidates for exemption on cost-benefit grounds. Given the uncertainties, however, in the analyses, particularly over system costs, some vehicle types with benefit-cost ratios of more than 1 in the upper scenario but less than 1 in the mid and lower scenarios may also be suitable candidates.

To facilitate such judgements, Figure 4-2, Figure 4-3, Figure 4-4, Figure 4-5, Figure 4-6 and Figure 4-7 present the results in a different way, with each vehicle type highlighted on a graph of target population size (corresponding to the mid scenario estimates) against the average benefit-cost ratios across all three scenarios as a proportion of the ratios for all N2/N3 or M2/M3 vehicles.

Vehicles towards the top right of these "prioritisation charts" represent those with higher benefit-cost ratios than the overall group and that are involved in a large number of accidents, whereas those towards the bottom left have benefit-cost ratios below the overall vehicle group and are responsible for only a small number of casualties.

Vehicles towards the top left corner of the graphs have high calculated relative benefit-cost ratios but are likely to be involved in only a small number of accidents and thus the confidence in the benefit-cost ratios is lower; whatever decision is taken regarding exemption of these vehicles would in any event, therefore, be likely to have a relatively low impact on casualty numbers.

Conversely, vehicles towards the bottom right of the charts have relatively low benefit-cost ratios, but are responsible for a large number of casualties. While this means confidence in the calculated ratios is relatively high, it also means that a decision to

exempt such vehicles would be likely to have a major impact on overall casualty numbers.

In summary, the ranges of benefit-cost ratios are broadly consistent with those derived (for the main vehicle groupings only) for the earlier research. Ratios are generally estimated to be well below unity (i.e. the benefits will be unlikely to exceed the costs) if the lower end of the ranges are used, corresponding to assuming higher fitment costs, lower effectiveness and lower overall target population casualty numbers. In the reverse scenario, where lower costs are assumed along with higher casualty numbers and higher system effectiveness, the ratios are generally well above unity, and often more than 10. Ratios of between 1 and 3, or a little more or less, are prevalent in the mid scenarios.

4.1 AEBS (all rear shunts)

All but one of the vehicle types assessed are estimated to have the potential to achieve a benefit-cost ratio of more than 1 in the upper estimate scenario, and the majority have ratios of more than 1 in the mid scenario, too. Only one vehicle type has such a ratio, though, in the lower scenario set of estimates.

The only vehicle type that has an estimated range of plausible benefit-cost ratios that does not have the value 1 within it, is the N2 tractor unit with gross weight less than 7.5 tonnes. It is estimated (based on the GB stock) that there are only about 7,000 of these vehicles in use across the EU27, and only about 600 new registrations per year. They are likely to account for only between 0 and 4 casualties in AEBS relevant accidents per year, and benefit-cost ratios are estimated to lie somewhere in the range 0 to 0.3.

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 as guilty party	All Roads	Fatal	2	1.5%	8	7.6%	Not available		10	4.1%			
		Serious	30	2.3%	62	4.4%			92	3.4%			
		Slight	1068	8.4%	771	8.2%			1839	8.3%			
	All Casualties		1100	7.8%	841	7.7%			1941	7.8%	3866	8783	15120
	Stock (1000s)		79.27		70.06						662		
	Rate (casualties per 1000 vehicles)		13.87		12.00						5.84	13.26	22.83
	Baseline (M2/M3) rate		7.08		11.17						4.78	10.85	18.68
	New registrations per year (1000s)		4.63								43		
	Casualty valuations (€million)										212	346	487
	Break-even cost (€ 100% effectiveness)										4,961	8,086	11,392
	Baseline (M2/M3) break-even cost (€										4,059	6,615	9,319

Figure 4-1. Example of results form

Table 4-1. Summary of AEBS (all rear shunts) target population, break-even costs and benefit-cost ratio estimates

	EU-27 annual estimates													
			AEBS (all rear shunts)											
			Target population (Casualties)			Simple Break-Even Costs (€) (if systems 100% effective)			Phased Break-Even Costs (€) (15 Yrs, fit to all new vehicles)			Phased Benefit:Cost Ratios (15 Yrs, fit to all new vehicles)		
Vehicle Type	Stock (1000s)	New registrations per annum (1000s)	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper
	Effectiveness								20%	35%	50%			
	System costs											€ 1,500	€ 750	€ 250
N2/N3	**5700**	**423**	**20514**	**48673**	**82935**	**€ 5,349**	**€ 7,247**	**€ 9,243**	**€ 625**	**€ 1,482**	**€ 2,700**	**0.4**	**2.0**	**10.8**
N3	**3192**	**317**	**15337**	**36317**	**61879**	**€ 5,964**	**€ 7,815**	**€ 9,791**	**€ 832**	**€ 1,908**	**€ 3,415**	**0.6**	**2.5**	**13.7**
N3 >16t	2987	307	13953	33040	56296	€ 5,600	€ 7,337	€ 9,193	€ 794	€ 1,821	€ 3,259	0.5	2.4	13.0
N2	**2508**	**106**	**5173**	**12347**	**21042**	**€ 3,507**	**€ 5,546**	**€ 7,598**	**€ 238**	**€ 657**	**€ 1,287**	**0.2**	**0.9**	**5.1**
N3 >16t Rigid (not towing)	1618	146	4902	11607	19776	€ 4,135	€ 5,418	€ 6,788	€ 549	€ 1,259	€ 2,254	0.4	1.7	9.0
N2 >5 <=7.5t	1796	73	3517	8394	14305	€ 3,480	€ 5,503	€ 7,539	€ 225	€ 624	€ 1,221	0.2	0.8	4.9
N3 >16t >3 axles	334	40	2036	4822	8216	€ 6,282	€ 8,232	€ 10,314	€ 948	€ 2,173	€ 3,889	0.6	2.9	15.6
N3 >16t Off Road	365	35	1785	4226	7201	€ 6,364	€ 8,339	€ 10,448	€ 867	€ 1,988	€ 3,558	0.6	2.7	14.2
N3 <=16t	205	10	1384	3277	5583	€ 17,372	€ 22,762	€ 28,519	€ 1,329	€ 3,047	€ 5,454	0.9	4.1	21.8
N3 <=16t Rigid (not towing)	202	10	1274	3017	5140	€ 16,473	€ 21,584	€ 27,044	€ 1,244	€ 2,852	€ 5,104	0.8	3.8	20.4
N2 >7.5t	333	12	996	2378	4053	€ 6,072	€ 9,602	€ 13,155	€ 345	€ 955	€ 1,868	0.2	1.3	7.5
N2 <=5t	379	22	662	1580	2693	€ 2,204	€ 3,485	€ 4,775	€ 201	€ 557	€ 1,090	0.1	0.7	4.4
N3 >16t Special Purpose	286	30	568	1346	2293	€ 2,333	€ 3,056	€ 3,829	€ 334	€ 766	€ 1,370	0.2	1.0	5.5
N2 Special Purpose	163	10	406	970	1652	€ 2,962	€ 4,684	€ 6,418	€ 288	€ 796	€ 1,558	0.2	1.1	6.2
N2 Off Road	264	13	297	709	1209	€ 1,602	€ 2,534	€ 3,471	€ 130	€ 359	€ 703	0.1	0.5	2.8
N3 <=16t Special Purpose	14	1	174	411	701	€ 23,432	€ 30,703	€ 38,468	€ 2,451	€ 5,621	€ 10,061	1.6	7.5	40.2
N3 >44t	?	?	26	327	557	?	?	?	?	?	?	?	?	?
N3 <=16t Off Road	14	0.3	15	112	190	€ 6,493	€ 26,664	€ 33,408	€ 217	€ 1,562	€ 2,797	0.1	2.1	11.2
N2 >3 axles *	2	0.2	0	15	26	€ 0	€ 4,267	€ 5,846	€ 0	€ 996	€ 1,949	0	1.3	7.8
N3 <=16t >3 axles *	0.5	0.01	0	8	13	€ 0	€ 39,522	€ 49,518	€ 0	€ 3,145	€ 5,629	0	4.2	22.5
N2 Tractor unit <=7.5t *	7	0.6	0	2	4	€ 0	€ 202	€ 277	€ 0	€ 43	€ 84	0	0.1	0.3
M2/M3	**883**	**57**	**4217**	**9580**	**16492**	**€ 4,059**	**€ 6,615**	**€ 9,319**	**€ 419**	**€ 1,196**	**€ 2,406**	**0.3**	**1.6**	**9.6**
M3	**662**	**43**	**3866**	**8783**	**15120**	**€ 4,961**	**€ 8,086**	**€ 11,392**	**€ 512**	**€ 1,462**	**€ 2,941**	**0.3**	**1.9**	**11.8**
M3 Class I/II/III	591	38	3798	8629	14855	€ 5,478	€ 8,928	€ 12,577	€ 564	€ 1,608	€ 3,237	0.4	2.1	12.9
M2	**221**	**14**	**351**	**797**	**1372**	**€ 1,351**	**€ 2,202**	**€ 3,102**	**€ 140**	**€ 398**	**€ 801**	**0.1**	**0.5**	**3.2**
M3 Class A	71	5	68	154	265	€ 790	€ 1,287	€ 1,813	€ 84	€ 239	€ 481	0.1	0.3	1.9
M3 articulated *	5	0.4	7	25	44	€ 972	€ 2,512	€ 3,539	€ 127	€ 576	€ 1,158	0.1	0.8	4.6
M3 >3 axles *	0.6	0.1	7	16	27	€ 3,798	€ 6,058	€ 8,535	€ 639	€ 1,784	€ 3,591	0.4	2.4	14.4

* NB. The numbers of these vehicles in use in GB are very low (data from other countries not available), so very low numbers of casualties are to be expected - EU-27 estimates are thus subject to significant uncertainty.

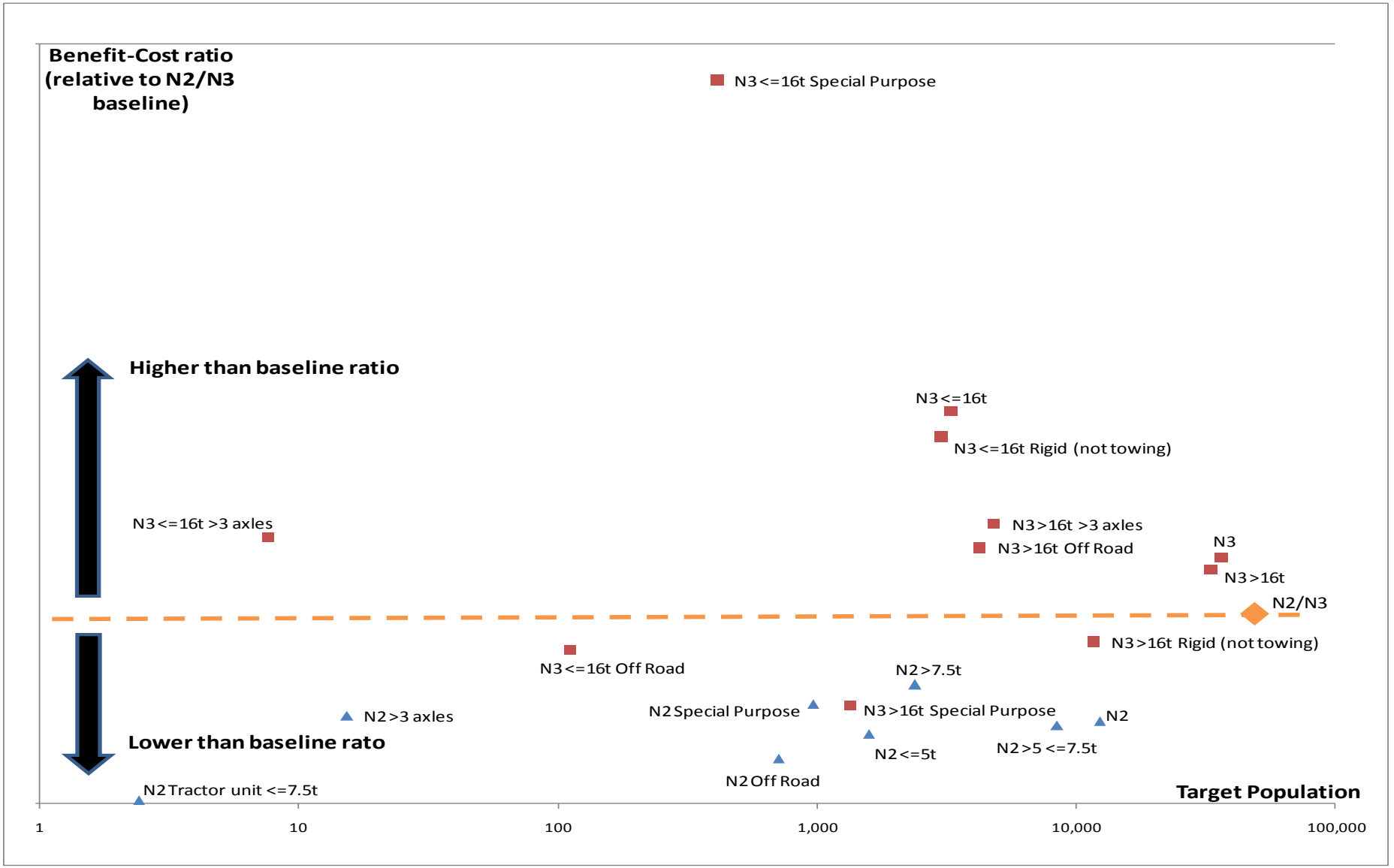

Figure 4-2. Prioritisation Chart for AEBS (all rear shunts), N2/N3 vehicle types

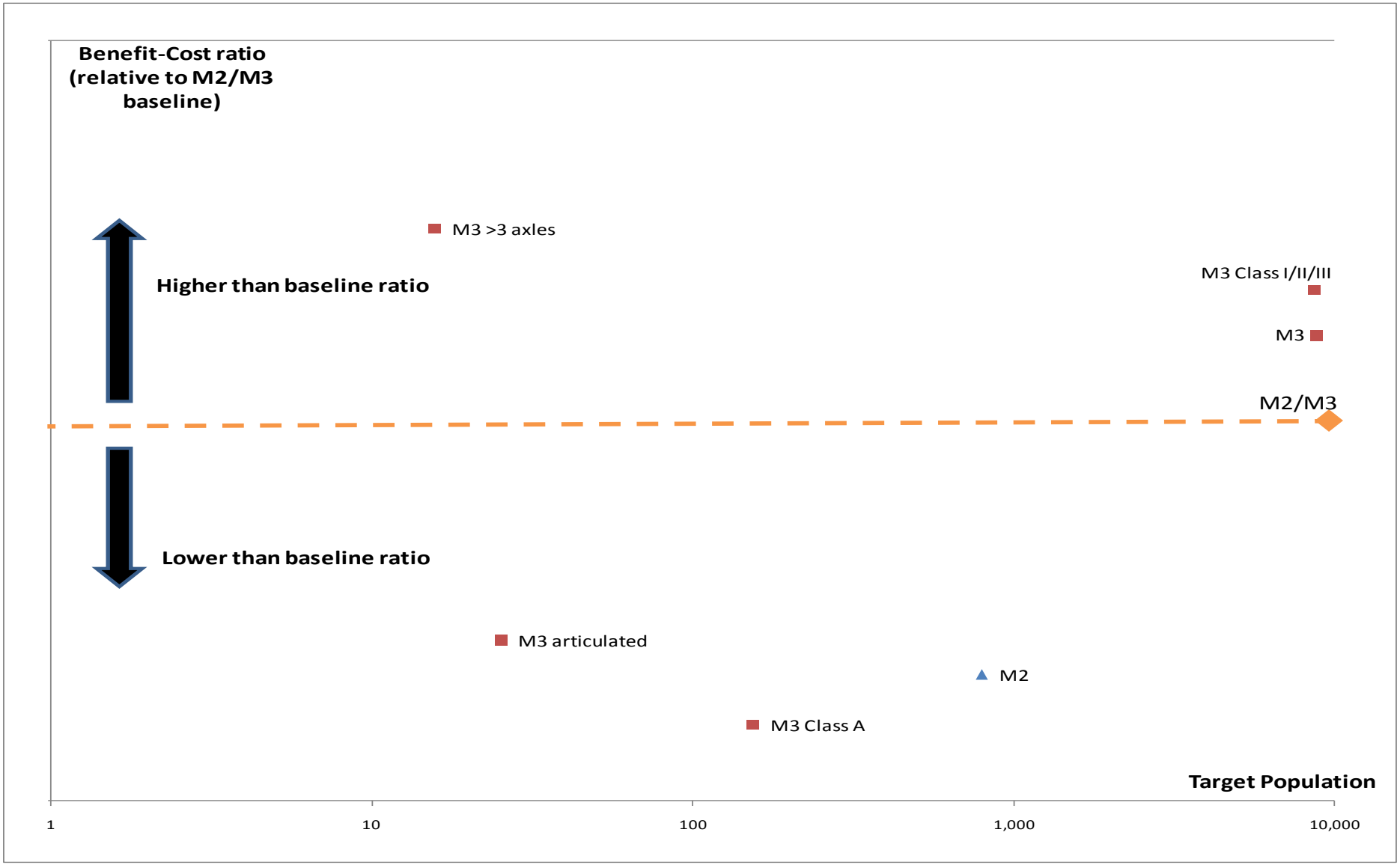

Figure 4-3. Prioritisation Chart for AEBS (all rear shunts), M2/M3 vehicle types

Table 4-2. Summary of AEBS (non stationary targets) target population, break-even costs and benefit-cost ratio estimates

	EU-27 annual estimates													
			AEBS (non stationary targets)											
			Target population (Casualties)			Simple Break-Even Costs (€) (if systems 100% effective)			Phased Break-Even Costs (€) (15 Yrs, fit to all new vehicles)			Phased Benefit:Cost Ratios (15 Yrs, fit to all new vehicles)		
Vehicle Type	Stock (1000s)	New registrations per annum (1000s)	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper
	Effectiveness								20%	35%	50%			
	System costs											€ 1,000	€ 500	€ 150
N2/N3	**5700**	**423**	**9501**	**22212**	**37548**	**€ 2,718**	**€ 3,691**	**€ 4,665**	**€ 318**	**€ 755**	**€ 1,363**	**0.3**	**1.5**	**9.1**
N3	**3192**	**317**	**7745**	**18244**	**30975**	**€ 2,901**	**€ 3,898**	**€ 4,926**	**€ 405**	**€ 952**	**€ 1,718**	**0.4**	**1.9**	**11.5**
N3 >16t	2987	307	7361	17340	29439	€ 2,845	€ 3,823	€ 4,832	€ 403	€ 949	€ 1,713	0.4	1.9	11.4
N3 >16t Rigid (not towing)	1618	146	2098	4942	8391	€ 1,705	€ 2,291	€ 2,895	€ 226	€ 532	€ 961	0.2	1.1	6.4
N2	**2508**	**106**	**1758**	**3972**	**6577**	**€ 2,177**	**€ 3,081**	**€ 3,894**	**€ 148**	**€ 365**	**€ 659**	**0.1**	**0.7**	**4.4**
N2 >5 <=7.5t	1796	73	1287	2908	4815	€ 2,327	€ 3,292	€ 4,161	€ 151	€ 373	€ 674	0.2	0.7	4.5
N3 >16t >3 axles	334	40	998	2350	3990	€ 2,965	€ 3,984	€ 5,035	€ 447	€ 1,052	€ 1,899	0.4	2.1	12.7
N3 >16t Off Road	365	35	754	1776	3015	€ 2,589	€ 3,479	€ 4,397	€ 353	€ 829	€ 1,497	0.4	1.7	10.0
N3 <=16t	205	10	384	904	1536	€ 4,642	€ 6,238	€ 7,884	€ 355	€ 835	€ 1,508	0.4	1.7	10.1
N3 <=16t Rigid (not towing)	202	10	335	788	1338	€ 4,167	€ 5,600	€ 7,078	€ 315	€ 740	€ 1,336	0.3	1.5	8.9
N3 >16t Special Purpose	286	30	262	617	1047	€ 1,035	€ 1,391	€ 1,758	€ 148	€ 348	€ 629	0.1	0.7	4.2
N2 >7.5t	333	12	271	613	1015	€ 3,021	€ 4,274	€ 5,402	€ 172	€ 425	€ 767	0.2	0.8	5.1
N2 <=5t	379	22	204	462	764	€ 1,242	€ 1,758	€ 2,222	€ 113	€ 281	€ 507	0.1	0.6	3.4
N2 Special Purpose	163	10	152	344	570	€ 2,030	€ 2,873	€ 3,631	€ 197	€ 488	€ 882	0.2	1.0	5.9
N2 Off Road	264	13	100	226	374	€ 985	€ 1,394	€ 1,762	€ 80	€ 198	€ 357	0.1	0.4	2.4
N3 <=16t Special Purpose	14	1	57	135	230	€ 7,470	€ 10,039	€ 12,687	€ 781	€ 1,838	€ 3,318	0.8	3.7	22.1
N3 >44t	?	?	11	128	218	?	?	?	?	?	?	?	?	?
N3 <=16t Off Road	14	0.3	13	44	74	€ 5,558	€ 10,393	€ 13,135	€ 186	€ 609	€ 1,100	0.2	1.2	7.3
N2 >3 axles *	2	0.2	0	7	12	€ 0	€ 3,589	€ 4,537	€ 0	€ 838	€ 1,512	0	1.7	10.1
N3 <=16t >3 axles *	0.5	0.01	0	3	5	€ 0	€ 15,405	€ 19,469	€ 0	€ 1,226	€ 2,213	0	2.5	14.8
N2 Tractor unit <=7.5t *	7	0.6	0	1	2	€ 0	€ 170	€ 215	€ 0	€ 36	€ 65	0	0.1	0.4
M2/M3	**883**	**57**	**1272**	**2836**	**4826**	**€ 2,400**	**€ 3,273**	**€ 4,143**	**€ 248**	**€ 592**	**€ 1,070**	**0.2**	**1.2**	**7.1**
M3	**662**	**43**	**1127**	**2513**	**4276**	**€ 2,836**	**€ 3,867**	**€ 4,895**	**€ 293**	**€ 699**	**€ 1,264**	**0.3**	**1.4**	**8.4**
M3 Class I/II/III	591	38	1110	2475	4212	€ 3,139	€ 4,280	€ 5,418	€ 323	€ 771	€ 1,394	0.3	1.5	9.3
M2	**221**	**14**	**145**	**323**	**549**	**€ 1,093**	**€ 1,491**	**€ 1,887**	**€ 113**	**€ 269**	**€ 487**	**0.1**	**0.5**	**3.2**
M3 Class A	71	5	17	38	65	€ 389	€ 530	€ 671	€ 41	€ 98	€ 178	0.0	0.2	1.2
M3 articulated *	5	0.4	6	11	18	€ 1,544	€ 1,760	€ 2,228	€ 202	€ 403	€ 729	0.2	0.8	4.9
M3 >3 axles *	0.6	0.1	0	4	7	€ 0	€ 2,661	€ 3,369	€ 0	€ 784	€ 1,417	0.0	1.6	9.4

* NB. The numbers of these vehicles in use in GB are very low (data from other countries not available), so very low numbers of casualties are to be expected - EU-27 estimates are thus subject to significant uncertainty.

