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**COMMISSION STAFF WORKING DOCUMENT**

*accompanying document to the*

**Proposal for a**

**REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL**

**on the protection of pedestrians and other vulnerable road users**

**Impact Assessment**

{COM(2007)560 final  
SEC(2007)1245}

## 1. PROBLEM DEFINITION

Every year in the twenty-five member states it is estimated that, presently, as many as 43,000 people are killed and nearly 1.7 million injured as a result of road accidents<sup>(1)</sup>. Of these as many as 8,000 vulnerable road users, pedestrians and cyclists, are killed and 300,000 injured. Measures to reduce these figures for the vulnerable road user are recognised as necessary when considered in parallel with the increasing encouragement to make use of public transport and cycling as alternatives to use of the car.

The Commission White Paper of 2001<sup>(2)</sup> sets a target to reduce the overall road toll by 50% by the year 2010 and recognises the role that improved safety measures in vehicles can provide, in particular by encouraging the use of active safety systems.

### 1.1 Industry Voluntary Agreement

During 2001 the Commission successfully concluded negotiations with the associations representing the European, Japanese and Korean automobile manufacturers (ACEA, JAMA and KAMA), concerning a commitment by the industry to introduce measures to improve pedestrian protection. The document forming this commitment<sup>(3)</sup> was presented to both the European Parliament and the Council for consultation. The main elements of the commitment, with respect to measures for improving the design of car fronts, were recognised as providing an improved safety level for pedestrians, and welcomed accordingly.

The Council gave its unanimous backing to the commitment and the European Parliament also supported the contents, but at the same time requested a “framework” Directive in this area. The Commission subsequently presented a Proposal for a Directive on pedestrian protection and this has been adopted as Directive 2003/102/EC of 17 November 2003.

### 1.2 The Existing Directive

Under the terms of the existing Directive, certain vehicles are required to pass a number of performance tests in two phases: phase I (which is based on recommendations from the Joint Research Centre) started in October 2005 and phase II (which is based on European Enhanced Vehicle-safety Committee recommendations) will start in 2010. Within five years from the start of phase II, all new vehicles within the scope of the Directive will have to comply with the test requirements.

However, in recognition of possible difficulties in fulfilling certain requirements and with a view to possible technological development in this area, the Directive foresaw the possibility to use alternative measures to the requirements laid down for the second phase of the proposal. Therefore, Article 5(1) of the Directive requires that a feasibility assessment had to be carried out by 1 July 2004 concerning the technical test provisions required under phase II and, in particular, other measures, or combination of measures, which potentially may have at least equal protective effects to those adopted in 2003.

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<sup>1</sup> Reference year 2004.

<sup>2</sup> OJ C 043 E, 19.2.2004, p. 250, COM(2001)370 final.

<sup>3</sup> OJ C 261 E, 30.10.2003, p. 576, COM(2001)389 final.

If, as a result of the feasibility assessment, it is considered necessary to adapt the requirements as regards the safety performance, Article 5(2) of the Directive requires that the Commission shall submit a proposal to the European Parliament and the Council to amend the Directive accordingly, under the condition that the amendments afford at least the same level of protection as the existing provisions.

### 1.3 Feasibility concerns

The contract for the study required under Article 5 of the Directive was placed, following full tender process, with the Transport Research Laboratory (TRL) in the UK.

The results of this study indicated that the requirements of the second phase would not be technically feasible for all vehicles and vehicle types as presently constituted and concluded that the majority of the parameters would have to be altered in order to make them feasible<sup>(4)</sup>.

As a possible complementary measure which could be used, in recognition that the Directive specifically allowed a combination of active and passive measures, the report considered the use of Brake Assist systems. The study contains an evaluation of the effectiveness of revised passive measures for the second phase used in combination with a requirement to fit all new vehicles with Brake Assist.

In parallel with the study initiated by the Commission, the European Automotive Manufacturers Association (ACEA) also carried out a feasibility study (using MATRA from France and TNO from the Netherlands)<sup>(5)</sup> and a study into the effectiveness of using Brake Assist (using the Technical University of Dresden)<sup>(6)</sup>. The results of the ACEA feasibility study concluded that the existing requirements for the second phase would not be feasible. The study carried out by Matra (on behalf of ACEA) provides many explanations and examples of feasibility problems. However, the study into the effectiveness of the use of Brake Assist indicated that it could, when used in conjunction with the requirements of the first phase of the Directive, provide an improved level of safety which would be better than that of the existing second phase requirements.

In addition, a further study completed by the Japanese Automotive Research Institute (JARI) also concluded that the existing phase II proposals were not feasible<sup>(7)</sup>.