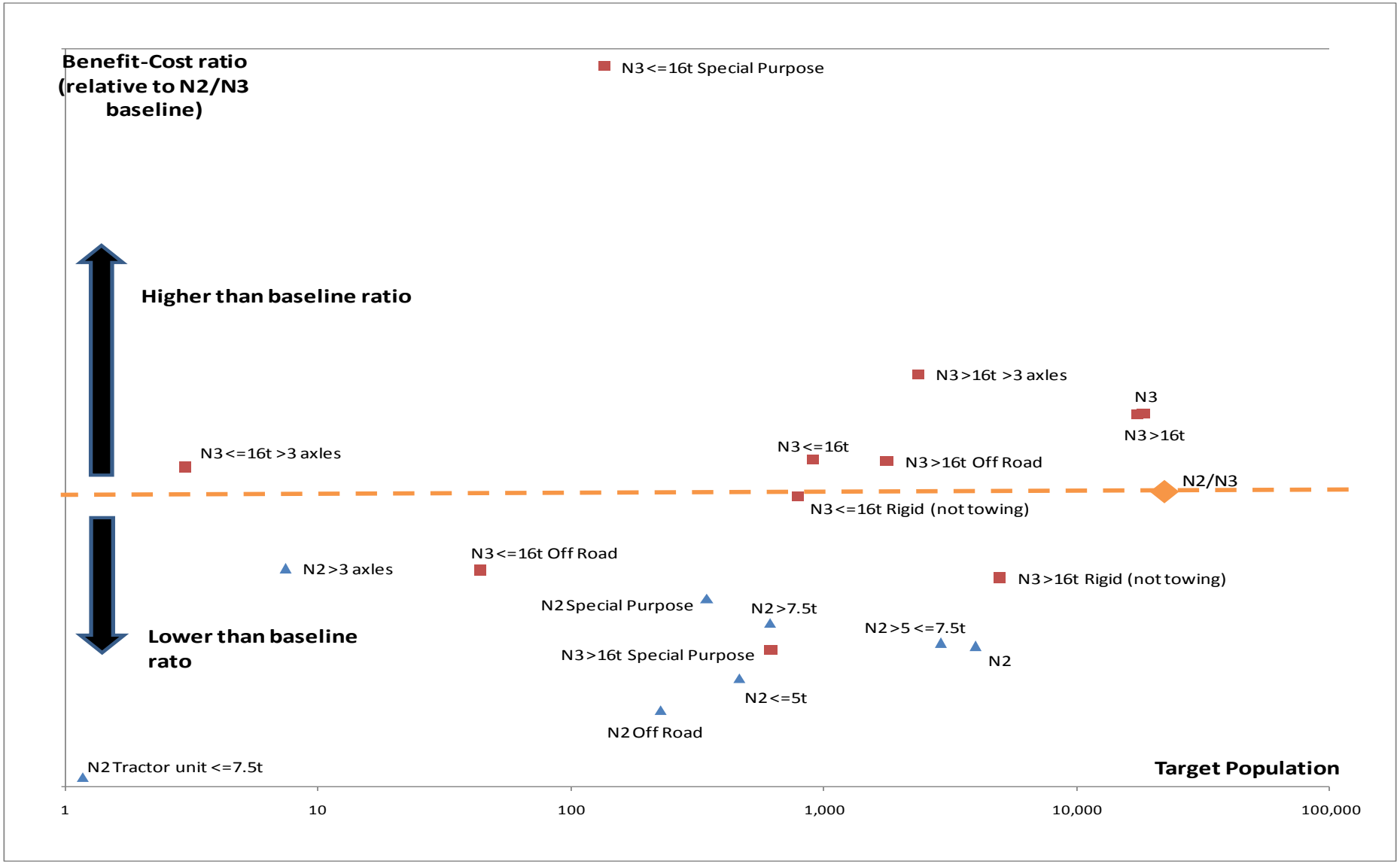

Figure 4-4. Prioritisation Chart for AEBS (non stationary targets), N2/N3 vehicle types

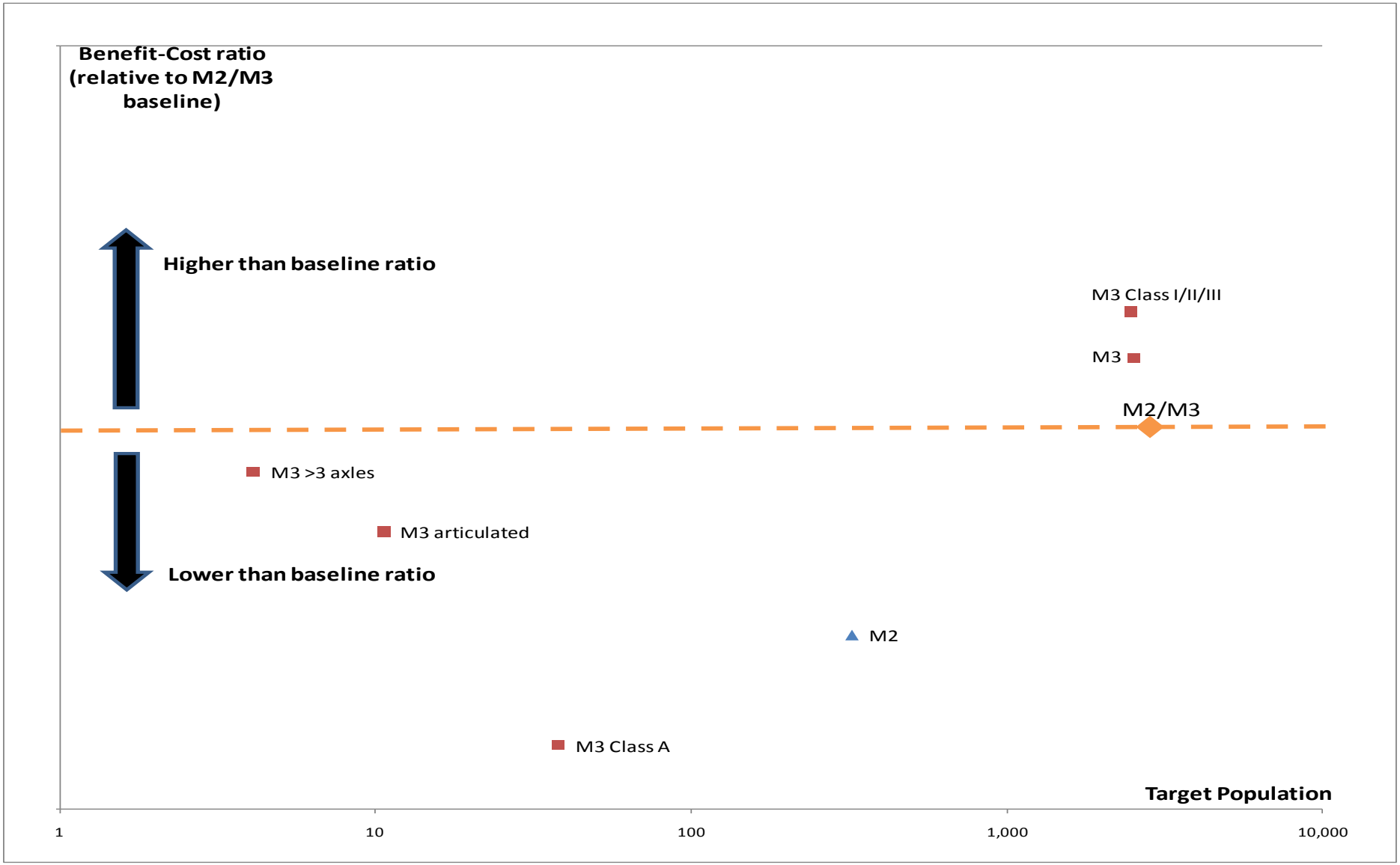

Figure 4-5. Prioritisation Chart for AEBS (non stationary targets), M2/M3 vehicle types

Table 4-3. Summary of LDWS target population, break-even costs and benefit-cost ratio estimates

	EU-27 annual estimates													
			LDWS											
			Target population (Casualties)			Simple Break-Even Costs (€) (if systems 100% effective)			Phased Break-Even Costs (€) (15 Yrs, fit to all new vehicles)			Phased Benefit:Cost Ratios (15 Yrs, fit to all new vehicles)		
Vehicle Type	Stock (1000s)	New registrations per annum (1000s)	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper
	Effectiveness								20%	40%	60%			
	System costs											€ 600	€ 400	€ 200
N2/N3	**5700**	**423**	**7705**	**16838**	**27495**	**€ 3,830**	**€ 4,853**	**€ 5,776**	**€ 448**	**€ 1,134**	**€ 2,024**	**0.7**	**2.8**	**10.1**
N3	**3192**	**317**	**5751**	**12641**	**20697**	**€ 3,615**	**€ 4,623**	**€ 5,536**	**€ 504**	**€ 1,290**	**€ 2,317**	**0.8**	**3.2**	**11.6**
N3 >16t	2987	307	5511	12112	19832	€ 3,574	€ 4,571	€ 5,474	€ 507	€ 1,296	€ 2,329	0.8	3.2	11.6
N2	**2508**	**106**	**1952**	**4192**	**6789**	**€ 4,474**	**€ 5,537**	**€ 6,491**	**€ 303**	**€ 750**	**€ 1,319**	**0.5**	**1.9**	**6.6**
N3 >16t Rigid (not towing)	1618	146	1617	3554	5819	€ 2,204	€ 2,819	€ 3,376	€ 293	€ 749	€ 1,345	0.5	1.9	6.7
N2 >5 <=7.5t	1796	73	1254	2693	4361	€ 4,194	€ 5,191	€ 6,085	€ 272	€ 673	€ 1,183	0.5	1.7	5.9
N2 >7.5t	333	12	424	912	1476	€ 8,746	€ 10,824	€ 12,689	€ 497	€ 1,230	€ 2,163	0.8	3.1	10.8
N3 >16t Off Road	365	35	292	643	1052	€ 1,685	€ 2,155	€ 2,580	€ 230	€ 587	€ 1,054	0.4	1.5	5.3
N2 <=5t	379	22	274	588	952	€ 3,080	€ 3,812	€ 4,469	€ 281	€ 696	€ 1,224	0.5	1.7	6.1
N2 Off Road	264	13	261	560	907	€ 4,752	€ 5,881	€ 6,895	€ 385	€ 953	€ 1,676	0.6	2.4	8.4
N3 >16t >3 axles	334	40	250	550	900	€ 1,248	€ 1,596	€ 1,911	€ 188	€ 481	€ 865	0.3	1.2	4.3
N3 <=16t	205	10	241	529	866	€ 4,881	€ 6,243	€ 7,476	€ 373	€ 955	€ 1,716	0.6	2.4	8.6
N3 <=16t Rigid (not towing)	202	10	225	496	811	€ 4,712	€ 6,026	€ 7,217	€ 356	€ 910	€ 1,634	0.6	2.3	8.2
N3 >16t Special Purpose	286	30	197	433	709	€ 1,307	€ 1,672	€ 2,002	€ 187	€ 479	€ 860	0.3	1.2	4.3
N2 Special Purpose	163	10	105	225	364	€ 2,580	€ 3,193	€ 3,744	€ 251	€ 620	€ 1,091	0.4	1.6	5.5
N3 >44t	?	?	0	206	337	?	?	?	?	?	?	?	?	?
N3 <=16t Special Purpose	14	1	45	99	161	€ 9,780	€ 12,508	€ 14,978	€ 1,023	€ 2,617	€ 4,701	1.7	6.5	23.5
N3 <=16t Off Road	14	0.3	15	70	115	€ 10,230	€ 28,474	€ 34,097	€ 343	€ 1,907	€ 3,425	0.6	4.8	17.1
N2 >3 axles *	2	0.2	11	23	37	€ 16,057	€ 18,676	€ 21,894	€ 2,141	€ 4,980	€ 8,758	4	12.5	43.8
N3 <=16t >3 axles *	0.5	0.01	0	5	8	€ 0	€ 42,205	€ 50,539	€ 0	€ 3,838	€ 6,895	0	9.6	34.5
N2 Tractor unit <=7.5t *	7	0.6	0	4	6	€ 0	€ 885	€ 1,037	€ 0	€ 215	€ 377	0	0.5	1.9
M2/M3	**883**	**57**	**2381**	**5073**	**8373**	**€ 9,356**	**€ 11,501**	**€ 13,397**	**€ 966**	**€ 2,376**	**€ 4,151**	**1.6**	**5.9**	**20.8**
M3	**662**	**43**	**2246**	**4786**	**7898**	**€ 11,768**	**€ 14,465**	**€ 16,849**	**€ 1,215**	**€ 2,988**	**€ 5,221**	**2.0**	**7.5**	**26.1**
M3 Class I/II/III	591	38	2206	4702	7759	€ 12,992	€ 15,971	€ 18,603	€ 1,338	€ 3,288	€ 5,745	2.2	8.2	28.7
M2	**221**	**14**	**135**	**288**	**475**	**€ 2,122**	**€ 2,608**	**€ 3,038**	**€ 219**	**€ 539**	**€ 941**	**0.4**	**1.3**	**4.7**
M3 articulated *	5	0.4	10	116	191	€ 5,558	€ 37,722	€ 43,939	€ 728	€ 9,877	€ 17,257	1.2	24.7	86.3
M3 Class A	71	5	39	84	139	€ 1,875	€ 2,304	€ 2,684	€ 199	€ 489	€ 854	0.3	1.2	4.3
M3 >3 axles *	0.6	0.1	0	72	118	€ 0	€ 90,976	€ 105,971	€ 0	€ 30,619	€ 53,499	0.0	76.5	267.5

* NB. The numbers of these vehicles in use in GB are very low (data from other countries not available), so very low numbers of casualties are to be expected - EU-27 estimates are thus subject to significant uncertainty.