The requirements of the present Directive cover a vehicle scope up to a gross vehicle mass of 2,500kg and concern all such vehicles in category M<sub>1</sub> (passenger cars) and N<sub>1</sub> vehicles (small cargo) which are built on the same platform of a pre-existing M<sub>1</sub> vehicle. The study into feasibility was carried out in consideration of a range of vehicle types and, in all cases, there were issues which had to be addressed in order to provide feasibility.

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4 [http://ec.europa.eu/enterprise/automotive/pagesbackground/pedestrianprotection/final\\_trl\\_2006.pdf](http://ec.europa.eu/enterprise/automotive/pagesbackground/pedestrianprotection/final_trl_2006.pdf)

5 [http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/summary\\_on\\_feasibility.pdf](http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/summary_on_feasibility.pdf)

6 [http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/summary\\_on\\_effectiveness.pdf](http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/summary_on_effectiveness.pdf)

7 [http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/jama\\_pst\\_study.pdf](http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/jama_pst_study.pdf)

Under the United Nations Economic Commission for Europe (UNECE) in Geneva work has progressed on the development of a global technical regulation (GTR) on pedestrian protection. This was developed by a committee of experts and made reference to all information available, including the results of work by the International Harmonised Research Activities (IHRA) committee, work carried out by both Japan and the United States and the results of the Commission study. The outcome of this work is a draft proposal for a UNECE GTR on the subject<sup>(8)</sup>.

Resulting from the many considerations provided by all of this work, the Commission study contractor, TRL, was requested to provide an assessment of the benefits of the two proposals, from industry and from the Commission, as compared to the present Directive requirements for phase II. In addition, the contractor was requested to include consideration of potential benefits which could be provided by extending the scope of vehicle to which the requirements applied. In cooperation with the Technical University of Dresden (TUD), the data sources used<sup>(9)</sup>, assumptions made and methods employed to evaluate the information were reviewed and both TUD and TRL revised the methods so as to ensure a correct use of the accident database made available and the methodology used.

As a result of the initial study into the issues of feasibility, TRL examined all possibilities and considered that certain modifications to requirements would provide a better degree of feasibility for implementation of the second phase. However, they also recognised that difficulties remained and that, consequently, it would still be challenging to achieve compliance. As a result of further work carried out by expert groups, including the International Harmonised Research Activities (IHRA) group, TRL reconsidered the information available and, by using a wider set of accident data, have presented the present evaluation of the Commission proposal.

The result of this work shows that there is agreement on the unfeasibility of the present requirements for phase II and there is a need to provide a modified approach.

### 1.3.1. Particular Feasibility concerns

Concerns were raised in the studies made by the European and Japanese Automotive Manufacturers' Associations as to the feasibility of each test required under the present Directive. Review of these concerns and reference to other sources of information led to certain considerations being made in some of the test requirements.

The automotive industry has indicated many areas where there is concern with the technical requirements of the present Directive and, when the feasibility study was being completed for the Commission, the work being carried out by the industry at the time was concentrated on achieving the implementation of the first phase requirements. The opinion was that the

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<sup>8</sup> <http://www.unece.org/trans/doc/2006/wp29grsp/ECE-TRANS-WP29-GRSP-2006-02e.pdf>

<sup>9</sup> Databases used:

The German In-Depth Accident Study (GIDAS), started in 1999 and jointly overseen by BAST (Bundesanstalt für Straßenwesen or Federal Highway Research Institute) and FAT (Forschungsvereinigung Automobiltechnik e.V. or German Association for Research into Automobile Technology).

The International Harmonized Research Activities (IHRA) pedestrian accident dataset created from pedestrian accident data available for Germany, Japan, USA and Australia.

industry could, with some difficulty, comply with the first phase requirements, but that the real problems lay with the more stringent second phase requirements. Even at a slightly later stage, during the discussions into the development of a GTR in Geneva, there existed many areas of concern as to the feasibility of these requirements. Areas of particular concern are indicated below.

(1) Headform tests to bonnet top

With respect to the feasibility of the construction of the vehicle bonnet to comply with the requirements imposed by the headform tests of the present Directive Phase II, the headform tests are considered to be not technically feasible as presently specified. The bonnet is required to perform a number of functions: it must be stiff enough to ensure stability when the vehicle is at speed and must withstand the stresses of many openings and closings; it must be correctly mounted using hinges and locks which provide security both at speed and in a collision. These requirements mean that suitably substantial hinges and bonnet locks must be provided which, by their nature, are hard and will present local difficulties with the impact tests. To absorb the energy from a headform on impact with the bonnet top requires that the bonnet should collapse and thus reduce the impact effect and this, in turn, requires that hard items beneath the bonnet are provided with a suitable space between them and the bonnet. Some items may be lowered or removed to a better location to provide this clearance, but the space under the bonnet is increasingly filled with equipment necessary for a modern car, much of which consists of the basic elements required to provide power and safety, e.g. the top of the engine itself, the energy absorbing beams providing crash resistance, the base of the windscreen and firewall, the tops of the suspension units, etc. To accommodate these elements in a manner which will not compromise either the requirements of the vehicle, passenger safety or the demands of performance and fuel economy is not always technically feasible at present.