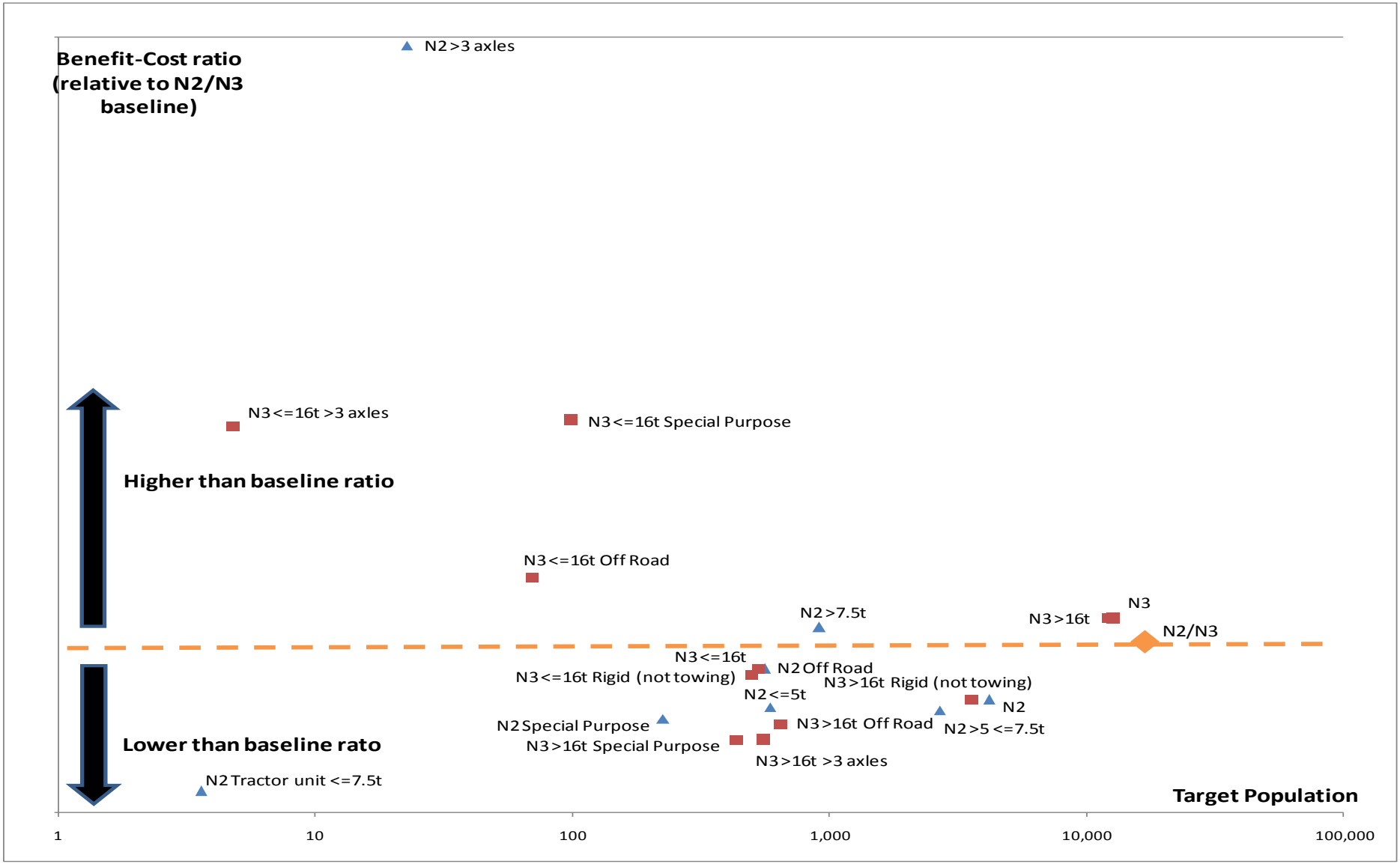

Figure 4-6. Prioritisation Chart for LDWS, N2/N3 vehicle types

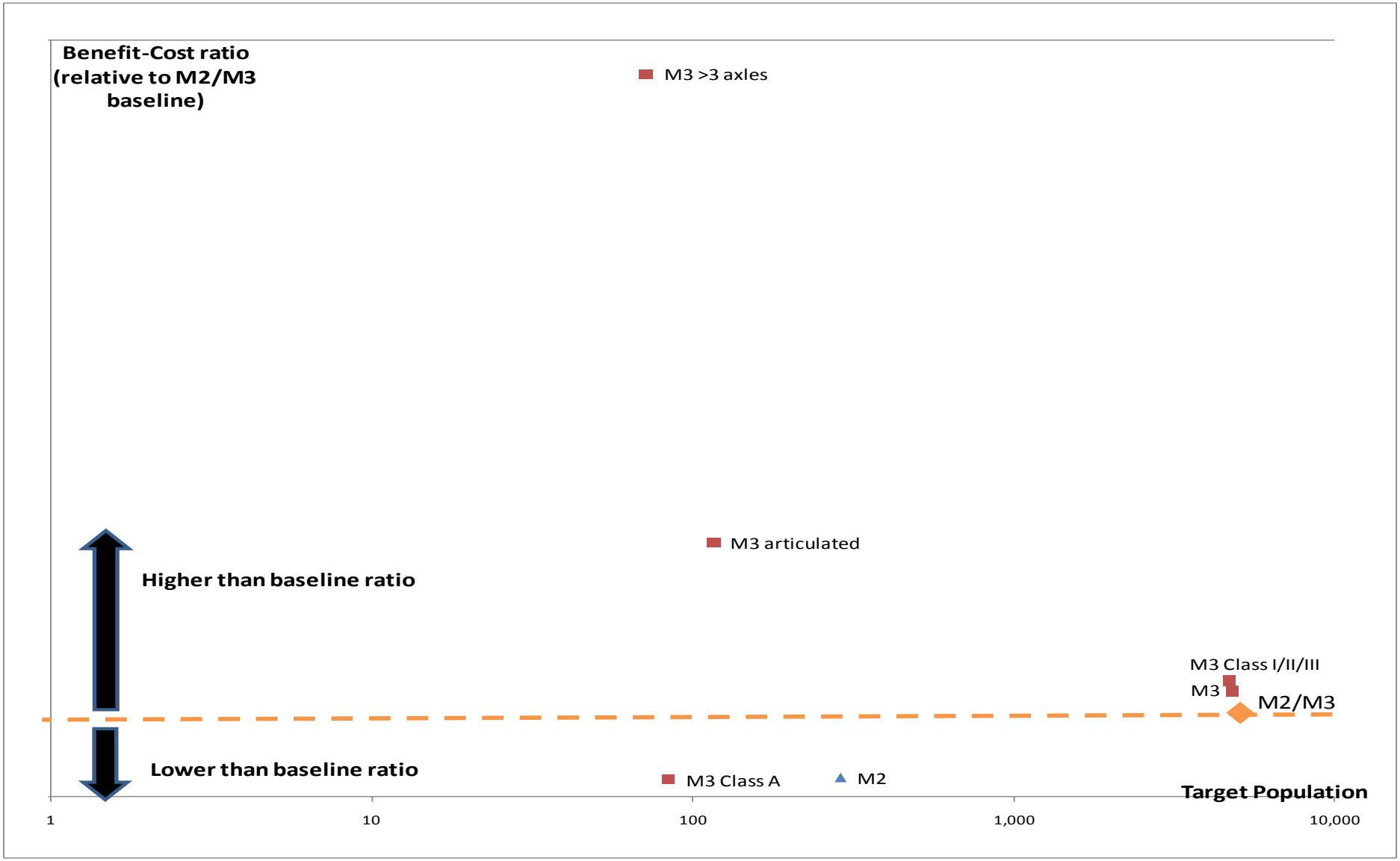

Figure 4-7. Prioritisation Chart for LDWS, M2/M3 vehicle types

4.2 AEBS (non stationary targets)

For the less sophisticated AEBS, relevant only to rear shunts involving a moving target vehicle, broadly the same conclusions apply as for the all rear shunts system. Benefit cost ratios are consistently unity or above in the upper scenario, except for the N2 tractor units less than 7.5 tonnes. With an upper estimate of just 2 relevant casualties per year, the benefit-cost ratio is estimated to lie somewhere between 0 and 0.4. All the other vehicle types, though, have estimated benefit-cost ratio ranges that could plausibly include the value 1.

4.3 LDWS

All the vehicle types achieve benefit-cost ratios of more than 1 in the upper scenario, and only one (N2 tractor units < 7.5 tonnes) fails to do so in the mid scenario.

5 Technical evaluations

Below is a summary of the technical exemptions requested by the industry and the motivation behind the request (i.e. those not related simply to too few vehicles being involved in too few accidents which would be highlighted by the cost-benefit analyses).

Table 5-1. Vehicle types put forward by stakeholders for LDWS exemption on technical grounds

	Vehicle Exemption	Motivation
N2/N3	off-road	Off road vehicles are designed for 'off road' use (including gravel roads). No lane markings exist off-road and speeds are below 60km/h (LDWS activation speed)
	Special purpose	LDWS are most efficient for 'long distance' trucks travelling on highways. Drivers of Special purpose vehicles are probably 'very active'.
	All vehicles with max speed lower than 60km/h	LDWS on the market only activate above 60km/h
	Vehicles not intended to tow a trailer	These vehicles are normally used for short distances, thus a limited benefit is foreseen whereas a high development cost is certain.
	More than 3 axle vehicles	Vehicles mainly dedicated to construction/heavy load purpose.
M3	Class I, II and Class A	These class of buses has a low average speed (mainly below 60km/h). Frequently crossing lines will result in many un-intended warnings. Class I: (city buses) average speed of 10-20km/h. Range = 0 - 50km/h. Active driver, a lot of stops in city driving (approx 450-600m between stops) Class II: (Suburban buses) Average speed 20-40km/h. Range = 0 - 80km/h. Active driver, several stops (approx 800 - 5000m between stops)
	All vehicles with max speed lower than 60km/h	*As per N2/N3 Vehicles*
M2	Urban transport vehicles	Average speed is low (mainly below 60km/h) Line markings in cities are difficult to detect.

Table 5-2. Vehicle types put forward by stakeholders for AEBS exemption on technical grounds

	Vehicle Exemption	Motivation
N2/N3	Vehicles >12T but less than 16T	This type of vehicle has air/hydraulic braking system. Possibly need to re-engineer the whole braking system; however this is technically feasible at this price.
	Off Road	Off road vehicles have a high chassis height which might cause a problem to install the sensor within suppliers recommendations. High pitch angle variations are limiting the field of view of the sensors. Environmental conditions may affect sensorial system. High risk of damaging the sensors during off road driving. Normally driving on gravel or dirt roads and at less than 60km/h.
	Special purpose	Some special chassis/body adaptations for special purpose vehicles might cause a problem to install sensors. These vehicles are not normally driven as 'long distance' trucks. Divers are most probably very active.
	Vehicles with driven front axle	AEBS are most efficient for 'long distance trucks' travelling on highways. Most of those trucks have only one driven axle.
	Vehicles with more than 3 axles	EVSC not mandatory for vehicles with more than 3 axles.
	All vehicles not intended to tow a trailer	These trucks are normally used for short distance travel. A limited benefit is foreseen whereas a high development cost is certain.
	All vehicles without rear air suspensions	Radar sensors have a limited vertical field of view. Rear steel suspended vehicles chassis height will change between laden and unladen. This could cause the target vehicles to occasionally be outside the sensors vertical view.
M3	Vehicles with more than 3 axles, artic buses and Class I or class A	Vehicles carrying standing passengers so AEBS could be dangerous. Av speed is low: City bus av speed = 10-20km/h. Range = 0 -50km/h. Active driver, a lot of stops in city traffic (approx 450-600m between stops). Standing passengers. No legal requirement for seatbelts.
	Class II	Low average speed. Av speed = 20-40km/h. range = 0 - 80km/h. Active driver (800-5000m between stops). Many standing passengers.
	Vehicles <12T	Vehicles carrying standing passengers so dangerous. Also there are some technical limitations for the sensor installation and system design.

The following sections consider these issues, using the authors' engineering judgement and experience, supplemented with additional information provided by some stakeholders during the course of the project. The project scope did not allow for any more detailed evaluations of these issues, e.g. by track testing or on-road trials.

5.1 AEBS

Additional information provided by stakeholders clarified that AEBS were expected to be capable of operating at speeds above 20 km/h, not 60 km/h as previously suggested. The technical grounds put forward relating to average speeds of less than 60 km/h can therefore be disregarded, unless those speeds are also less than 20 km/h.

5.1.1 Relevance of EVSC

Most of the exemption proposals stem from the stakeholder view that vehicles not required to be fitted with EVSC (Enhanced Vehicle Stability Control), and therefore not fitted with it, would not be amenable to AEBS fitment. As a consequence, the vehicle types proposed for exemption are, in the main, the same vehicle types as are already exempt from EVSC requirements. These include off road and special purpose vehicles, including those with more than one driven axle and with more than 3 axles, and buses with a gross weight of less than 12 tonnes (which tend to be based on commercial vehicle chassis that don't have EVSC fitted).

The argument goes that AEBS relies on some components already fitted as part of the EVSC system (e.g. steering wheel angle, lateral acceleration and yawing moment sensors). Stakeholders were asked to estimate the additional costs involved in fitting AEBS to vehicles not already equipped with EVSC, but a definitive answer has not been provided. For vehicles already equipped with electronic brake actuation, the extra costs would be likely to be quite low, but for systems equipped with conventional pneumatic or air-over-hydraulic systems, though, more substantial extra hardware would be needed to generate the brake actuation forces (that would normally be provided by the driver). It is also argued that the EVSC functionality helps to ensure vehicle stability under braking, which would also apply when an AEBS system operates. This is particularly relevant when braking on a bend, when an anti-lock brake system may not always be sufficient on its own to maintain vehicle stability, particularly for relatively small vehicles (larger vehicles tend to overturn before the limit of lateral adhesion is reached).

In the absence of detailed cost information it is not possible to provide a definitive view as to whether fitting the additional brake actuation hardware alongside the AEBS system is justified. For heavy vehicles in particular, fitting AEBS to a vehicle that does not have EVSC but does have ABS is considered likely to be able to provide very close to the same degree of safety when braking heavily as would be available if EVSC was also available.

The fundamental purpose of AEBS is to apply the brakes in situations where the driver should be applying them anyway, but isn't. The information provided by stakeholders argues that the hardware needed to replace the driver's right foot would be prohibitively difficult/expensive in the absence of EVSC (which has the basic hardware as standard, although modifications would even then be needed to allow for higher brake actuation pressures). Even if this is indeed the case, the option of providing instead a Forward Collision Warning (FCW) system to alert the driver to provide the necessary brake actuation is a potential compromise. It is considered likely that the majority of the costs of AEBS relate to the forward sensing radar and control/false alarm prevention electronics and software, rather than the brake actuation hardware.

Another stakeholder from industry confirms that it is possible to conceive of an AEBS using an active brake booster and not requiring an EVSC system. This suggests that the view that AEBS is not feasible without EVSC is not correct but that there may be different costs, levels of effectiveness and lead times to develop the alternative approach.

5.1.2 Steel suspensions

Another common theme running through the exemption proposals is that vehicles not equipped with air rear suspensions should be exempt because the larger pitch angle variations (loaded and unloaded vehicles) would prevent the forward sensors working properly. Self levelling headlights are common place on many vehicles, so it would seem to be relatively straightforward for manufacturers to fit AEBS sensors to similar units, and thus to compensate for changes in pitch angle according to loading condition. This view is confirmed by stakeholder feedback suggesting that mechanical levelling systems would add only about €50 to the overall system costs. Stakeholders have also provided evidence that somewhere between 10-30% of small vehicles (N2 and M2) are currently equipped with air suspension, whereas for larger vehicles (M3 and N3), the proportion is close to 100% (except for off road vehicles).

Excessive chassis height effecting the ability of the sensors to work properly has also been proposed as a problem for some vehicles. Stakeholders have suggested that the sensors will operate properly if mounted between 300 and 1000mm from the ground.

It is considered reasonable, though, to expect sensors fitted to off road vehicles to become soiled with mud and damaged by stones etc unless mitigating measures are taken. Cleaning systems are available, e.g. for High Intensity Discharge headlamps. Stakeholders were not able to suggest a cost for such systems being fitted to AEBS sensors, but it seems unlikely that costs would be prohibitive. It is also considered unlikely that sensors could not be positioned somewhere where the chances of being struck by stones were minimised, even if not eliminated altogether. Additional costs would be likely to be incurred, however, to cover more frequent sensor repair or replacement than would be expected on vehicles used on road only.

5.1.3 Duty cycles

The final group of proposed exemptions stem from the way the vehicles are perceived to be used or driven, specifically the alertness level of the driver and whether or not the vehicle was likely to be carrying standing passengers.

An AEBS will only apply emergency braking if it detects that an impact with another vehicle is likely, and when it does so it cannot generate any higher decelerations than would occur if the driver reacted by applying emergency braking. There does not, therefore, seem to be any reason to exempt vehicles simply on the grounds of having standing passengers. It is considered that most standing passengers would rather the vehicle braked sharply to avoid an impact (or at least greatly reduce its severity), even if that meant they fell over in the process. The injuries from allowing the vehicle to have an impact would be likely to be much greater. There may, however, be a question of liability in the event that the system suffered a false alarm and braked unnecessarily. The consequences of such a false alarm could be greater for vehicles with standing passengers than for one carrying only belted and/or seated occupants.

The driver alertness argument (relevant to M3 vehicles) is generally based on average speeds being low and with frequent stops. This should be evident in the target population statistics for AEBS, both through a general lack of AEBS relevant accidents involving such vehicles (because their drivers are alert and so don’t get involved in rear shunts) and a general lack of AEBS relevant accidents on non-urban roads (because buses aren’t used outside of urban areas). The target population data confirm this, with the involvement rates for M3 Class A, for example, being much less than for all M3 vehicles, and with about 85-90% of the casualties arising in urban areas. In consequence, the estimated benefit-cost ratios for these vehicles are lower than for M3 overall, but still more than 1 in the upper scenario, though less than 1 (unlike M3 overall) in the mid scenario.

5.2 LDWS

Similar arguments for LDWS have been proposed as for AEBS regarding exemption for vehicles not required to fit EVSC, though with some differences. The main arguments here are that vehicles used off road, for special purposes or in primarily urban areas will tend to be either doing less than 60 km/h (i.e. at speeds too low for the LDWS to operate) or operating in conditions where road markings do not exist or are difficult to see, or both.

Clearly if LDWS are designed/required not to operate at speeds below 60 km/h, then there can be no justification for fitting them to vehicles incapable of speeds above 60 km/h. The question then, though, is whether vehicles that are capable of more than 60 km/h (which the vast majority are) get involved in LDWS relevant accidents on roads outside of urban areas.

An analysis of the target population data reveals that about 75% of the LDWS relevant accidents involving the types of N2 and N3 vehicles proposed for exemption occurred in non urban areas (defined as roads with a speed limit above 40 mile/h, 64 km/h). It is likely that some of the remaining 25% occurred on urban roads with speed limits above 60 km/h (it includes all roads with a speed limit of 40 mile/h, which is 64 km/h). The situation for M3 vehicles is somewhat different, with only about 30% of the casualties arising in non urban areas, though again a proportion of the remainder will also be on roads with speed limits of more than 60 km/h. There is, therefore, some suggestion that the benefit-cost ratios for M3 vehicles may slightly overestimate the true picture, perhaps by a factor of 2, though the resulting values are still comfortably and invariably higher than 1 in the upper scenario, and often in the mid scenario also. The likelihood of over-estimation for N2/N3 vehicles is much lower, and insufficient to alter the main CBA findings.

6 Summary discussion and conclusions

The cost-benefit analyses indicate that all but one of the vehicle types assessed (N2 tractor units under 7.5t GVW) have the potential to achieve a benefit-cost ratio of more than one for both types of AEBS, and all do so for LDWS. This is true, though, only in the upper scenario involving a combination of assumptions about, for example, low system costs, high effectiveness rates and high overall target populations. In the opposite, lower, scenario, where target populations are based on reported accidents only, where effectiveness is assumed to be low and where implementation costs are assumed to be high, benefit-cost ratios are almost invariably estimated to be well below 1.

In the mid range scenario, which may represent a "best guess" of the true situation as it combines mid-point estimates of effectiveness, target populations and costs, LDWS ratios are almost invariably still above 1, and usually well above. For AEBS, the mid range ratios are usually very close to 1 (either just below or just above).

A range of possible technical grounds for exemption have also been assessed, via a desk-based study and stakeholder dialogue.

For AEBS, the main proposals stem from the view that it would be prohibitively difficult and expensive to install such systems in vehicles not equipped with EVSC and that, therefore, the same exemptions should apply as already apply to EVSC. A full evaluation has not been possible because no evidence on the extra costs has been provided. It seems reasonable, however, to postulate that systems could be developed that do not rely on the presence of EVSC. The costs would depend on the functional complexities of the systems (e.g. whether or not they simply use the ABS to provide stability under heavy braking) and the numbers of vehicles over which the development costs could be spread. An alternative approach may be to require forward collision warning systems to alert the driver to apply the brakes if full AEBS is not feasible or cost effective.

For LDWS, the stakeholder view that systems designed only to operate at speeds over 60 km/h would be of little use to vehicles used mainly off-road or in urban areas is partly supported by the accident data, but not enough to suggest that such systems could not still provide a benefit-cost ratio of more than 1.

6.1 Study limitations

Decisions regarding the applicability of the cost-benefit analysis and technical evaluations to questions of possible exemption for specific vehicle types are, of course, a political matter for stakeholders and legislators to debate and decide upon. It is important, though, to remember that the technical assessments, benefit-cost ratios and break-even costs presented in this report are all based on a wide variety of assumptions and subject to a long list of limitations, which are explained in more detail elsewhere in this report but that can be summarised as:

- Past accident and casualty statistics are imperfect predictors of future patterns. Generally speaking, casualty rates are falling across the EU27 so the overall target populations in 5, 10 or 20 years time may be substantially lower than the estimates in this report, which are based on the situation in 2005-2008. They may, though, be similar or even higher – we can only know after those time periods have elapsed. Casualty rates are falling precisely because new safety measures are being introduced, be they aimed at vehicles, road users or the road infrastructure, and a steady flow of new measures, AEBS and LDWS for example, will be needed to continue that very welcome downward trend.
- The accident analyses were necessarily based on samples of data from, at best, three Member States and often from only one or two. Under and over-estimates of the target populations, stock numbers and new registrations are all possible due to the inevitable, but unquantifiable, sampling inaccuracies and variations between all 27 EU Member States. These will tend to have a larger effect for the

more specialised vehicle types assessed, where very low numbers in use and very low accident involvement rates combine to give a high level of uncertainty when making target population estimates for the EU27. This and the greater uncertainty in system development and installation costs for such vehicles inevitably lead to a high level of uncertainty in estimated benefit-cost ratios for these vehicle types. In such situations, however, the overall potential for casualty reduction is likely to be low, so absolute confidence in the benefit-cost ratios may be less important.

- The vehicle types assessed within the accident databases are, generally speaking, not exact matches to the vehicle types proposed by stakeholders for exemptions. Whilst the matches to categorisations by gross vehicle weight (for N2 and N3) and number of axles are likely to be good, other, more specialised vehicle types are less well matched, e.g. off-road and special purpose vehicles. Matching for M2 and M3 is even more difficult as there is very little gross weight data (M2 and M3 are based on a 5t gross weight threshold), and no data on the number or frequency of standing passengers.
- The accident analyses include injury accidents only, or more accurately injury accidents reported to the police only. The mid and upper scenarios endeavour to make some allowance for the well known problem of under-reporting, but how accurately either of them do so is impossible to know for certain. What is certain is that the statistics and benefit estimates make no allowance for non injury (damage only) accidents. These accident types are likely to be numerous and AEBS and LDWS could both be expected to prevent or mitigate a reasonable proportion of them. While these accident types have a very low societal value, relative to casualty valuations, they do represent significant costs and lost productivity to commercial vehicle operators.
- Different AEBS and LDWS architectures will have different operational characteristics, costs and effectiveness in differing applications and accident scenarios. The analyses presented here are entirely generic and can only attempt to allow for these variations by using quite wide ranges of likely effectiveness and costs. As new systems are developed and refined, it is likely that costs will tend to reduce and effectiveness will tend to improve. It is likely, though, that bespoke systems designed and developed to suit highly specialised vehicle types, would be more expensive, on a per vehicle basis, than generic systems.
- The cost-benefit analyses have used a simplified model of the penetration of AEBS and LDWS into the vehicle fleet, do not take into account the time value of money (i.e. no discount rate is applied), and are based on a fifteen year investment period (chosen as being close to the average life of M2/M3/N2/N3 vehicles). The effects of these characteristics on the overall results, however, are likely to be small and unlikely to alter the main conclusions. Choosing a much shorter investment period would tend to lower the estimated benefit-cost ratios, while a longer period would tend to raise them.

6.2 Stakeholder comments

An initial draft of this report was presented to the Motor Vehicles Working Group (MVWG) in Brussels on 5th July 2010. The presentation slides are at Appendix E.

One industry stakeholder group present commented on the substantial differences in target populations between the lower and upper estimates, and the uncertainties regarding system costs. In response, it was explained that because most of the differences in casualty numbers are in the slight injury category, the effects on the cost-benefit analyses were much smaller, because the casualty valuations tend to be dominated by the estimated numbers of fatalities. For most of the vehicle types the valuations vary from lower to upper by a factor of about 2, whereas the effectiveness

and system cost estimates vary by factors of roughly 3 and 6 respectively, and thus have a greater overall effect on the calculated range of benefit-cost ratios. It was accepted that system costs would depend on the specific application and might be even higher than the upper estimates used in some cases.

A Member State representative and an NGO stakeholder group both commented that their conclusion from the draft report was that AEBS and LDWS should be fitted to all M2, M3, N2 and N3 vehicles.

The authors' assessment of the comments made suggested that the original draft report may have encouraged a little too much emphasis to be placed on the calculated benefit-cost ratios, without a full and proper appreciation of the uncertainties inherent in the analyses and the possible alternative approaches to prioritising exemption decisions. In response, this final report includes a fuller discussion of these issues and the prioritisation charts presented in Section 4.

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Appendix A Phased break-even cost calculations

A.1 Average vehicle life ≥ 15 years

When S/R ≥ 15, where S is the overall stock number and R is the number of new registrations per annum,

Benefits in year n, are :

B_n, = nReT/S ,

where e is the system effectiveness (proportion of total target population valuation actually saved).

The cumulative benefits, B_c, after n years (=B_1 + B_2 + B_3 +....B_n) are:

n(n+1)ReT/2S .

For a 15 year period (n = 15),

B_c = 120ReT/S .

The costs in year n, C_n, are cR, where c is the cost per vehicle.

For a 15 year period, the cumulative costs C_c are 15cR.

So, after 15 years, the ratio of cumulative benefits to cumulative costs, B_c:C_c, is:

B_c/C_c = 120ReT/15cRS = 8eT/Sc .

At break-even, ratio = 1 and c=C_p, so:

Sc = 8eT, and:

C_p = 8eT/S .

Relating C_p to C_s (simple break-even), gives:

C_p/C_s = 8eTR/ST = 8eR/S , and:

C_p = 8C_seR/S

A.2 Average vehicle life <15 years

When S/R is less than 15, the fleet will be fully equipped before the end of the 15 year evaluation period, and the benefits each year after that point will then be capped at the 100% penetration rate (= eT).

Assuming that n years are at <100% penetration and a years are at 100% penetration, where a = 15 – n , then n = S/R (the average vehicle life).

The cumulative benefits after 15 years are:

B_c = n(n+1)ReT/2S + aeT = n(n+1)ReT/2S + 15eT – neT

= (S + R)eT/2R + 15eT – SeT/R

= 15.5eT - SeT/2R

=eT(15.5 – S/2R)

= eT(31R – S)/2R .

For a 15 year period, the cumulative costs C_c are 15cR, and the ratio of cumulative benefits to cumulative costs, B_c:C_c, is:

eT(31R – S)/30cR^2

At break-even, ratio = 1 and c=C_p, so:

30cR^2 = eT(31R – S) , and:

$C_p = eT(31R - S)/30R^2$.

Relating C_p to C_s (simple break-even), gives:

$C_p/C_s = ReT(31R - S)/30TR^2$

$= e(31R - S)/30R$

Appendix B AEBS (all rear shunts)

Base data

Casualties in accidents involving... GB +FR: average 2005 - 2008 DE: GIDAS extrapolated to 2008 CARE (EU16): average 2005-2007		GB			DE			FR			GB + DE + FR			CARE (EU16)			
		N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All casualties	All Accidents
All Roads	Fatal	467	140	2964	799	105	4482	666	89	4731	1932	335	12177	4803	822	28828	25475
	Serious	1963	1299	27859	5919	1394	72920	2258	575	38513	10140	3268	139292	16597	4945	226450	190845
	Slight	14759	12697	221204	23111	9385	350135	2992	1375	63287	40862	23456	634626	63669	33602	1051960	754294
All casualties (accidents)		17189	14136	252027	29829	10884	427537	5916	2039	106531	52934	27058	786095	85070	39369	1307238	970614
Stock (1000s)		518.51	180.12	33607	862.19	75.27	54980										
Rate (casualties per 1000 vehicles per year)		33.2	78.5	7.5	34.6	144.6	7.8										

REMARKS: Data include all involved category N and M vehicles and not only those that caused the accident. Reported accidents only.

Casualties in accidents involving... EU27 estimates		Lower				Mid		Upper				
		All Accidents	All casualties	N2/N3	M2/M3	N2/N3	M2/M3	N2/N3	M2/M3	Valuations		
All Roads	Fatal	37498	42433	7070	1210	7070	1210	7212	1234	2105000	€	
	Serious	252396	299484	21950	6540	35352	12102	44189	15128	236500	€	
	Slight	997566	1391234	84203	44439	212109	102869	371191	180021	18250	€	
All casualties (accidents)		1287459	1733151	113224	52189	254531	116182	422592	196383	Per casualty		
Stock (1000s)						5700	883					
Rate (casualties per 1000 vehicles per year)				19.9	59.1	44.7	131.6	74.1	222.4			

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2/N3 as guilty party	**All Roads** Fatal	40	8.6%	132	16.5%	13	2.0%	185	9.6%	678	678	691
	Serious	186	9.5%	712	12.0%	105	4.7%	1003	9.9%	2171	3497	4371
	Slight	2733	18.5%	5543	24.0%	297	9.9%	8573	21.0%	17665	44499	77873
	All Casualties	**2959**	**17.2%**	**6387**	**21.4%**	**415**	**7.0%**	**9761**	**18.4%**	**20514**	**48673**	**82935**
	Stock (1000s)	519.96		862.19							**5700**	
	Rate (casualties per 1000 vehicles)	**5.69**		**7.41**						**3.60**	**8.54**	**14.55**
	Baseline (N2/N3) rate	5.69		7.41						3.60	8.54	14.55
	New registrations per year (1000s)	52.85									**423**	
	Casualty valuations (€million)									**2,262**	**3,066**	**3,910**
	Break-even cost (€ 100% effectiveness)									**5,349**	**7,247**	**9,243**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 as guilty party	**All Roads** Fatal	8	1.7%	9	1.1%	1	0.2%	18	0.9%	66	66	67
	Serious	39	2.0%	248	4.2%	10	0.4%	297	2.9%	642	1035	1293
	Slight	801	5.4%	1307	5.7%	59	2.0%	2167	5.3%	4465	11247	19682
	All Casualties	**847**	**4.9%**	**1564**	**5.2%**	**70**	**1.2%**	**2481**	**4.7%**	**5173**	**12347**	**21042**
	Stock (1000s)	226.44		422.00							**2508**	
	Rate (casualties per 1000 vehicles)	**3.74**		**3.71**						**2.06**	**4.92**	**8.39**
	Baseline (N2/N3) rate	5.69		7.41						3.60	8.54	14.55
	New registrations per year (1000s)	18.61									**106**	
	Casualty valuations (€million)									**372**	**589**	**807**
	Break-even cost (€ 100% effectiveness)									**3,507**	**5,546**	**7,598**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 <= 5t as guilty party	**All Roads** Fatal	2	0.3%	0	0.0%	Not available		2	0.1%			
	Serious	3	0.2%	9	0.2%			12	0.2%			
	Slight	68	0.5%	227	10%			295	0.8%			
	All Casualties	**73**	**0.4%**	**236**	**0.8%**			**309**	**0.7%**	**662**	**1580**	**2693**
	Stock (1000s)	28.63		69.37							**379**	
	Rate (casualties per 1000 vehicles)	**2.54**		**3.40**						**1.75**	**4.17**	**7.11**
	Baseline (N2/N3) rate	5.69		7.41						3.60	8.54	14.55
	New registrations per year (1000s)	3.79									**22**	
	Casualty valuations (€million)									**48**	**75**	**103**
	Break-even cost (€ 100% effectiveness)									**2,204**	**3,485**	**4,775**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >5t <= 7.5t as guilty party	**All Roads** Fatal	6	1.4%	9	1.1%	Not available		15	1.2%			
	Serious	33	1.7%	220	3.7%			253	3.2%			
	Slight	688	4.7%	683	3.0%			1371	3.6%			
	All Casualties	**727**	**4.2%**	**912**	**3.1%**			**1639**	**3.5%**	**3517**	**8394**	**14305**
	Stock (1000s)	179.45		285.00							**1796**	
	Rate (casualties per 1000 vehicles)	**4.05**		**3.20**						**1.96**	**4.67**	**7.96**
	Baseline (N2/N3) rate	5.69		7.41						3.60	8.54	14.55
	New registrations per year (1000s)	12.75									**73**	
	Casualty valuations (€million)									**253**	**400**	**548**
	Break-even cost (€ 100% effectiveness)									**3,480**	**5,503**	**7,539**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >7.5t as guilty party	**All Roads** Fatal	0	0.0%	0	0.0%	Not available		0	0.0%			
	Serious	3	0.1%	19	0.3%			22	0.3%			
	Slight	45	0.3%	398	1.7%			443	1.2%			
	All Casualties	**47**	**0.3%**	**417**	**1.4%**			**464**	**1.0%**	**996**	**2378**	**4053**
	Stock (1000s)	18.37		67.63							**333**	
	Rate (casualties per 1000 vehicles)	**2.58**		**6.17**						**3.00**	**7.15**	**12.18**
	Baseline (N2/N3) rate	5.69		7.41						3.60	8.54	14.55
	New registrations per year (1000s)	2.07									**12**	
	Casualty valuations (€million)									**72**	**113**	**155**
	Break-even cost (€ 100% effectiveness)									**6,072**	**9,602**	**13,155**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Off Road as guilty party	**All Roads** Fatal	0.4	0.1%	Not available				0.4	0.1%			
	Serious	2	0.1%					2	0.1%			
	Slight	46	0.3%					46	0.3%			
	All Casualties	**49**	**0.3%**					**49**	**0.3%**	**297**	**709**	**1209**
	Stock (1000s)	23.81									**264**	
	Rate (casualties per 1000 vehicles)	**2.04**								**1.13**	**2.69**	**4.58**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	2.34									**13**	
	Casualty valuations (€million)									**21**	**34**	**46**
	Break-even cost (€ 100% effectiveness)									**1,602**	**2,534**	**3,471**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Special Purpose as guilty party	**All Roads** Fatal	0.4	0.1%	Not available				0.4	0.1%			
	Serious	3	0.2%					3	0.2%			
	Slight	63	0.4%					63	0.4%			
	All Casualties	**67**	**0.4%**					**67**	**0.4%**	**406**	**970**	**1652**
	Stock (1000s)	14.68									**163**	
	Rate (casualties per 1000 vehicles)	**4.53**								**2.50**	**5.96**	**10.16**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	1.73									**10**	
	Casualty valuations (€million)									**29**	**46**	**63**
	Break-even cost (€ 100% effectiveness)									**2,962**	**4,684**	**6,418**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >3 axles as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**15**	**26**
	Stock (1000s)	0.17		5.7	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**2**	
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**8.13**	**13.86**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	0.03									**0.2**	
	Casualty valuations (€million)									**0**	**0.7**	**1.0**
	Break-even cost (€ 100% effectiveness)									**0**	**4,267**	**5,846**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Tractor Unit <= 7.5t as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**2**	**4**
	Stock (1000s)	0.66		0.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**7**	
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**0.33**	**0.56**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	0.10									**0.6**	
	Casualty valuations (€million)									**0**	**0.12**	**0.16**
	Break-even cost (€ 100% effectiveness)									**0**	**202**	**277**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3	**All Roads**	Fatal	32	6.9%	123	15.4%	12	1.8%	167	8.7%	612	612	624
		Serious	147	7.5%	463	7.8%	95	4.2%	705	7.0%	1527	2459	3073
		Slight	1932	13.1%	4235	18.3%	238	8.0%	6405	15.7%	13198	33247	58182
	All Casualties		**2111**	**12.3%**	**4821**	**16.2%**	**345**	**5.8%**	**7277**	**13.7%**	**15337**	**36317**	**61879**
	Stock (1000s)		293.52		440.19							**3192**	
	Rate (casualties per 1000 vehicles)		**7.19**		**10.95**						**4.80**	**11.38**	**19.39**
	Baseline (N2/N3) rate		5.69		7.41						3.60	8.54	14.55
as guilty party	New registrations per year (1000s)		34.24									**317**	
	Casualty valuations (€million)										**1,890**	**2,476**	**3,102**
	Break-even cost (€ 100% effectiveness)										**5,964**	**7,815**	**9,791**
	Baseline (N2/N3) break-even cost (€										5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t	**All Roads**	Fatal	0	0.0%	12	1.5%	Not available		12	0.9%			
		Serious	3	0.1%	21	0.4%			24	0.3%			
		Slight	69	0.5%	521	2.3%			590	1.6%			
	All Casualties		**71**	**0.4%**	**554**	**1.9%**			**625**	**1.3%**	**1384**	**3277**	**5583**
	Stock (1000s)		18.67		28.51							**205**	
	Rate (casualties per 1000 vehicles)		**3.83**		**19.43**						**6.74**	**15.96**	**27.20**
	Baseline (N2/N3) rate		5.69		7.41						3.60	8.54	14.55
as guilty party	New registrations per year (1000s)		1.72									**10**	
	Casualty valuations (€million)										**170**	**223**	**280**
	Break-even cost (€ 100% effectiveness)										**17,372**	**22,762**	**28,519**
	Baseline (N2/N3) break-even cost (€										5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Off Road	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0.4	0.0%					0.4	0.0%			
		Slight	0.4	0.0%					0.4	0.0%			
	All Casualties		**1**	**0.0%**					**1**	**0.0%**	**15**	**112**	**190**
	Stock (1000s)		1.24		13.2	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**14**	
	Rate (casualties per 1000 vehicles)		**0.63**								**1.10**	**8.19**	**13.95**
	Baseline (N2/N3) rate		5.69								3.60	8.54	14.55
as guilty party	New registrations per year (1000s)		0.05									**0.3**	
	Casualty valuations (€million)										**2**	**8**	**10**
	Break-even cost (€ 100% effectiveness)										**6,493**	**26,664**	**33,408**
	Baseline (N2/N3) break-even cost (€										5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Special Purpose	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	9	0.1%					9	0.1%			
	All Casualties		**9**	**0.1%**					**9**	**0.1%**	**174**	**411**	**701**
	Stock (1000s)		127									**14**	
	Rate (casualties per 1000 vehicles)		**7.06**								**12.44**	**29.45**	**50.17**
	Baseline (N2/N3) rate		5.69								3.60	8.54	14.55
	New registrations per year (1000s)		0.16									**1**	
	Casualty valuations (€million)										**21**	**28**	**35**
	Break-even cost (€ 100% effectiveness)										**23,432**	**30,703**	**38,468**
	Baseline (N2/N3) break-even cost (€										5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t >3 axles	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	0	0.0%					0	0.0%			
	All Casualties		**0**	**0.0%**					**0**	**0.0%**	**0**	**8**	**13**
	Stock (1000s)		0.04		0.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**0.5**	
	Rate (casualties per 1000 vehicles)		**0.00**								**0.00**	**16.48**	**28.07**
	Baseline (N2/N3) rate		5.69								3.60	8.54	14.55
	New registrations per year (1000s)		0.002									**0.01**	
	Casualty valuations (€million)										**0**	**0.5**	**0.6**
	Break-even cost (€ 100% effectiveness)										**0**	**39,522**	**49,518**
	Baseline (N2/N3) break-even cost (€										5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Rigid (not towing)	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	2	0.1%					2	0.1%			
		Slight	64	0.4%					64	0.4%			
	All Casualties		**66**	**0.4%**					**66**	**0.4%**	**1274**	**3017**	**5140**
	Stock (1000s)		18.37									**202**	
	Rate (casualties per 1000 vehicles)		**3.58**								**6.31**	**14.94**	**25.45**
	Baseline (N2/N3) rate		5.69								3.60	8.54	14.55
	New registrations per year (1000s)		1.67									**10**	
	Casualty valuations (€million)										**157**	**206**	**258**
	Break-even cost (€ 100% effectiveness)										**16,473**	**21,584**	**27,044**
	Baseline (N2/N3) break-even cost (€										5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t as guilty party	**All Roads** Fatal	32	6.9%	111	13.9%	Not available		143	11.3%			
	Serious	145	7.4%	442	7.5%			587	7.4%			
	Slight	1863	12.6%	3714	16.1%			5577	14.7%			
	All Casualties	**2040**	**11.9%**	**4267**	**14.3%**			**6307**	**13.4%**	13953	33040	56296
	Stock (1000s)	274.85		411.68							**2987**	
	Rate (casualties per 1000 vehicles)	**7.42**		**10.36**						**4.67**	**11.06**	**18.85**
	Baseline (N2/N3) rate	5.69		7.41						3.60	8.54	14.55
	New registrations per year (1000s)	32.52									**307**	
	Casualty valuations (€million)									**1,719**	**2,252**	**2,822**
	Break-even cost (€ 100% effectiveness)									**5,600**	**7,337**	**9,193**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Off Road as guilty party	**All Roads** Fatal	0.4	0.1%	Not available				0.4	0.1%			
	Serious	11	0.6%					11	0.6%			
	Slight	249	1.7%					249	1.7%			
	All Casualties	**261**	**1.5%**					**261**	**1.5%**	1785	4226	7201
	Stock (1000s)	33.60									**365**	
	Rate (casualties per 1000 vehicles)	**7.77**								**4.89**	**11.58**	**19.72**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	3.66									**35**	
	Casualty valuations (€million)									**220**	**288**	**361**
	Break-even cost (€ 100% effectiveness)									**6,364**	**8,339**	**10,448**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Special Purpose as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	8	0.4%					8	0.4%			
	Slight	75	0.5%					75	0.5%			
	All Casualties	**83**	**0.5%**					**83**	**0.5%**	568	1346	2293
	Stock (1000s)	26.32									**286**	
	Rate (casualties per 1000 vehicles)	**3.16**								**1.99**	**4.71**	**8.02**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	3.18									**30**	
	Casualty valuations (€million)									**70**	**92**	**115**
	Break-even cost (€ 100% effectiveness)									**2,333**	**3,056**	**3,829**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t >3 axles	**All Roads** Fatal	1	0.3%	Not available				1	0.3%			
	Serious	18	0.9%					18	0.9%			
	Slight	278	19%					278	19%			
	All Casualties	**298**	**17%**					**298**	**17%**	**2036**	**4822**	**8216**
as guilty party	**Stock** (1000s)	30.78									**334**	
	Rate (casualties per 1000 vehicles)	**9.67**								**6.09**	**14.42**	**24.56**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	4.23									**40**	
	Casualty valuations (€million)									**251**	**329**	**412**
	Break-even cost (€ 100% effectiveness)									**6,282**	**8,232**	**10,314**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Rigid (not towing)	**All Roads** Fatal	4	0.9%	Not available				4	0.9%			
	Serious	43	2.2%					43	2.2%			
	Slight	669	4.5%					669	4.5%			
	All Casualties	**717**	**4.2%**					**717**	**4.2%**	**4902**	**11607**	**19776**
as guilty party	**Stock** (1000s)	148.86									**1618**	
	Rate (casualties per 1000 vehicles)	**4.81**								**3.03**	**7.18**	**12.23**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	15.47									**146**	
	Casualty valuations (€million)									**604**	**791**	**991**
	Break-even cost (€ 100% effectiveness)									**4,135**	**5,418**	**6,788**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >44t	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.0%					1	0.0%			
	Slight	3	0.0%					3	0.0%			
	All Casualties	**4**	**0.0%**					**4**	**0.0%**	**26**	**327**	**557**
as guilty party	**Stock** (1000s)	?		38.7	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**?**	
	Rate (casualties per 1000 vehicles)	?								**?**	**?**	**?**
	Baseline (N2/N3) rate	5.69								3.60	8.54	14.55
	New registrations per year (1000s)	?									**?**	
	Casualty valuations (€million)									**3**	**22**	**28**
	Break-even cost (€ 100% effectiveness)									**?**	**?**	**?**
	Baseline (N2/N3) break-even cost (€									5,349	7,247	9,243