A study completed by the International Harmonised Research Activities (IHRA) group, using work from the United States (NHTSA), Japan (JARI) and Australia (RARU), into the conditions of head contact for both adult and child using a variety of vehicle shapes and pedestrian postures provided a conclusion that the resultant actual head impact speed on the bonnet should be taken as 32 km/h and not 40 km/h as in phase II of the Directive which was found to be not feasible. Presently, Japan is the only other country with legislation on pedestrian protection and the required test speed for head impact is set at a requirement of 32 km/h. However, the Commission now proposes a somewhat more demanding figure of 35 km/hr which, in its judgement, is still feasible.

Additionally there was concern that the headform being used for the child headform test was not representative of the real situation in that it was too light at 2.5kg. Review in the study showed agreement with a move to a 3.5kg headform as being more representative of both a child and a small adult. As a consequence, using this child headform with the increased weight and at the lower test speed of 35km/hr provides an overall increase in the test energy applied.

(2) Legform tests to bumper

The requirement for the lower legform test has always raised concerns with respect to the need to provide enough energy absorption in the bumper structure while still providing the required protection expected in impacts with other objects and continuing to ensure the expected operation of crash sensors for airbag operation. There has been recent discussion on

the use of an alternative legform test which would be more representative of the human leg in that it would bend upon impact. This instrument has not, however, been proven for regulatory use at this stage and could not be considered in this proposal. Thus the present legform impactor will continue to be used for the purposes of the existing test and further examination of impact conditions have led to a slight change in the requirements, thus leading to improved feasibility.

### (3) Upper Legform tests to bonnet leading edge

The use of the upper legform to bonnet leading edge test was proposed in the final report from the EEVC (WG17, 1998) on which the existing requirements are based. However, it was already questioned in that report by members of the committee<sup>(10)</sup>. It has continued to draw criticism ever since, for example, at the International Technical Conference on the Enhanced Safety of Vehicles (ESV) in Washington 2005<sup>(11)</sup>. Since the original development of the upper legform test to the bonnet, it has been recognised as being unrepresentative of the impact mechanism for a pedestrian to vehicle impact and, in addition, not to fully relate to present-day vehicle shapes. The argument against the test has since been confirmed in that the type of vehicle it was designed for back in the 1990s no longer exists<sup>(12)</sup>. In addition, it has been recognised that the test instrument does not reproduce the expected mechanism of a pedestrian impact whereby the body will roll more over the bonnet edge rather than produce a single point impact. In other words, the biofidelity of the test is insufficient as it tends to simulate injuries that do not occur in practice.

In addition, the test is considered to present feasibility problems as a result of the general nature of the bonnet leading edge. By virtue of its definition, the leading edge is located on a bend or fold in the outer metallic surface of the vehicle and is in the area which contains certain items, such as, headlights, bonnet lock, structural units, etc. All of these items create a real difficulty in achieving the required result and are equally difficult to locate away from the area.

Thus, it is proposed that the test is maintained in its present form for monitoring purposes only with a view to gathering information to assess whether potential improvements can be made both to the test itself and to the vehicles. The monitoring procedure will also ensure that there is no increase in risk of injury from the front end of the bonnet as a result of changes required in the bumper area of the vehicle due to the requirements of the tests in that area.

#### 1.3.2. Consideration of other vulnerable road users

The tests prescribed have been developed to replicate the impact of a pedestrian with a vehicle. It is recognised that consideration should be made for other vulnerable road users and this has been the case with respect to cyclists in that all the figures provided for fatalities and serious injuries include the numbers of cyclists involved and the possible benefits provided.

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<sup>10</sup> EEVC Working Group 17 Report, Improved Test Methods to Evaluate Pedestrian Protection afforded by Passenger Cars (December 1998 with September 2002 updates), p. 12.

<sup>11</sup> "Assessing Femur and Pelvis Injury Risk in Car-Pedestrian Collisions: Comparison of Full Body PMTO Impacts, and a Human Body Finite Element Model", International Technical Conference on the Enhanced Safety of Vehicles (ESV), Washington 2005 by Snedeker *et al.*

<sup>12</sup> "Technical Feasibility Study on EEVC/WG17 Pedestrian Subsystem Test", Japan Automobile Research Institute, June 2004 p. 41.