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M2/M3	**All Roads**	Fatal	3	2.1%	8	7.6%	2	2.2%	13	3.9%	47	47	48
		Serious	38	2.9%	62	4.4%	29	5.0%	129	3.9%	258	477	596
		Slight	1235	9.7%	771	8.2%	59	4.3%	2065	8.8%	3912	9056	15848
	All Casualties		**1276**	**9.0%**	**841**	**7.7%**	**90**	**4.4%**	**2207**	**8.2%**	**4217**	**9580**	**16492**
	Stock (1000s)		180.18		75.27							**883**	
	Rate (casualties per 1000 vehicles)		**7.08**		**11.17**						**4.78**	**10.85**	**18.68**
	Baseline (M2/M3) rate		7.08		11.17						4.78	10.85	18.68
	New registrations per year (1000s)		12.28									**57**	
	Casualty valuations (€million)										**231**	**377**	**531**
	Break-even cost (€ 100% effectiveness)										**4,059**	**6,615**	**9,319**
	Baseline (M2/M3) break-even cost (€										4,059	6,615	9,319

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M2	**All Roads**	Fatal	1	0.6%	0	0.0%	Not available		1	0.3%			
		Serious	8	0.6%	0	0.0%			8	0.2%			
		Slight	167	1.3%	0	0.0%			167	0.7%			
	All Casualties		**176**	**1.2%**	**0**	**0.0%**			**176**	**0.7%**	**351**	**797**	**1372**
	Stock (1000s)		100.91		5.21							**221**	
	Rate (casualties per 1000 vehicles)		**1.75**		**0.00**						**1.59**	**3.61**	**6.22**
	Baseline (M2/M3) rate		7.08		11.17						4.78	10.85	18.68
	New registrations per year (1000s)		7.65									**14**	
	Casualty valuations (€million)										**19**	**31**	**44**
	Break-even cost (€ 100% effectiveness)										**1,351**	**2,202**	**3,102**
	Baseline (M2/M3) break-even cost (€										4,059	6,615	9,319

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3	**All Roads**	Fatal	2	1.5%	8	7.6%	Not available		10	4.1%			
		Serious	30	2.3%	62	4.4%			92	3.4%			
		Slight	1068	8.4%	771	8.2%			1839	8.3%			
	All Casualties		**1100**	**7.8%**	**841**	**7.7%**			**1941**	**7.8%**	**3866**	**8783**	**15120**
	Stock (1000s)		79.27		70.06							**662**	
	Rate (casualties per 1000 vehicles)		**13.87**		**12.00**						**5.84**	**13.26**	**22.83**
	Baseline (M2/M3) rate		7.08		11.17						4.78	10.85	18.68
	New registrations per year (1000s)		4.63									**43**	
	Casualty valuations (€million)										**212**	**346**	**487**
	Break-even cost (€ 100% effectiveness)										**4,961**	**8,086**	**11,392**
	Baseline (M2/M3) break-even cost (€										4,059	6,615	9,319

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 class A (>5t and <23 passengers)	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.1%					1	0.1%			
	Slight	19	0.1%					19	0.1%			
	All Casualties	**19**	**0.1%**					**19**	**0.1%**	**68**	**154**	**265**
as guilty party	**Stock** (1000s)	8.50								**71**		
	Rate (casualties per 1000 vehicles)	**2.27**								**0.95**	**2.17**	**3.73**
	Baseline (M2/M3) rate	7.08								4.78	10.85	18.68
	New registrations per year (1000s)	0.51								**5**		
	Casualty valuations (€million)									**4**	**6**	**9**
	Break-even cost (€ 100% effectiveness)									**790**	**1,287**	**1,813**
	Baseline (M2/M3) break-even cost (€									4,059	6,615	9,319

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 Class I/II/III (>5t and >22 passengers)	**All Roads** Fatal	2	1.5%	Not available				2	1.5%			
	Serious	29	2.2%					29	2.2%			
	Slight	1049	8.3%					1049	8.3%			
	All Casualties	**1080**	**7.6%**					**1080**	**7.6%**	**3798**	**8629**	**14855**
as guilty party	**Stock** (1000s)	70.77								**591**		
	Rate (casualties per 1000 vehicles)	**15.27**								**6.42**	**14.59**	**25.13**
	Baseline (M2/M3) rate	7.08								4.78	10.85	18.68
	New registrations per year (1000s)	4.12								**38**		
	Casualty valuations (€million)									**208**	**340**	**478**
	Break-even cost (€ 100% effectiveness)									**5,478**	**8,928**	**12,577**
	Baseline (M2/M3) break-even cost (€									4,059	6,615	9,319

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 >3 axles	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	2	0.0%					2	0.0%			
	All Casualties	**2**	**0.0%**					**2**	**0.0%**	**7**	**16**	**27**
as guilty party	**Stock** (1000s)	0.07		24.0	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**0.6**		
	Rate (casualties per 1000 vehicles)	**28.57**								**12.02**	**26.73**	**46.02**
	Baseline (M2/M3) rate	7.08								4.78	10.85	18.68
	New registrations per year (1000s)	0.01								**0.1**		
	Casualty valuations (€million)									**0**	**0.6**	**0.9**
	Break-even cost (€ 100% effectiveness)									**3,798**	**6,058**	**8,535**
	Baseline (M2/M3) break-even cost (€									4,059	6,615	9,319

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 articulated buses and coaches **as guilty party**	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	2	0.0%					2	0.0%			
	All Casualties		**2**	**0.0%**					**2**	**0.0%**	**7**	**25**	**44**
	Stock (1000s)		0.54		38.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**5**		
	Rate (casualties per 1000 vehicles)		**3.70**								**1.56**	**5.62**	**9.67**
	Baseline (M2/M3) rate		7.08								4.78	10.85	18.68
	New registrations per year (1000s)		0.04								**0.4**		
	Casualty valuations (€million)										**0**	**1.0**	**1.4**
	Break-even cost (€, 100% effectiveness)										**972**	**2,512**	**3,539**
	Baseline (M2/M3) break-even cost (€										4,059	6,615	9,319

Appendix C AEBS (non stationary targets)

Base data

Casualties in accidents involving... GB +FR: average 2005 - 2008 DE: GIDAS extrapolated to 2008 CARE (EU16): average 2005-2007		GB			DE			FR			GB + DE + FR			CARE (EU16)			
		N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All casualties	All Accidents
All Roads	Fatal	467	140	2964	799	105	4482	666	89	4731	1932	335	12177	4803	822	28828	25475
	Serious	1963	1299	27859	5919	1394	72920	2258	575	38513	10140	3268	139292	16597	4945	226450	190845
	Slight	14759	12697	221204	23111	9385	350135	2992	1375	63287	40862	23456	634626	63669	33602	1051960	754294
All casualties (accidents)		**17189**	**14136**	**252027**	**29829**	**10884**	**427537**	**5916**	**2039**	**106531**	**52934**	**27058**	**786095**	**85070**	**39369**	**1307238**	**970614**
Stock (1000s)		518.51	180.12	33607	862.19	75.27	54980										
Rate (casualties per 1000 vehicles per year)		33.2	78.5	7.5	34.6	144.6	7.8										

REMARKS: Data include all involved category N and M vehicles and not only those that caused the accident. Reported accidents only.

Casualties in accidents involving... EU27 estimates		Lower				Mid		Upper				
		All Accidents	All casualties	N2/N3	M2/M3	N2/N3	M2/M3	N2/N3	M2/M3	Valuations		
All Roads	Fatal	37498	**42433**	7070	1210	7070	1210	7212	1234	**2105000**	**€**	
	Serious	252396	299484	21950	6540	35352	12102	44189	15128	**236500**	**€**	
	Slight	997566	1391234	84203	44439	212109	102869	371191	180021	**18250**	**€**	
All casualties (accidents)		**1287459**	**1733151**	**113224**	**52189**	**254531**	**116182**	**422592**	**196383**	**Per casualty**		
Stock (1000s)						5700	883					
Rate (casualties per 1000 vehicles per year)				19.9	59.1	44.7	131.6	74.1	222.4			

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2/N3	**All Roads** Fatal	13	2.9%	66	8.3%	10	15%	89	4.6%	327	327	333
	Serious	78	4.0%	458	7.7%	87	3.9%	623	6.1%	1348	2171	2714
	Slight	1039	7.0%	2512	10.9%	247	8.3%	3798	9.3%	7826	19714	34500
as guilty party	**All Casualties**	**1130**	**6.6%**	**3036**	**10.2%**	**344**	**5.8%**	**4510**	**8.5%**	**9501**	**22212**	**37548**
	Stock (1000s)	519.96		862.19							**5700**	
	Rate (casualties per 1000 vehicles)	**2.17**		**3.52**						**1.67**	**3.90**	**6.59**
	Baseline (N2/N3) rate	2.17		3.52						167	3.90	6.59
	New registrations per year (1000s)	52.85									**423**	
	Casualty valuations (€million)									**1,150**	**1,561**	**1,973**
	Break-even cost (€ 100% effectiveness)									**2,718**	**3,691**	**4,665**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2	**All Roads** Fatal	4	0.9%	9	1.1%	1	0.2%	14	0.7%	52	52	53
	Serious	15	0.7%	170	2.9%	8	0.4%	193	1.9%	417	671	839
	Slight	240	1.6%	337	1.5%	49	1.6%	626	1.5%	1290	3249	5685
as guilty party	**All Casualties**	**259**	**1.5%**	**516**	**1.7%**	**58**	**1.0%**	**833**	**1.6%**	**1758**	**3972**	**6577**
	Stock (1000s)	226.44		422.00							**2508**	
	Rate (casualties per 1000 vehicles)	**1.14**		**1.22**						**0.70**	**1.58**	**2.62**
	Baseline (N2/N3) rate	2.17		3.52						167	3.90	6.59
	New registrations per year (1000s)	18.61									**106**	
	Casualty valuations (€million)									**231**	**327**	**414**
	Break-even cost (€ 100% effectiveness)									**2,177**	**3,081**	**3,894**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 <= 5t	**All Roads** Fatal	2	0.4%	0	0.0%	Not available		2	0.1%			
	Serious	1	0.1%	9	0.2%			10	0.1%			
	Slight	31	0.2%	47	0.2%			78	0.2%			
as guilty party	**All Casualties**	**34**	**0.2%**	**56**	**0.2%**			**90**	**0.2%**	**204**	**462**	**764**
	Stock (1000s)	28.63		69.37							**379**	
	Rate (casualties per 1000 vehicles)	**1.19**		**0.81**						**0.54**	**1.22**	**2.02**
	Baseline (N2/N3) rate	2.17		3.52						167	3.90	6.59
	New registrations per year (1000s)	3.79									**22**	
	Casualty valuations (€million)									**27**	**38**	**48**
	Break-even cost (€ 100% effectiveness)									**1,242**	**1,758**	**2,222**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >5t <= 7.5t as guilty party	**All Roads** Fatal	2	0.5%	9	1.1%	Not available		11	0.9%			
	Serious	12	0.6%	150	2.5%			162	2.1%			
	Slight	194	1.3%	199	0.9%			393	1.0%			
	All Casualties	**209**	**1.2%**	**358**	**1.2%**			**567**	**1.2%**	**1287**	**2908**	**4815**
	Stock (1000s)	179.45		285.00							**1796**	
	Rate (casualties per 1000 vehicles)	**1.16**		**1.26**						**0.72**	**1.62**	**2.68**
	Baseline (N2/N3) rate	2.17		3.52						1.67	3.90	6.59
	New registrations per year (1000s)	12.75									**73**	
	Casualty valuations (€million)									**169**	**240**	**303**
	Break-even cost (€ 100% effectiveness)									**2,327**	**3,292**	**4,161**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >7.5t as guilty party	**All Roads** Fatal	0	0.0%	0	0.0%	Not available		0	0.0%			
	Serious	1	0.0%	11	0.2%			12	0.1%			
	Slight	15	0.1%	93	0.4%			108	0.3%			
	All Casualties	**16**	**0.1%**	**104**	**0.3%**			**120**	**0.3%**	**271**	**613**	**1015**
	Stock (1000s)	18.37		67.63							**333**	
	Rate (casualties per 1000 vehicles)	**0.84**		**1.54**						**0.82**	**1.84**	**3.05**
	Baseline (N2/N3) rate	2.17		3.52						1.67	3.90	6.59
	New registrations per year (1000s)	2.07									**12**	
	Casualty valuations (€million)									**36**	**50**	**64**
	Break-even cost (€ 100% effectiveness)									**3,021**	**4,274**	**5,402**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Off Road as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0.4	0.0%					0.4	0.0%			
	Slight	14	0.1%					14	0.1%			
	All Casualties	**15**	**0.1%**					**15**	**0.1%**	**100**	**226**	**374**
	Stock (1000s)	23.81									**264**	
	Rate (casualties per 1000 vehicles)	**0.62**								**0.38**	**0.86**	**1.42**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	2.34									**13**	
	Casualty valuations (€million)									**13**	**19**	**24**
	Break-even cost (€ 100% effectiveness)									**985**	**1,394**	**1,762**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Special Purpose as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.1%					1	0.1%			
	Slight	21	0.1%					21	0.1%			
	All Casualties	**22**	**0.1%**					**22**	**0.1%**	**152**	**344**	**570**
	Stock (1000s)	14.68									**163**	
	Rate (casualties per 1000 vehicles)	**1.53**								**0.94**	**2.12**	**3.51**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	1.73									**10**	
	Casualty valuations (€million)									**20**	**28**	**36**
	Break-even cost (€ 100% effectiveness)									**2,030**	**2,873**	**3,631**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >3 axles as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**7**	**12**
	Stock (1000s)	0.17		5.7	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**2**	
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**3.96**	**6.56**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	0.03									**0.2**	
	Casualty valuations (€million)									**0**	**0.6**	**0.8**
	Break-even cost (€ 100% effectiveness)									**0**	**3,589**	**4,537**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Tractor Unit <= 7.5t as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**1**	**2**
	Stock (1000s)	0.66		0.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**7**	
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**0.16**	**0.27**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	0.10									**0.6**	
	Casualty valuations (€million)									**0**	**0.10**	**0.12**
	Break-even cost (€ 100% effectiveness)									**0**	**170**	**215**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3	**All Roads** Fatal	9	2.0%	57	7.1%	9	1.4%	75	3.9%	275	275	281
	Serious	63	3.2%	290	4.9%	78	3.5%	431	4.3%	933	1503	1879
	Slight	799	5.4%	2175	9.4%	198	6.6%	3172	7.8%	6537	16466	28815
	All Casualties	**871**	**5.1%**	**2522**	**8.5%**	**285**	**4.8%**	**3678**	**6.9%**	**7745**	**18244**	**30975**
as guilty party	**Stock** (1000s)	293.52		440.19							**3192**	
	Rate (casualties per 1000 vehicles)	**2.97**		**5.73**						**2.43**	**5.72**	**9.70**
	Baseline (N2/N3) rate	2.17		3.52						1.67	3.90	6.59
	New registrations per year (1000s)	34.24									**317**	
	Casualty valuations (€million)									**919**	**1,235**	**1,561**
	Break-even cost (€ 100% effectiveness)									**2,901**	**3,898**	**4,926**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t	**All Roads** Fatal	0	0.0%	0	0.0%	**Not available**		0	0.0%			
	Serious	1	0.1%	21	0.4%			22	0.3%			
	Slight	22	0.1%	124	0.5%			146	0.4%			
	All Casualties	**23**	**0.1%**	**145**	**0.5%**			**168**	**0.4%**	**384**	**904**	**1536**
as guilty party	**Stock** (1000s)	18.67		28.51							**205**	
	Rate (casualties per 1000 vehicles)	**1.24**		**5.09**						**1.87**	**4.41**	**7.48**
	Baseline (N2/N3) rate	2.17		3.52						1.67	3.90	6.59
	New registrations per year (1000s)	1.72									**10**	
	Casualty valuations (€million)									**46**	**61**	**77**
	Break-even cost (€ 100% effectiveness)									**4,642**	**6,238**	**7,884**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Off Road	**All Roads** Fatal	0	0.0%	**Not available**				0	0.0%			
	Serious	0.4	0.0%					0.4	0.0%			
	Slight	0.4	0.0%					0.4	0.0%			
	All Casualties	**1**	**0.0%**					**1**	**0.0%**	**13**	**44**	**74**
as guilty party	**Stock** (1000s)	1.24		13.2	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**14**	
	Rate (casualties per 1000 vehicles)	**0.65**								**0.98**	**3.21**	**5.46**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	0.05									**0.3**	
	Casualty valuations (€million)									**2**	**3**	**4**
	Break-even cost (€ 100% effectiveness)									**5,558**	**10,393**	**13,135**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Special Purpose	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	3	0.0%					3	0.0%			
	All Casualties	**3**	**0.0%**					**3**	**0.0%**	**57**	**135**	**230**
as guilty party	**Stock** (1000s)	1.27									14	
	Rate (casualties per 1000 vehicles)	**2.74**								**4.12**	**9.70**	**16.46**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	0.16									1	
	Casualty valuations (€million)									**7**	**9**	**12**
	Break-even cost (€ 100% effectiveness)									**7,470**	**10,039**	**12,687**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t >3 axles	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**3**	**5**
as guilty party	**Stock** (1000s)	0.04		0.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						0.5	
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**6.47**	**10.98**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	0.002									0.01	
	Casualty valuations (€million)									**0**	**0.20**	**0.26**
	Break-even cost (€ 100% effectiveness)									**0**	**15,405**	**19,469**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Rigid (not towing)	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.1%					1	0.1%			
	Slight	19	0.1%					19	0.1%			
	All Casualties	**20**	**0.1%**					**20**	**0.1%**	**335**	**788**	**1338**
as guilty party	**Stock** (1000s)	18.37									202	
	Rate (casualties per 1000 vehicles)	**1.10**								**1.66**	**3.90**	**6.63**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	1.67									10	
	Casualty valuations (€million)									**40**	**53**	**67**
	Break-even cost (€ 100% effectiveness)									**4,167**	**5,600**	**7,078**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t as guilty party	**All Roads** Fatal	9	2.0%	57	7.1%	Not available		66	5.2%			
	Serious	62	3.1%	269	4.5%			331	4.2%			
	Slight	777	5.3%	2051	8.9%			2828	7.5%			
	All Casualties	**848**	**4.9%**	**2377**	**8.0%**			**3225**	**6.9%**	**7361**	**17340**	**29439**
	Stock (1000s)	274.85		411.68							**2987**	
	Rate (casualties per 1000 vehicles)	**3.09**		**5.77**						**2.46**	**5.81**	**9.86**
	Baseline (N2/N3) rate	2.17		3.52						1.67	3.90	6.59
	New registrations per year (1000s)	32.52									**307**	
	Casualty valuations (€million)									**873**	**1,174**	**1,483**
	Break-even cost (€ 100% effectiveness)									**2,845**	**3,823**	**4,832**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Off Road as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	6	0.3%					6	0.3%			
	Slight	81	0.6%					81	0.6%			
	All Casualties	**87**	**0.5%**					**87**	**0.5%**	**754**	**1776**	**3015**
	Stock (1000s)	33.60									**365**	
	Rate (casualties per 1000 vehicles)	**2.59**								**2.06**	**4.86**	**8.26**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	3.66									**35**	
	Casualty valuations (€million)									**89**	**120**	**152**
	Break-even cost (€ 100% effectiveness)									**2,589**	**3,479**	**4,397**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Special Purpose as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.1%					1	0.1%			
	Slight	29	0.2%					29	0.2%			
	All Casualties	**30**	**0.2%**					**30**	**0.2%**	**262**	**617**	**1047**
	Stock (1000s)	26.32									**286**	
	Rate (casualties per 1000 vehicles)	**1.15**								**0.92**	**2.16**	**3.66**
	Baseline (N2/N3) rate	2.17								1.67	3.90	6.59
	New registrations per year (1000s)	3.18									**30**	
	Casualty valuations (€million)									**31**	**42**	**53**
	Break-even cost (€ 100% effectiveness)									**1,035**	**1,391**	**1,758**
	Baseline (N2/N3) break-even cost (€									2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t >3 axles as guilty party	**All Roads**	Fatal	0	0.1%	Not available				0	0.1%			
		Serious	6	0.3%					6	0.3%			
		Slight	108	0.7%					108	0.7%			
	All Casualties		**115**	**0.7%**					**115**	**0.7%**	**998**	**2350**	**3990**
	Stock (1000s)		30.78									**334**	
	Rate (casualties per 1000 vehicles)		**3.73**								**2.98**	**7.03**	**11.93**
	Baseline (N2/N3) rate		2.17								1.67	3.90	6.59
	New registrations per year (1000s)		4.23									**40**	
	Casualty valuations (€million)										**118**	**159**	**201**
	Break-even cost (€ 100% effectiveness)										**2,965**	**3,984**	**5,035**
	Baseline (N2/N3) break-even cost (€										2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Rigid (not towing) as guilty party	**All Roads**	Fatal	17	0.4%	Not available				17	0.4%			
		Serious	15	0.7%					15	0.7%			
		Slight	226	1.5%					226	1.5%			
	All Casualties		**242**	**1.4%**					**242**	**1.4%**	**2098**	**4942**	**8391**
	Stock (1000s)		148.86									**1618**	
	Rate (casualties per 1000 vehicles)		**1.62**								**1.30**	**3.06**	**5.19**
	Baseline (N2/N3) rate		2.17								1.67	3.90	6.59
	New registrations per year (1000s)		15.47									**146**	
	Casualty valuations (€million)										**249**	**335**	**423**
	Break-even cost (€ 100% effectiveness)										**1,705**	**2,291**	**2,895**
	Baseline (N2/N3) break-even cost (€										2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >44t as guilty party	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0.4	0.0%					0.4	0.0%			
		Slight	1	0.0%					1	0.0%			
	All Casualties		**1**	**0.0%**					**1**	**0.0%**	**11**	**128**	**218**
	Stock (1000s)		?		38.7	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**?**	
	Rate (casualties per 1000 vehicles)		?								**?**	**?**	**?**
	Baseline (N2/N3) rate		2.17								1.67	3.90	6.59
	New registrations per year (1000s)		?									**?**	
	Casualty valuations (€million)										**1**	**9**	**11**
	Break-even cost (€ 100% effectiveness)										**?**	**?**	**?**
	Baseline (N2/N3) break-even cost (€										2,718	3,691	4,665

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M2/M3	**All Roads**	Fatal	2	1.2%	8	7.6%	2	2.2%	12	3.5%	43	43	43
		Serious	15	1.2%	16	1.1%	26	4.5%	57	1.7%	114	211	264
		Slight	406	3.2%	132	1.4%	51	3.7%	589	2.5%	1115	2582	4519
	All Casualties		**423**	**3.0%**	**156**	**1.4%**	**79**	**3.9%**	**658**	**2.4%**	**1272**	**2836**	**4826**
	Stock (1000s)		180.18		75.27							**883**	
	Rate (casualties per 1000 vehicles)		**2.34**		**2.07**						**1.44**	**3.21**	**5.47**
as guilty party	Baseline (M2/M3) rate		2.34		2.07						1.44	3.21	5.47
	New registrations per year (1000s)		12.28									**57**	
	Casualty valuations (€million)										**137**	**187**	**236**
	Break-even cost (€ 100% effectiveness)										**2,400**	**3,273**	**4,143**
	Baseline (M2/M3) break-even cost (€										2,400	3,273	4,143

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M2	**All Roads**	Fatal	1	0.4%	0	0.0%	Not available		1	0.2%			
		Serious	4	0.3%	0	0.0%			4	0.1%			
		Slight	61	0.5%	0	0.0%			61	0.3%			
	All Casualties		**66**	**0.5%**	**0**	**0.0%**			**66**	**0.2%**	**145**	**323**	**549**
	Stock (1000s)		100.91		5.21							**221**	
	Rate (casualties per 1000 vehicles)		**0.65**		**0.00**						**0.66**	**1.46**	**2.49**
as guilty party	Baseline (M2/M3) rate		2.34		2.07						1.44	3.21	5.47
	New registrations per year (1000s)		7.65									**14**	
	Casualty valuations (€million)										**16**	**21**	**27**
	Break-even cost (€ 100% effectiveness)										**1,093**	**1,491**	**1,887**
	Baseline (M2/M3) break-even cost (€										2,400	3,273	4,143

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3	**All Roads**	Fatal	1	0.8%	8	7.6%	Not available		9	3.7%			
		Serious	11	0.8%	16	1.1%			27	1.0%			
		Slight	345	2.7%	132	1.4%			477	2.2%			
	All Casualties		**357**	**2.5%**	**156**	**1.4%**			**513**	**2.0%**	**1127**	**2513**	**4276**
	Stock (1000s)		79.27		70.06							**662**	
	Rate (casualties per 1000 vehicles)		**4.50**		**2.23**						**1.70**	**3.79**	**6.46**
as guilty party	Baseline (M2/M3) rate		2.34		2.07						1.44	3.21	5.47
	New registrations per year (1000s)		4.63									**43**	
	Casualty valuations (€million)										**121**	**165**	**209**
	Break-even cost (€ 100% effectiveness)										**2,836**	**3,867**	**4,895**
	Baseline (M2/M3) break-even cost (€										2,400	3,273	4,143

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 class A (>5t and <23 passengers)	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	5	0.0%					5	0.0%			
	All Casualties	**5**	**0.0%**					**5**	**0.0%**	**17**	**38**	**65**
as guilty party	**Stock** (1000s)	8.50		208.6	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**71**		
	Rate (casualties per 1000 vehicles)	**0.63**								**0.24**	**0.53**	**0.91**
	Baseline (M2/M3) rate	2.34								144	3.21	5.47
	New registrations per year (1000s)	0.51								**5**		
	Casualty valuations (€million)									**2**	**2**	**3**
	Break-even cost (€ 100% effectiveness)									**389**	**530**	**671**
	Baseline (M2/M3) break-even cost (€)									2,400	3,273	4,143

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 Class I/II/III (>5t and >22 passengers)	**All Roads** Fatal	1	0.8%	Not available				1	0.8%			
	Serious	10	0.8%					10	0.8%			
	Slight	340	2.7%					340	2.7%			
	All Casualties	**351**	**2.5%**					**351**	**2.5%**	**1110**	**2475**	**4212**
as guilty party	**Stock** (1000s)	70.77								**591**		
	Rate (casualties per 1000 vehicles)	**4.96**								**1.88**	**4.19**	**7.12**
	Baseline (M2/M3) rate	2.34								144	3.21	5.47
	New registrations per year (1000s)	4.12								**38**		
	Casualty valuations (€million)									**119**	**163**	**206**
	Break-even cost (€ 100% effectiveness)									**3,139**	**4,280**	**5,418**
	Baseline (M2/M3) break-even cost (€)									2,400	3,273	4,143

CASUALTIES in AEBS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 >3 axles	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**4**	**7**
as guilty party	**Stock** (1000s)	0.07		24.0	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**0.6**		
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**7.03**	**11.96**
	Baseline (M2/M3) rate	2.34								144	3.21	5.47
	New registrations per year (1000s)	0.01								**0.1**		
	Casualty valuations (€million)									**0**	**0.27**	**0.34**
	Break-even cost (€ 100% effectiveness)									**0**	**2,661**	**3,369**
	Baseline (M2/M3) break-even cost (€)									2,400	3,273	4,143

CASUALTIES in AEBS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 articulated buses and coaches **as guilty party**	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	2	0.0%					2	0.0%			
	All Casualties		**2**	**0.0%**					**2**	**0.0%**	**6**	**11**	**18**
	Stock (1000s)		0.54		38.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**5**		
	Rate (casualties per 1000 vehicles)		**3.34**								**1.26**	**2.35**	**4.01**
	Baseline (M2/M3) rate		2.34								1.44	3.21	5.47
	New registrations per year (1000s)		0.04								**0.4**		
	Casualty valuations (€ million)										**0.6**	**0.7**	**0.9**
	Break-even cost (€ 100% effectiveness)										**1,544**	**1,760**	**2,228**
	Baseline (M2/M3) break-even cost (€										2,400	3,273	4,143

Appendix D LDWS

Base data

Casualties in accidents involving... GB +FR: average 2005 - 2008 DE: GIDAS extrapolated to 2008 CARE (EU16): average 2005-2007		GB			DE			FR			GB + DE + FR			CARE (EU16)			
		N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All vehicles	N2/N3	M2/M3	All casualties	All Accidents
All Roads	Fatal	467	140	2964	799	105	4482	666	89	4731	1932	335	12177	4803	822	28828	25475
	Serious	1963	1299	27859	5919	1394	72920	2258	575	38513	10140	3268	139292	16597	4945	226450	190845
	Slight	14759	12697	221204	23111	9385	350135	2992	1375	63287	40862	23456	634626	63669	33602	1051960	754294
All casualties (accidents)		17189	14136	252027	29829	10884	427537	5916	2039	106531	52934	27058	786095	85070	39369	1307238	970614
Stock (1000s)		518.51	180.12	33607	862.19	75.27	54980										
Rate (casualties per 1000 vehicles per year)		33.2	78.5	7.5	34.6	144.6	7.8										

REMARKS: Data include all involved category N and M vehicles and not only those that caused the accident. Reported accidents only.

Casualties in accidents involving... EU27 estimates		Lower				Mid		Upper	
		All Accidents	All casualties	N2/N3	M2/M3	N2/N3	M2/M3	N2/N3	M2/M3
All Roads	Fatal	37498	42433	7070	1210	7070	1210	7212	1234
	Serious	252396	299484	21950	6540	35352	12102	44189	15128
	Slight	997566	1391234	84203	44439	212109	102869	371191	180021
All casualties (accidents)		1287459	1733151	113224	52189	254531	116182	422592	196383
Stock (1000s)						5700	883		
Rate (casualties per 1000 vehicles per year)				19.9	59.1	44.7	131.6	74.1	222.4

Valuations		
2105000	€	
236500	€	
18250	€	
Per casualty		

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2/N3	**All Roads**	Fatal	17	3.6%	52	6.5%	68	10.2%	137	7.1%	501	501	511
		Serious	59	3.0%	547	9.2%	315	14.0%	921	9.1%	1994	3212	4014
		Slight	225	1.5%	2011	8.7%	293	9.8%	2529	6.2%	5211	13126	22971
	All Casualties		**301**	**1.7%**	**2610**	**8.7%**	**676**	**11.4%**	**3587**	**6.8%**	**7705**	**16838**	**27495**
as guilty party	**Stock** (1000s)		519.96		862.19							**5700**	
	Rate (casualties per 1000 vehicles)		**0.58**		**3.03**						**1.35**	**2.95**	**4.82**
	Baseline (N2/N3) rate		0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)		52.85									**423**	
	Casualty valuations (€million)										**1,620**	**2,053**	**2,443**
	Break-even cost (€ 100% effectiveness)										**3,830**	**4,853**	**5,776**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2	**All Roads**	Fatal	2	0.4%	29	3.6%	11	1.7%	42	2.2%	154	154	157
		Serious	16	0.8%	199	3.4%	35	1.6%	250	2.5%	540	870	1088
		Slight	53	0.4%	514	2.2%	43	1.4%	610	1.5%	1258	3168	5544
	All Casualties		**71**	**0.4%**	**742**	**2.5%**	**89**	**1.5%**	**902**	**1.7%**	**1952**	**4192**	**6789**
as guilty party	**Stock** (1000s)		226.44		422.00							**2508**	
	Rate (casualties per 1000 vehicles)		**0.31**		**1.76**						**0.78**	**1.67**	**2.71**
	Baseline (N2/N3) rate		0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)		18.61									**106**	
	Casualty valuations (€million)										**475**	**588**	**689**
	Break-even cost (€ 100% effectiveness)										**4,474**	**5,537**	**6,491**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 <= 5t	**All Roads**	Fatal	1	0.1%	0	0.0%	Not available		1	0.1%			
		Serious	1	0.1%	12	0.2%			13	0.2%			
		Slight	5	0.0%	95	0.4%			100	0.3%			
	All Casualties		**7**	**0.0%**	**107**	**0.4%**			**114**	**0.2%**	**274**	**588**	**952**
as guilty party	**Stock** (1000s)		28.63		69.37							**379**	
	Rate (casualties per 1000 vehicles)		**0.24**		**1.54**						**0.72**	**1.55**	**2.51**
	Baseline (N2/N3) rate		0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)		3.79									**22**	
	Casualty valuations (€million)										**67**	**82**	**97**
	Break-even cost (€ 100% effectiveness)										**3,080**	**3,812**	**4,469**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >5t <= 7.5t as guilty party	All Roads Fatal	1	0.3%	29	3.6%	Not available		30	2.4%			
	Serious	14	0.7%	134	2.3%			148	1.9%			
	Slight	45	0.3%	299	1.3%			344	0.9%			
	All Casualties	**60**	**0.4%**	**462**	**1.5%**			**522**	**1.1%**	**1254**	**2693**	**4361**
	Stock (1000s)	179.45		285.00							**1796**	
	Rate (casualties per 1000 vehicles)	**0.34**		**1.62**						**0.70**	**1.50**	**2.43**
	Baseline (N2/N3) rate	0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)	12.75									**73**	
	Casualty valuations (€million)									**305**	**378**	**443**
	Break-even cost (€ 100% effectiveness)									**4,194**	**5,191**	**6,085**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >7.5t as guilty party	All Roads Fatal	0	0.0%	0	0.0%	Not available		0	0.0%			
	Serious	0	0.0%	53	0.9%			53	0.7%			
	Slight	3	0.0%	120	0.5%			123	0.3%			
	All Casualties	**4**	**0.0%**	**173**	**0.6%**			**177**	**0.4%**	**424**	**912**	**1476**
	Stock (1000s)	18.37		67.63							**333**	
	Rate (casualties per 1000 vehicles)	**0.21**		**2.56**						**1.28**	**2.74**	**4.44**
	Baseline (N2/N3) rate	0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)	2.07									**12**	
	Casualty valuations (€million)									**103**	**128**	**150**
	Break-even cost (€ 100% effectiveness)									**8,746**	**10,824**	**12,689**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Off Road as guilty party	All Roads Fatal	0.7	0.1%	Not available				0.7	0.1%			
	Serious	3	0.2%					3	0.2%			
	Slight	6	0.0%					6	0.0%			
	All Casualties	**9**	**0.1%**					**9**	**0.1%**	**261**	**560**	**907**
	Stock (1000s)	23.81									**264**	
	Rate (casualties per 1000 vehicles)	**0.40**								**0.99**	**2.12**	**3.44**
	Baseline (N2/N3) rate	0.58								1.35	2.95	4.82
	New registrations per year (1000s)	2.34									**13**	
	Casualty valuations (€million)									**63**	**79**	**92**
	Break-even cost (€ 100% effectiveness)									**4,752**	**5,881**	**6,895**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Special Purpose as guilty party	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	4	0.0%					4	0.0%			
	All Casualties		**4**	**0.0%**					**4**	**0.0%**	**105**	**225**	**364**
	Stock (1000s)		14.68									**163**	
	Rate (casualties per 1000 vehicles)		**0.26**								**0.64**	**1.38**	**2.24**
	Baseline (N2/N3) rate		0.58								1.35	2.95	4.82
	New registrations per year (1000s)		1.73									**10**	
	Casualty valuations (€million)										**25**	**32**	**37**
	Break-even cost (€ 100% effectiveness)										**2,580**	**3,193**	**3,744**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 >3 axles as guilty party	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0.4	0.0%					0.4	0.0%			
		Slight	0	0.0%					0	0.0%			
	All Casualties		**0.4**	**0.0%**					**0.4**	**0.0%**	**11**	**23**	**37**
	Stock (1000s)		0.17		5.7	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**2**	
	Rate (casualties per 1000 vehicles)		**2.42**								**6.00**	**12.11**	**19.61**
	Baseline (N2/N3) rate		0.58								1.35	2.95	4.82
	New registrations per year (1000s)		0.03									**0.2**	
	Casualty valuations (€million)										**2.7**	**3.2**	**4**
	Break-even cost (€ 100% effectiveness)										**16,057**	**18,676**	**21,894**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N2 Tractor Unit <= 7.5t as guilty party	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	0	0.0%					0	0.0%			
	All Casualties		**0**	**0.0%**					**0**	**0.0%**	**0**	**4**	**6**
	Stock (1000s)		0.66		0.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**7**	
	Rate (casualties per 1000 vehicles)		**0.00**								**0.00**	**0.49**	**0.80**
	Baseline (N2/N3) rate		0.58								1.35	2.95	4.82
	New registrations per year (1000s)		0.10									**0.6**	
	Casualty valuations (€million)										**0**	**0.5**	**0.6**
	Break-even cost (€ 100% effectiveness)										**0**	**885**	**1,037**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3	All Roads Fatal	15	3.1%	23	2.9%	57	8.6%	95	4.9%	346	346	353
	Serious	44	2.2%	348	5.9%	280	12.4%	672	6.6%	1454	2341	2927
	Slight	171	1.2%	1497	6.5%	249	8.3%	1917	4.7%	3951	9953	17417
	All Casualties	**230**	**1.3%**	**1868**	**6.3%**	**586**	**9.9%**	**2684**	**5.1%**	**5751**	**12641**	**20697**
	Stock (1000s)	293.52		440.19							**3192**	
as guilty party	**Rate** (casualties per 1000 vehicles)	**0.78**		**4.24**						**1.80**	**3.96**	**6.48**
	Baseline (N2/N3) rate	0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)	34.24									**317**	
	Casualty valuations (€million)									**1,145**	**1,465**	**1,754**
	Break-even cost (€ 100% effectiveness)									**3,615**	**4,623**	**5,536**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t	All Roads Fatal	0	0.0%	0	0.0%	Not available		0	0.0%			
	Serious	1	0.0%	0	0.0%			1	0.0%			
	Slight	6	0.0%	81	0.4%			87	0.2%			
	All Casualties	**7**	**0.0%**	**81**	**0.3%**			**88**	**0.2%**	**241**	**529**	**866**
	Stock (1000s)	18.67		28.51							**205**	
as guilty party	**Rate** (casualties per 1000 vehicles)	**0.36**		**2.84**						**1.17**	**2.58**	**4.22**
	Baseline (N2/N3) rate	0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)	1.72									**10**	
	Casualty valuations (€million)									**48**	**61**	**73**
	Break-even cost (€ 100% effectiveness)									**4,881**	**6,243**	**7,476**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Off Road	All Roads Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0.4	0.0%					0.4	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0.4**	**0.0%**					**0.4**	**0.0%**	**15**	**70**	**115**
	Stock (1000s)	1.24		13.2	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**14**	
as guilty party	**Rate** (casualties per 1000 vehicles)	**0.33**								**1.08**	**5.14**	**8.42**
	Baseline (N2/N3) rate	0.58								1.35	2.95	4.82
	New registrations per year (1000s)	0.05									**0.3**	
	Casualty valuations (€million)									**3**	**8**	**10**
	Break-even cost (€ 100% effectiveness)									**10,230**	**28,474**	**34,097**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Special Purpose	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0.4	0.0%					0.4	0.0%			
	Slight	1	0.0%					1	0.0%			
	All Casualties	**1**	**0.0%**					**1**	**0.0%**	**45**	**99**	**161**
	Stock (1000s)	127									**14**	
	Rate (casualties per 1000 vehicles)	**0.99**								**3.21**	**7.06**	**11.56**
	Baseline (N2/N3) rate	0.58								135	2.95	4.82
	New registrations per year (1000s)	0.16									**1**	
	Casualty valuations (€million)									**9**	**11**	**14**
	Break-even cost (€ 100% effectiveness)									**9,780**	**12,508**	**14,978**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t >3 axles	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**5**	**8**
	Stock (1000s)	0.04		0.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**0.5**	
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**10.35**	**16.95**
	Baseline (N2/N3) rate	0.58								135	2.95	4.82
	New registrations per year (1000s)	0.002									**0.01**	
	Casualty valuations (€million)									**0**	**0.6**	**0.7**
	Break-even cost (€ 100% effectiveness)									**0**	**42,205**	**50,539**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 <= 16t Rigid (not towing)	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.0%					1	0.0%			
	Slight	6	0.0%					6	0.0%			
	All Casualties	**6**	**0.0%**					**6**	**0.0%**	**225**	**496**	**811**
	Stock (1000s)	18.37									**202**	
	Rate (casualties per 1000 vehicles)	**0.34**								**1.12**	**2.45**	**4.02**
	Baseline (N2/N3) rate	0.58								135	2.95	4.82
	New registrations per year (1000s)	167									**10**	
	Casualty valuations (€million)									**45**	**57**	**69**
	Break-even cost (€ 100% effectiveness)									**4,712**	**6,026**	**7,217**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t as guilty party	**All Roads** Fatal	15	3.1%	23	2.9%	Not available		38	3.0%			
	Serious	43	2.2%	348	5.9%			391	5.0%			
	Slight	165	1.1%	1416	6.1%			1581	4.2%			
	All Casualties	**223**	**1.3%**	**1787**	**6.0%**			**2010**	**4.3%**	**5511**	**12112**	**19832**
	Stock (1000s)	274.85		411.68							**2987**	
	Rate (casualties per 1000 vehicles)	**0.81**		**4.34**						**1.85**	**4.06**	**6.64**
	Baseline (N2/N3) rate	0.58		3.03						1.35	2.95	4.82
	New registrations per year (1000s)	32.52									**307**	
	Casualty valuations (€million)									**1,097**	**1,403**	**1,681**
	Break-even cost (€ 100% effectiveness)									**3,574**	**4,571**	**5,474**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Off Road as guilty party	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	1	0.0%					1	0.0%			
	Slight	11	0.1%					11	0.1%			
	All Casualties	**12**	**0.1%**					**12**	**0.1%**	**292**	**643**	**1052**
	Stock (1000s)	33.60									**365**	
	Rate (casualties per 1000 vehicles)	**0.35**								**0.80**	**1.76**	**2.88**
	Baseline (N2/N3) rate	0.58								1.35	2.95	4.82
	New registrations per year (1000s)	3.66									**35**	
	Casualty valuations (€million)									**58**	**74**	**89**
	Break-even cost (€ 100% effectiveness)									**1,685**	**2,155**	**2,580**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Special Purpose as guilty party	**All Roads** Fatal	2	0.4%	Not available				2	0.4%			
	Serious	2	0.1%					2	0.1%			
	Slight	4	0.0%					4	0.0%			
	All Casualties	**8**	**0.0%**					**8**	**0.0%**	**197**	**433**	**709**
	Stock (1000s)	26.32									**286**	
	Rate (casualties per 1000 vehicles)	**0.30**								**0.69**	**1.51**	**2.48**
	Baseline (N2/N3) rate	0.58								1.35	2.95	4.82
	New registrations per year (1000s)	3.18									**30**	
	Casualty valuations (€million)									**39**	**50**	**60**
	Break-even cost (€ 100% effectiveness)									**1,307**	**1,672**	**2,002**
	Baseline (N2/N3) break-even cost (€									3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t >3 axles	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	1	0.1%					1	0.1%			
		Slight	9	0.1%					9	0.1%			
	All Casualties		**10**	**0.1%**					**10**	**0.1%**	**250**	**550**	**900**
	Stock (1000s)		30.78									**334**	
	Rate (casualties per 1000 vehicles)		**0.33**								**0.75**	**1.64**	**2.69**
	Baseline (N2/N3) rate		0.58								1.35	2.95	4.82
	New registrations per year (1000s)		4.23									**40**	
	Casualty valuations (€million)										**50**	**64**	**76**
	Break-even cost (€ 100% effectiveness)										**1,248**	**1,596**	**1,911**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >16t Rigid (not towing)	**All Roads**	Fatal	8	16%	Not available				8	16%			
		Serious	9	0.5%					9	0.5%			
		Slight	49	0.3%					49	0.3%			
	All Casualties		**65**	**0.4%**					**65**	**0.4%**	**1617**	**3554**	**5819**
	Stock (1000s)		148.86									**1618**	
	Rate (casualties per 1000 vehicles)		**0.44**								**1.00**	**2.20**	**3.60**
	Baseline (N2/N3) rate		0.58								1.35	2.95	4.82
	New registrations per year (1000s)		15.47									**146**	
	Casualty valuations (€million)										**322**	**412**	**493**
	Break-even cost (€ 100% effectiveness)										**2,204**	**2,819**	**3,376**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	n	% of N2/N3	Lower	Mid	Upper
N3 >44t	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	0	0.0%					0	0.0%			
	All Casualties		**0**	**0.0%**					**0**	**0.0%**	**0**	**206**	**337**
	Stock (1000s)		?		38.7	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all N2/N3s						**?**	
	Rate (casualties per 1000 vehicles)		?								**?**	**?**	**?**
	Baseline (N2/N3) rate		0.58								1.35	2.95	4.82
	New registrations per year (1000s)		?									**?**	
	Casualty valuations (€million)										**0**	**24**	**29**
	Break-even cost (€ 100% effectiveness)										**?**	**?**	**?**
	Baseline (N2/N3) break-even cost (€										3,830	4,853	5,776

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M2/M3	**All Roads**	Fatal	3	1.8%	23	21.9%	28	31.4%	54	16.0%	194	194	197
		Serious	20	1.5%	95	6.8%	82	14.3%	197	6.0%	394	729	911
		Slight	89	0.7%	701	7.5%	157	11.4%	947	4.0%	1793	4151	7264
	All Casualties		**111**	**0.8%**	**819**	**7.5%**	**267**	**13.1%**	**1197**	**4.4%**	**2381**	**5073**	**8373**
	Stock (1000s)		180.18		75.27							**883**	
	Rate (casualties per 1000 vehicles)		**0.61**		**10.88**						**2.70**	**5.75**	**9.48**
	Baseline (M2/M3) rate		0.61		10.88						2.70	5.75	9.48
	New registrations per year (1000s)		12.28									**57**	
	Casualty valuations (€million)										**533**	**656**	**764**
	Break-even cost (€ 100% effectiveness)										**9,356**	**11,501**	**13,397**
	Baseline (M2/M3) break-even cost (€										9,356	11,501	13,397

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M2	**All Roads**	Fatal	2	1.3%	0	0.0%	Not available		2	0.5%			
		Serious	7	0.5%	13	0.9%			20	0.6%			
		Slight	31	0.2%	0	0.0%			31	0.1%			
	All Casualties		**40**	**0.3%**	**13**	**0.1%**			**53**	**0.2%**	**135**	**288**	**475**
	Stock (1000s)		100.91		5.21							**221**	
	Rate (casualties per 1000 vehicles)		**0.39**		**2.50**						**0.61**	**1.30**	**2.15**
	Baseline (M2/M3) rate		0.61		10.88						2.70	5.75	9.48
	New registrations per year (1000s)		7.65									**14**	
	Casualty valuations (€million)										**30**	**37**	**43**
	Break-even cost (€ 100% effectiveness)										**2,122**	**2,608**	**3,038**
	Baseline (M2/M3) break-even cost (€										9,356	11,501	13,397

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3	**All Roads**	Fatal	1	0.5%	23	21.9%	Not available		24	9.7%			
		Serious	13	1.0%	82	5.9%			95	3.5%			
		Slight	58	0.5%	701	7.5%			759	3.4%			
	All Casualties		**71**	**0.5%**	**806**	**7.4%**			**877**	**3.5%**	**2246**	**4786**	**7898**
	Stock (1000s)		79.27		70.06							**662**	
	Rate (casualties per 1000 vehicles)		**0.90**		**11.50**						**3.39**	**7.23**	**11.93**
	Baseline (M2/M3) rate		0.61		10.88						2.70	5.75	9.48
	New registrations per year (1000s)		4.63									**43**	
	Casualty valuations (€million)										**503**	**618**	**720**
	Break-even cost (€ 100% effectiveness)										**11,768**	**14,465**	**16,849**
	Baseline (M2/M3) break-even cost (€										9,356	11,501	13,397

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 class A (>5t and <23 passengers)	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	1	0.0%					1	0.0%			
	All Casualties	**1**	**0.0%**					**1**	**0.0%**	**39**	**84**	**139**
as guilty party	**Stock** (1000s)	8.50		208.6	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**71**		
	Rate (casualties per 1000 vehicles)	**0.15**								**0.55**	**1.18**	**1.95**
	Baseline (M2/M3) rate	0.61								2.70	5.75	9.48
	New registrations per year (1000s)	0.51								**5**		
	Casualty valuations (€million)									**9**	**11**	**13**
	Break-even cost (€ 100% effectiveness)									**1,875**	**2,304**	**2,684**
	Baseline (M2/M3) break-even cost (€)									9,356	11,501	13,397

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 Class I/II/III (>5t and >22 passengers)	**All Roads** Fatal	1	0.5%	Not available				1	0.5%			
	Serious	13	10%					13	10%			
	Slight	56	0.4%					56	0.4%			
	All Casualties	**70**	**0.5%**					**70**	**0.5%**	**2206**	**4702**	**7759**
as guilty party	**Stock** (1000s)	70.77								**591**		
	Rate (casualties per 1000 vehicles)	**0.99**								**3.73**	**7.95**	**13.12**
	Baseline (M2/M3) rate	0.61								2.70	5.75	9.48
	New registrations per year (1000s)	4.12								**38**		
	Casualty valuations (€million)									**494**	**608**	**708**
	Break-even cost (€ 100% effectiveness)									**12,992**	**15,971**	**18,603**
	Baseline (M2/M3) break-even cost (€)									9,356	11,501	13,397

CASUALTIES in LDWS relevant accidents with ...		GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
		n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 >3 axles	**All Roads** Fatal	0	0.0%	Not available				0	0.0%			
	Serious	0	0.0%					0	0.0%			
	Slight	0	0.0%					0	0.0%			
	All Casualties	**0**	**0.0%**					**0**	**0.0%**	**0**	**72**	**118**
as guilty party	**Stock** (1000s)	0.07		24.0	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**0.6**		
	Rate (casualties per 1000 vehicles)	**0.00**								**0.00**	**122.28**	**201.80**
	Baseline (M2/M3) rate	0.61								2.70	5.75	9.48
	New registrations per year (1000s)	0.01								**0.1**		
	Casualty valuations (€million)									**0**	**9.2**	**11**
	Break-even cost (€ 100% effectiveness)									**0**	**90,976**	**105,971**
	Baseline (M2/M3) break-even cost (€)									9,356	11,501	13,397

CASUALTIES in LDWS relevant accidents with ...			GB Annual Average 2005 - 2008		DE GIDAS extrapolated to 2008		FR Annual Average 2005 - 2008		Combined GB + DE + FR		EU Estimates		
			n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	n	% of M2/M3	Lower	Mid	Upper
M3 articulated buses and coaches **as guilty party**	**All Roads**	Fatal	0	0.0%	Not available				0	0.0%			
		Serious	0	0.0%					0	0.0%			
		Slight	0.3	0.0%					0.3	0.0%			
	All Casualties		**0.3**	**0.0%**					**0.3**	**0.0%**	**10**	**116**	**191**
	Stock (1000s)		0.54		38.9	GB casualties per year in all accidents involving these vehicles. Mid & Upper estimates assume same involvement rate as all M2/M3s					**5**		
	Rate (casualties per 1000 vehicles)		**0.58**								**2.18**	**25.69**	**42.40**
	Baseline (M2/M3) rate		0.61								2.70	5.75	9.48
	New registrations per year (1000s)		0.04								**0.4**		
	Casualty valuations (€million)										**2**	**15**	**17**
	Break-even cost (€, 100% effectiveness)										**5,558**	**37,722**	**43,939**
	Baseline (M2/M3) break-even cost (€										9,356	11,501	13,397

Appendix E Draft Final Report Presentation to MVWG, 5 July 2010

Contents

- Introduction
- Identification of Vehicle Types & Target Populations
- Vehicle stock, new registration, system cost and effectiveness estimates
- Cost Benefit Analyses
- Technical evaluations
- Conclusions and limitations

Introduction

- General Safety Regulation aims to mandate AEBS and LDWS for all N2, N3, M2 and M3 vehicles;
- Exemptions permitted if cost/benefit analysis and/or other vehicle-specific safety aspects show fitment to be inappropriate;
- TRL tasked by EC to follow up its earlier analyses on N2/N3 and M2/M3 with more detailed analyses of specific vehicle types.
- Use of GB, German and French data to estimate EU27 target populations, i.e. all casualties that might be preventable by 100% effective AEBS or LDWS;
- Consideration of effectiveness, system costs and vehicle stock/new registration data to produce vehicle-specific cost-benefit analyses.
- Desk-based assessment of suggested technical exemptions.

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Vehicle Types

N2/N3 vehicle types that are possible to identify or approximate, e.g. by body type, GVW. Most detailed vehicle type can be applied to each of the vehicle types above it, e.g. Off road vehicles can be N2, N3≤16t or N3>16t – all available combinations are shown in the later slides.

Vehicle Type	Comment
N2/N3	**Goods vehicles >3.5t and large vehicles classed as "other motor vehicles" such as refuse collectors, mobile cranes, recovery vehicles**
N2	**GVW<=12t**
N3	**GVW>12t**
N3≤16t	***GVW >12t and <=16t***
N3 >16t	***GVW >16t***
Off road	Rigid vehicles only where body types are tipper/concrete mixer
Special purpose	Rigid vehicles with body types such as breakdown truck, skip loader, street cleanser, road stripper etc.
>5t and ≤7.5t	N2 restricted by GVW
≤5t	N2 restricted by GVW
> 7.5t	N2 restricted by GVW
Tractor ≤ 7.5t	Vehicles with an articulated wheel-plan, restricted by GVW
>3 axles	Rigid vehicles with more than 3 axles or articulated vehicles with a tow vehicle with more than 3 axles
Not intended to tow O3 or O4 trailer	Cannot identify vehicles not designed to tow, but can identify rigid vehicles that were not towing at the time of the accident – likely to result in over-estimate
Intended to tow O3 or O4 trailer with more than 3 axles and trailer for exceptional load transport and trailers with areas for standing passengers	Not possible to identify specific trailers, but possible to identify vehicles with GVW>44T which are likely to include some of these vehicles

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Identification of vehicles types in accident data sources

Vehicle Type	GB	DE	FR
All vehicle types	✔	✔	✔
N2/N3	✔	✔	✔
N2	✔	✔	✔
N2 Off road	✔		
N2 Special purpose	✔		
N2 > 3 axles	✔		
N2 <5T	✔	✔	
N2 >5T <7.5T	✔	✔	
N2 > 7.5T	✔	✔	
N2 Tractor <7.5T	✔		
N3	✔	✔	✔
N3 <=16t	✔	✔	
N3 <=16t off road	✔		
N3 <=16t special purpose	✔		
N3 <=16t >3axles	✔		
N3 <=16t rigid (not towing at time)	✔		
N3 >16t	✔	✔	
N3 >16t off road	✔		
N3>16t special purpose	✔		
N3 >16t >3axles	✔		
N3 >16t rigid (not towing at time)	✔		
N3 >44t exceptional load	✔		

Data Sources

- Great Britain
  - National road accident statistics (Stats19), and Stats19 linked to Vehicle Registration data
  - 2005-2008
- Germany
  - Gidas data from 1999-2009 weighted to National Statistics for 2008
- France
  - National accident statistics
  - 2007

Vehicle Type	GB	DE	FR
M2/M3	✔	✔	✔
M2	✔	✔	
M3	✔	✔	
M3<= 23 seats	✔		
M3>23 seats	✔		
M3>3 axles	✔		
M3 articulated	✔		

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Target Populations - LDWS

The unintentional lane change of the vehicle of interest is identified based on a number of criteria:

- the manoeuvre being carried out (general driving, not making a specific manoeuvre)
- The impact location on the vehicle of interest and the other vehicle
- Driver behaviour factors that could contribute to leaving the lane unintentionally e.g., fatigue, distraction, etc

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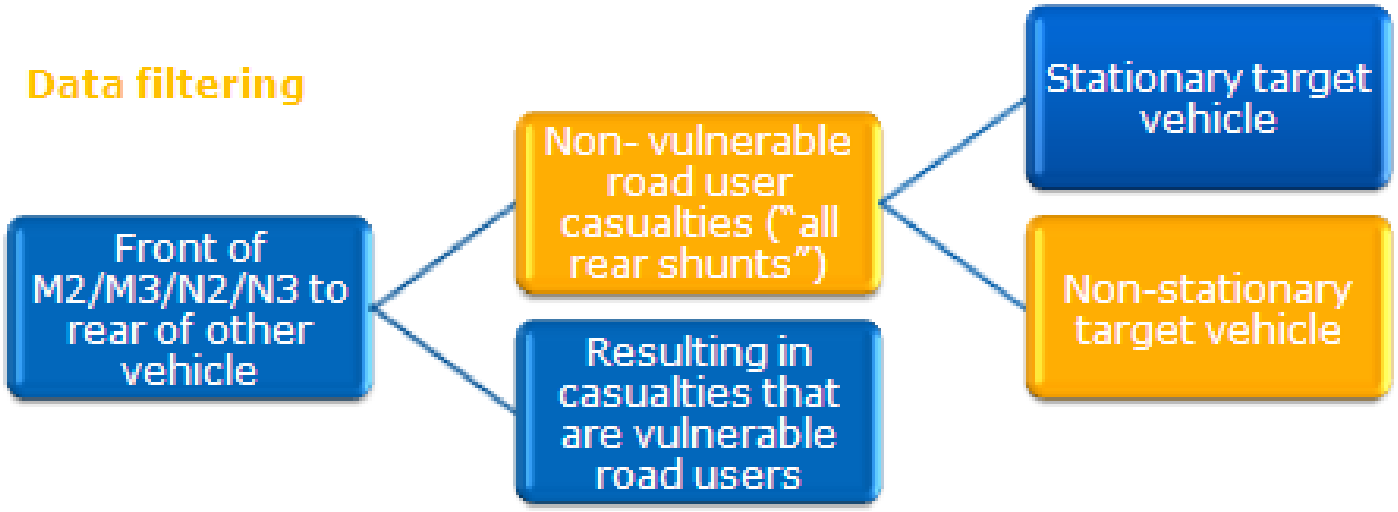
Target Populations - AEBS

Data filtering



- Groups of interest in Orange;
- Current sytems require the target vehicle to be tracked while it is moving. It is not possible to differentiate between vehicles moving or not moving prior to impact;
- The closest approximation is to identify target vehicles that are likely to be stationary on impact by selecting manoeuvres such as parked, held up, waiting to turn;
- Have also assessed all rear shunt accidents, to quantify potential of future systems that can recognise stationary and non-stationary target vehicles.

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EU Accident/Casualty Statistics

EU27 – DG-TREN Statistical Pocketbook 2010

Measure	2005	2006	2007	2008	05-08 Annual Average
Accidents – all severities	1,321,450	1,299,245	1,296,928	1,232,211	1,287,459
Fatalities	45,300	43,062	42,496	38,875	42,433

EU16 – from CARE where vehicle types, all severities and years are available - 2005-2007 annual average

Accident type	Annual average number of casualties (EU16*)		
	Fatal	Serious	Slight
All	28,828	226,450	1,051,960
Involving N2/N3**	4,803	16,597	63,669
Involving M2/M3	822	4,945	33,602

•Austria, Belgium, Czech Republic, Germany, Denmark, Spain , France , United Kingdom, Greece, Hungary, Malta, Netherlands, Portugal, Romania, Sweden, Slovenia,
•** Data for other motor vehicles (OMV) only available for for 14 of 16 Member States. OMVs for GB included agricultural and have been updated using Stats19 data to remove the agricultural vehicles

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EU27 Casualty Estimates

- Overall number of fatalities known for EU27, so proportions involved in N2/N3 or M2/M3 in EU16 assumed to apply to EU27, e.g. M2/M3 fatalities = (42433 x 822/28828) = 1210;
- For non-fatal casualties, overall number of EU27 accidents assumed to be split by severity (fatal, serious and slight) in same proportions as EU16, and numbers of casualties also assumed to be in same ratios per accident for each severity;
- These estimates, though, are based only on reported accidents, so represent a "lower" estimate.
- "Mid" estimate makes some allowance for under-reporting by using GB & German proportions of fatal:serious:slight (fatalities same as lower estimate).
- "Upper" estimate goes one step further and uses best available research to make allowance for under-reporting in GB and Germany, and apply small correction for deaths > 30 days.

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EU27 Casualty Estimates

Estimates for all N2/N3 and M2/M3 casualties in EU27.
Valuations based on 2008 UK costs.

Accident type	Estimated annual average number of casualties (EU27)				Value
	Fatal	Serious	Slight	All	€m
Lower estimates					
Involving N2/N3 (ratios)	7,070 (1:)	21,950 (3:)	84,203 (12)	113,223	21,611
Involving M2/M3 (ratios)	1,210 (1:)	6,540 (5:)	44,439 (37)	52,189	4,905
Mid estimates					
Involving N2/N3 (ratios)	7,070 (1:)	35,352 (5:)	212,109 (30)	254,531	27,115
Involving M2/M3 (ratios)	1,210 (1:)	12,102 (10:)	102,869 (85)	116,181	7,287
Upper estimates					
Involving N2/N3 (ratios)	7,212 (1:)	44,189 (6:)	371,191 (51)	422,592	32,406
Involving M2/M3 (ratios)	1,234 (1:)	15,128 (12:)	180,021 (146)	196,383	9,462

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Vehicle stock and new registration estimates

- No comprehensive published data on numbers of vehicles in use across EU27 by vehicle types of interest;
- For N2/N3, EU27 stocks have been estimated based on appropriate combinations of EU27 data for all goods vehicles in use and for new vehicle registrations (for N2/N3 vehicles and N3 > 16t), from DG-TREN Pocketbook, national data from GB and Germany, and data provided by industry stakeholders;
- For M2/M3, EU27 stocks and new registrations published in Pocketbook. Specific vehicle types estimated using GB and Germany data.
- Estimates of 5.7million N2/N3 vehicles in use (2.5m N2, 3.2m N3), and 883,000 M2/M3 (221,000 M2, 662,000 M3).
- Estimates of 423,000 N2/N3 and 57,000 M2/M3 new registrations per year (based on 2006-08 averages).

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System costs and effectiveness estimates

- Research literature review and figures provided by stakeholders (for earlier projects) used to make estimates:
- AEBS (all rear shunts): €250-€1500, 20-50% effectiveness;
- AEBS (non stationary targets): €150-€1000, 20-50% effectiveness;
- LDWS: €200-€600, 20-60% effectiveness.

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Cost – Benefit Analyses

- First stage: simple break-even analysis based on target populations and new registrations only;
- Second stage: Phased analysis allowing for effectiveness and gradual introduction into vehicle fleet over 15 year evaluation period (via mandatory fitment to all new vehicles).
- Results in form of break-even costs (maximum cost of systems per vehicle to provide a benefit-cost ratio > 1) and benefit:cost ratios (based on estimated system cost ranges).

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Results - AEBS (all rear shunts)

	EU-27 annual estimates													
			AEBS (all rear shunts)											
			Target population (Casualties)			Simple Break-Even Costs (€) (if systems 100% effective)			Phased Break-Even Costs (€) (15 Yrs, fit to all new vehicles)			Phased Benefit:Cost Ratios (15 Yrs, fit to all new vehicles)		
Vehicle Type	Stock (1000s)	New registrations per annum (1000s)	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper
	Effectiveness								20%	35%	50%			
	System costs											€ 1,500	€ 750	€ 250
N2/N3	**5700**	**423**	**20514**	**48673**	**82935**	**€ 5,349**	**€ 7,247**	**€ 9,243**	**€ 625**	**€ 1,482**	**€ 2,700**	**0.4**	**2.0**	**10.8**
N3	**3192**	**317**	**15337**	**36317**	**61879**	**€ 5,964**	**€ 7,815**	**€ 9,791**	**€ 832**	**€ 1,908**	**€ 3,415**	**0.6**	**2.5**	**13.7**
N3 >16t	2987	307	13953	33040	56296	€ 5,600	€ 7,337	€ 9,193	€ 794	€ 1,821	€ 3,259	0.5	2.4	13.0
N2	**2508**	**106**	**5173**	**12347**	**21042**	**€ 3,507**	**€ 5,546**	**€ 7,598**	**€ 238**	**€ 657**	**€ 1,287**	**0.2**	**0.9**	**5.1**
N3 >16t Rigid (not towing)	1618	146	4902	11607	19776	€ 4,135	€ 5,418	€ 6,788	€ 549	€ 1,259	€ 2,254	0.4	1.7	9.0
N2 >5 <=7.5t	1796	73	3517	8394	14305	€ 3,480	€ 5,503	€ 7,539	€ 225	€ 624	€ 1,221	0.2	0.8	4.9
N3 >16t >3 axles	334	40	2036	4822	8216	€ 6,282	€ 8,232	€ 10,314	€ 948	€ 2,173	€ 3,889	0.6	2.9	15.6
N3 >16t Off Road	365	35	1785	4226	7201	€ 6,364	€ 8,339	€ 10,448	€ 867	€ 1,988	€ 3,558	0.6	2.7	14.2
N3 <=16t	205	10	1384	3277	5583	€ 17,372	€ 22,762	€ 28,519	€ 1,329	€ 3,047	€ 5,454	0.9	4.1	21.8
N3 <=16t Rigid (not towing)	202	10	1274	3017	5140	€ 16,473	€ 21,584	€ 27,044	€ 1,244	€ 2,852	€ 5,104	0.8	3.8	20.4
N2 >7.5t	333	12	996	2378	4053	€ 6,072	€ 9,602	€ 13,155	€ 345	€ 955	€ 1,868	0.2	1.3	7.5
N2 <=5t	379	22	662	1580	2693	€ 2,204	€ 3,485	€ 4,775	€ 201	€ 557	€ 1,090	0.1	0.7	4.4
N3 >16t Special Purpose	286	30	568	1346	2293	€ 2,333	€ 3,056	€ 3,829	€ 334	€ 766	€ 1,370	0.2	1.0	5.5
N2 Special Purpose	163	10	406	970	1652	€ 2,962	€ 4,684	€ 6,418	€ 288	€ 796	€ 1,558	0.2	1.1	6.2
N2 Off Road	264	13	297	709	1209	€ 1,602	€ 2,534	€ 3,471	€ 130	€ 359	€ 703	0.1	0.5	2.8
N3 <=16t Special Purpose	14	1	174	411	701	€ 23,432	€ 30,703	€ 38,468	€ 2,451	€ 5,621	€ 10,061	1.6	7.5	40.2
N3 >44t	?	?	26	327	557	?	?	?	?	?	?	?	?	?
N3 <=16t Off Road	14	0	15	112	190	€ 6,493	€ 26,664	€ 33,408	€ 217	€ 1,562	€ 2,797	0.1	2.1	11.2
N2 >3 axles *	2	0.2	0	15	26	€ 0	€ 4,267	€ 5,846	€ 0	€ 996	€ 1,949	0	1.3	7.8
N3 <=16t >3 axles *	0.5	0.01	0	8	13	€ 0	€ 39,522	€ 49,518	€ 0	€ 3,145	€ 5,629	0	4.2	22.5
N2 Tractor unit <=7.5t *	7	0.6	0	2	4	€ 0	€ 202	€ 277	€ 0	€ 43	€ 84	0	0.1	0.3
M2/M3	**883**	**57**	**4217**	**9580**	**16492**	**€ 4,059**	**€ 6,615**	**€ 9,319**	**€ 419**	**€ 1,196**	**€ 2,406**	**0.3**	**1.6**	**9.6**
M3	**662**	**43**	**3866**	**8783**	**15120**	**€ 4,961**	**€ 8,086**	**€ 11,392**	**€ 512**	**€ 1,462**	**€ 2,941**	**0.3**	**1.9**	**11.8**
M3 Class I/II/III	591	38	3798	8629	14855	€ 5,478	€ 8,928	€ 12,577	€ 564	€ 1,608	€ 3,237	0.4	2.1	12.9
M2	**221**	**14**	**351**	**797**	**1372**	**€ 1,351**	**€ 2,202**	**€ 3,102**	**€ 140**	**€ 398**	**€ 801**	**0.1**	**0.5**	**3.2**
M3 Class A	71	5	68	154	265	€ 790	€ 1,287	€ 1,813	€ 84	€ 239	€ 481	0.1	0.3	1.9
M3 articulated *	5	0.4	7	25	44	€ 972	€ 2,512	€ 3,539	€ 127	€ 576	€ 1,158	0.1	0.8	4.6
M3 >3 axles *	0.6	0.1	7	16	27	€ 3,798	€ 6,058	€ 8,535	€ 639	€ 1,784	€ 3,591	0.4	2.4	14.4

* NB. The numbers of these vehicles in use in GB are very low (data from other countries not available), so very low numbers of casualties are to be expected - EU-27 estimates are thus subject to significant uncertainty.

Results - AEBS (non stationary targets only)

	EU-27 annual estimates													
			AEBS (non stationary targets)											
			Target population (Casualties)			Simple Break-Even Costs (€) (if systems 100% effective)			Phased Break-Even Costs (€) (15 Yrs, fit to all new vehicles)			Phased Benefit:Cost Ratios (15 Yrs, fit to all new vehicles)		
Vehicle Type	Stock (1000s)	New registrations per annum (1000s)	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper
	Effectiveness								20%	35%	50%			
	System costs											€ 1,000	€ 500	€ 150
N2/N3	**5700**	**423**	**9501**	**22212**	**37548**	**€ 2,718**	**€ 3,691**	**€ 4,665**	**€ 318**	**€ 755**	**€ 1,363**	**0.3**	**1.5**	**9.1**
N3	**3192**	**317**	**7745**	**18244**	**30975**	**€ 2,901**	**€ 3,898**	**€ 4,926**	**€ 405**	**€ 952**	**€ 1,718**	**0.4**	**1.9**	**11.5**
N3 >16t	2987	307	7361	17340	29439	€ 2,845	€ 3,823	€ 4,832	€ 403	€ 949	€ 1,713	0.4	1.9	11.4
N3 >16t Rigid (not towing)	1618	146	2098	4942	8391	€ 1,705	€ 2,291	€ 2,895	€ 226	€ 532	€ 961	0.2	1.1	6.4
N2	**2508**	**106**	**1758**	**3972**	**6577**	**€ 2,177**	**€ 3,081**	**€ 3,894**	**€ 148**	**€ 365**	**€ 659**	**0.1**	**0.7**	**4.4**
N2 >5 <=7.5t	1796	73	1287	2908	4815	€ 2,327	€ 3,292	€ 4,161	€ 151	€ 373	€ 674	0.2	0.7	4.5
N3 >16t >3 axles	334	40	998	2350	3990	€ 2,965	€ 3,984	€ 5,035	€ 447	€ 1,052	€ 1,899	0.4	2.1	12.7
N3 >16t Off Road	365	35	754	1776	3015	€ 2,589	€ 3,479	€ 4,397	€ 353	€ 829	€ 1,497	0.4	1.7	10.0
N3 <=16t	205	10	384	904	1536	€ 4,642	€ 6,238	€ 7,884	€ 355	€ 835	€ 1,508	0.4	1.7	10.1
N3 <=16t Rigid (not towing)	202	10	335	788	1338	€ 4,167	€ 5,600	€ 7,078	€ 315	€ 740	€ 1,336	0.3	1.5	8.9
N3 >16t Special Purpose	286	30	262	617	1047	€ 1,035	€ 1,391	€ 1,758	€ 148	€ 348	€ 629	0.1	0.7	4.2
N2 >7.5t	333	12	271	613	1015	€ 3,021	€ 4,274	€ 5,402	€ 172	€ 425	€ 767	0.2	0.8	5.1
N2 <=5t	379	22	204	462	764	€ 1,242	€ 1,758	€ 2,222	€ 113	€ 281	€ 507	0.1	0.6	3.4
N2 Special Purpose	163	10	152	344	570	€ 2,030	€ 2,873	€ 3,631	€ 197	€ 488	€ 882	0.2	1.0	5.9
N2 Off Road	264	13	100	226	374	€ 985	€ 1,394	€ 1,762	€ 80	€ 198	€ 357	0.1	0.4	2.4
N3 <=16t Special Purpose	14	1	57	135	230	€ 7,470	€ 10,039	€ 12,687	€ 781	€ 1,838	€ 3,318	0.8	3.7	22.1
N3 >44t	?	?	11	128	218	?	?	?	?	?	?	?	?	?
N3 <=16t Off Road	14	0	13	44	74	€ 5,558	€ 10,393	€ 13,135	€ 186	€ 609	€ 1,100	0.2	1.2	7.3
N2 >3 axles *	2	0.2	0	7	12	€ 0	€ 3,589	€ 4,537	€ 0	€ 838	€ 1,512	0	1.7	10.1
N3 <=16t >3 axles *	0.5	0.01	0	3	5	€ 0	€ 15,405	€ 19,469	€ 0	€ 1,226	€ 2,213	0	2.5	14.8
N2 Tractor unit <=7.5t *	7	0.6	0	1	2	€ 0	€ 170	€ 215	€ 0	€ 36	€ 65	0	0.1	0.4
M2/M3	**883**	**57**	**1272**	**2836**	**4826**	**€ 2,400**	**€ 3,273**	**€ 4,143**	**€ 248**	**€ 592**	**€ 1,070**	**0.2**	**1.2**	**7.1**
M3	**662**	**43**	**1127**	**2513**	**4276**	**€ 2,836**	**€ 3,867**	**€ 4,895**	**€ 293**	**€ 699**	**€ 1,264**	**0.3**	**1.4**	**8.4**
M3 Class I/II/III	591	38	1110	2475	4212	€ 3,139	€ 4,280	€ 5,418	€ 323	€ 771	€ 1,394	0.3	1.5	9.3
M2	**221**	**14**	**145**	**323**	**549**	**€ 1,093**	**€ 1,491**	**€ 1,887**	**€ 113**	**€ 269**	**€ 487**	**0.1**	**0.5**	**3.2**
M3 Class A	71	5	17	38	65	€ 389	€ 530	€ 671	€ 41	€ 98	€ 178	0.0	0.2	1.2
M3 articulated *	5	0.4	6	11	18	€ 1,544	€ 1,760	€ 2,228	€ 202	€ 403	€ 729	0.2	0.8	4.9
M3 >3 axles *	0.6	0.1	0	4	7	€ 0	€ 2,661	€ 3,369	€ 0	€ 784	€ 1,417	0.0	1.6	9.4

* NB. The numbers of these vehicles in use in GB are very low (data from other countries not available), so very low numbers of casualties are to be expected - EU-27 estimates are thus subject to significant uncertainty.

Results - LDWS

	EU-27 annual estimates													
			LDWS											
			Target population (Casualties)			Simple Break-Even Costs (€) (if systems 100% effective)			Phased Break-Even Costs (€) (15 Yrs, fit to all new vehicles)			Phased Benefit:Cost Ratios (15 Yrs, fit to all new vehicles)		
Vehicle Type	Stock (1000s)	New registrations per annum (1000s)	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper	Lower	Mid	Upper
	Effectiveness								20%	40%	60%			
	System costs											€ 600	€ 400	€ 200
N2/N3	**5700**	**423**	**7705**	**16838**	**27495**	**€ 3,830**	**€ 4,853**	**€ 5,776**	**€ 448**	**€ 1,134**	**€ 2,024**	**0.7**	**2.8**	**10.1**
N3	**3192**	**317**	**5751**	**12641**	**20697**	**€ 3,615**	**€ 4,623**	**€ 5,536**	**€ 504**	**€ 1,290**	**€ 2,317**	**0.8**	**3.2**	**11.6**
N3 >16t	2987	307	5511	12112	19832	€ 3,574	€ 4,571	€ 5,474	€ 507	€ 1,296	€ 2,329	0.8	3.2	11.6
N2	**2508**	**106**	**1952**	**4192**	**6789**	**€ 4,474**	**€ 5,537**	**€ 6,491**	**€ 303**	**€ 750**	**€ 1,319**	**0.5**	**1.9**	**6.6**
N3 >16t Rigid (not towing)	1618	146	1617	3554	5819	€ 2,204	€ 2,819	€ 3,376	€ 293	€ 749	€ 1,345	0.5	1.9	6.7
N2 >5 <=7.5t	1796	73	1254	2693	4361	€ 4,194	€ 5,191	€ 6,085	€ 272	€ 673	€ 1,183	0.5	1.7	5.9
N2 >7.5t	333	12	424	912	1476	€ 8,746	€ 10,824	€ 12,689	€ 497	€ 1,230	€ 2,163	0.8	3.1	10.8
N3 >16t Off Road	365	35	292	643	1052	€ 1,685	€ 2,155	€ 2,580	€ 230	€ 587	€ 1,054	0.4	1.5	5.3
N2 <=5t	379	22	274	588	952	€ 3,080	€ 3,812	€ 4,469	€ 281	€ 696	€ 1,224	0.5	1.7	6.1
N2 Off Road	264	13	261	560	907	€ 4,752	€ 5,881	€ 6,895	€ 385	€ 953	€ 1,676	0.6	2.4	8.4
N3 >16t >3 axles	334	40	250	550	900	€ 1,248	€ 1,596	€ 1,911	€ 188	€ 481	€ 865	0.3	1.2	4.3
N3 <=16t	205	10	241	529	866	€ 4,881	€ 6,243	€ 7,476	€ 373	€ 955	€ 1,716	0.6	2.4	8.6
N3 <=16t Rigid (not towing)	202	10	225	496	811	€ 4,712	€ 6,026	€ 7,217	€ 356	€ 910	€ 1,634	0.6	2.3	8.2
N3 >16t Special Purpose	286	30	197	433	709	€ 1,307	€ 1,672	€ 2,002	€ 187	€ 479	€ 860	0.3	1.2	4.3
N2 Special Purpose	163	10	105	225	364	€ 2,580	€ 3,193	€ 3,744	€ 251	€ 620	€ 1,091	0.4	1.6	5.5
N3 >44t	?	?	0	206	337	?	?	?	?	?	?	?	?	?
N3 <=16t Special Purpose	14	1	45	99	161	€ 9,780	€ 12,508	€ 14,978	€ 1,023	€ 2,617	€ 4,701	1.7	6.5	23.5
N3 <=16t Off Road	14	0	15	70	115	€ 10,230	€ 28,474	€ 34,097	€ 343	€ 1,907	€ 3,425	0.6	4.8	17.1
N2 >3 axles *	2	0.2	11	23	37	€ 16,057	€ 18,676	€ 21,894	€ 2,141	€ 4,980	€ 8,758	4	12.5	43.8
N3 <=16t >3 axles *	0.5	0.01	0	5	8	€ 0	€ 42,205	€ 50,539	€ 0	€ 3,838	€ 6,895	0	9.6	34.5
N2 Tractor unit <=7.5t *	7	0.6	0	4	6	€ 0	€ 885	€ 1,037	€ 0	€ 215	€ 377	0	0.5	1.9
M2/M3	**883**	**57**	**2381**	**5073**	**8373**	**€ 9,356**	**€ 11,501**	**€ 13,397**	**€ 966**	**€ 2,376**	**€ 4,151**	**1.6**	**5.9**	**20.8**
M3	**662**	**43**	**2246**	**4786**	**7898**	**€ 11,768**	**€ 14,465**	**€ 16,849**	**€ 1,215**	**€ 2,988**	**€ 5,221**	**2.0**	**7.5**	**26.1**
M3 Class I/II/III	591	38	2206	4702	7759	€ 12,992	€ 15,971	€ 18,603	€ 1,338	€ 3,288	€ 5,745	2.2	8.2	28.7
M2	**221**	**14**	**135**	**288**	**475**	**€ 2,122**	**€ 2,608**	**€ 3,038**	**€ 219**	**€ 539**	**€ 941**	**0.4**	**1.3**	**4.7**
M3 articulated *	5	0.4	10	116	191	€ 5,558	€ 37,722	€ 43,939	€ 728	€ 9,877	€ 17,257	1.2	24.7	86.3
M3 Class A	71	5	39	84	139	€ 1,875	€ 2,304	€ 2,684	€ 199	€ 489	€ 854	0.3	1.2	4.3
M3 >3 axles *	0.6	0.1	0	72	118	€ 0	€ 90,976	€ 105,971	€ 0	€ 30,619	€ 53,499	0.0	76.5	267.5

* NB. The numbers of these vehicles in use in GB are very low (data from other countries not available), so very low numbers of casualties are to be expected - EU-27 estimates are thus subject to significant uncertainty.

Results - observations

- For AEBS, only N2 tractor units <= 7.5t give benefit-cost ratios < 1 in all three scenarios;
- For LDWS, no vehicle types have ratio < 1 in all scenarios;
- Assuming low target populations, low effectiveness and high costs gives benefit-cost ratios very often < 1;
- In the mid scenario, ratios are usually well above 1 for LDWS and close to 1 (+/-) for AEBS;
- Results for N2/N3 and M2/M3 in line with earlier research;
- Heavier vehicles (N3 and M3) tend to give higher benefit-cost ratios than the lighter ones (N2 and M2);
- Results generally more sensitive to ranges of cost estimates (e.g. 1:6) than effectiveness (1:3) or casualty valuations (1:2)

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Technical Evaluations

- Various stakeholders have provided technical justifications for the vehicles they propose should be exempt. TRL have reviewed these based on literature, accident data and further input/explanation from stakeholders;
- For AEBS, main view that would be prohibitively expensive for vehicles not equipped with EVSC and that, therefore, the same exemptions should apply to AEBS as already apply to EVSC;
- Full evaluation not possible because no evidence on the extra costs provided. Reasonable, however, to postulate that systems could be developed that do not rely on the presence of EVSC. Costs would depend on functionality and the numbers of vehicles over which the development costs could be spread;
- An alternative approach may be to require forward collision warning systems to alert the driver to apply the brakes if full AEBS is not feasible or cost effective.
- For LDWS, the stakeholder view that systems designed only to operate at speeds over 60 km/h would be of little use to vehicles used mainly off-road or in urban areas is partly supported by the accident data, but not enough to suggest that such systems could not still provide a benefit-cost ratio of more than 1.

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Conclusions & Limitations

- Decisions regarding the applicability of the cost-benefit analysis and technical evaluations to questions of possible exemption for specific vehicle types are a political matter for stakeholders and legislators to debate and decide upon;
- Important, though, to remember that the technical assessments, benefit-cost ratios and break-even costs presented in this report are all based on a wide variety of assumptions and subject to limitations, e.g:
  - Past accident/casualty statistics are imperfect predictors of future patterns.
  - Accident analyses based on samples of data from, at best, 3 Member States and often only 1 or 2, giving a high level of uncertainty when making EU27 estimates, particular where low numbers of vehicles and accidents combine.
  - The vehicle types assessed within the accident databases are, generally speaking, not exact matches to the vehicle types proposed by stakeholders for exemptions.
  - Different AEBS and LDWS architectures will have different operational characteristics, costs and effectiveness in differing applications and accident scenarios. The analyses presented here are entirely generic and can only attempt to allow for these variations by using quite wide ranges of likely effectiveness and costs.

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