The problems associated in providing more benefit for the cyclist is that a greater number of them, when struck by a vehicle, will interact with the windscreen area and this has been recognised as problematic even for pedestrians. The windscreen itself is not so much of a problem but the upper and lower frames and the side A-pillars form a basic hard part of the vehicle framework essential for protection of the occupants in frontal, side and roll-over accidents, and, consequently, can not be made 'softer' for impact. As a result of this, even the protection of the pedestrian does not provide any requirements for this difficult area. On the other hand, the introduction of Brake Assist does greatly benefit all vulnerable road users, including cyclists, in that, by its use, the potential impact speed is reduced or the impact avoided altogether.

## **2. OBJECTIVES**

Directive 2003/102/EC was intended to provide a level of safety to vulnerable road users, particularly pedestrians, when in collision with a passenger vehicle. The content of this Directive recognised the potential for feasibility problems in the technical realisation of the requirements and allowed for a study to be undertaken to identify where problems lay and what the possibilities were to overcome them. It was always a basic requirement that the intended level of safety to be provided would in no way be compromised. The study carried out as required under this Directive has shown that there are feasibility problems with the present requirements and has identified where the problems lie.

The objective of this proposal is to provide an acceptable level of protection for vulnerable road users in the Internal Market by the definition of adequate product standards while at the same time removing the lack of feasibility in the application of requirements.

## **3. POLICY OPTIONS**

The feasibility assessment undertaken according to Article 5(1) of Directive 2003/102/EC has been completed and indicates that the measures, in fact, are not feasible for all vehicles and vehicle types as presently specified in the Directive and should be changed. As required under the terms of the Directive, the study examined the possible use of active safety systems which could be available for use within the required timescale. With this consideration, the use of Brake Assist systems was identified as a suitable technology for immediate use.

Five options have been identified as being consistent with the needs to provide technical feasibility in the requirements for Phase II. However, not all comply with the requirements of Article 5(1) in ensuring that the amended requirements are "at least equivalent in terms of actual effectiveness". These options are as follows:

- take no action on the requirements at this time, possibly postpone the dates of application to allow further progress and continue monitoring technical progress with the option of amending the existing Directive at a later stage,
- provide amendments to the passive safety requirements of Phase II in accordance with an Industry proposal to provide feasibility,

- provide moderate amendments to the passive safety requirements of Phase II in line with suggestions originally made by the external consultant during the preparation of the feasibility study,
  - provide amendments to the passive safety requirements of Phase II in accordance with the results of the study completed into the feasibility of Phase II,
  - provide amendments to the passive safety requirements of Phase II in accordance with the results of the study completed into the feasibility of Phase II, and require the use of additional active safety systems to ensure there is no reduction in the levels of safety provided.
- (1) *Continue with the existing Directive for the present, possibly postpone the dates of application to allow further progress and monitor the implementation of the requirements with the option of providing any necessary amendments at a later stage.*

This approach would have certain shortcomings:

- First, the present phase II requirements are judged to be unfeasible by all concerned and it is not considered that providing extra time would make them feasible. The independent feasibility assessment has already factored in technological advances to be expected between now and the beginning of phase II. As this assessment has been independent from both the Commission and car manufacturers one can confidently assume that it gives a proper impression of what is to be expected as regards the passive safety performance of car fronts.
- Second, the requirements of phase II of the Directive are now clearly recognised as having problems with technical feasibility in their implementation and offer a high potential for problems in attempting to comply with them. It would thus be irresponsible, while recognising this, to wait for these problems to appear before attempting to provide a solution.
- Third, the product cycle in the automotive production sector is characterised by long lead-times, and the development of new vehicle types to be put on the market is recognised as requiring a preparation and engineering planning timeframe of up to five years. Thus, if one envisages a revision of the Directive - and the Commission cannot ignore the fact that the requirements of phase II of the present Directive are not considered to be technically feasible - this should be done as early in the investment cycle of the affected industry as possible.
- Fourth, with the increasing number of heavier vehicles being used on urban roads, the risk of fatal and severe accidents involving vulnerable road users rises. However, as these vehicles are presently not covered by the existing Directive, their inclusion - which is recommended - requires that a new proposal should now be made.
- Fifth, technical progress as regards active safety measures, such as Brake Assist systems, enables significantly improved protection of vulnerable road users. However, in accordance with Article 5(2) of Directive 2003/102, a legal obligation to fit cars with such a system for this purpose requires a new proposal to be made now.



For these reasons, the option of continuing with the existing Directive has not been seen as a reasonable approach and, consequently, has not been considered any further.

- (2) *Provide amendments to the existing requirements for phase II in accordance with an Industry proposal to provide feasibility*

The study report and those reports of studies commissioned by industry have stated that the existing passive safety requirements are not feasible as required by Directive 2003/102/EC and should therefore be amended. The industry has consequently made a proposal that the requirements of Phase I of the Directive be maintained and that, in addition, Brake Assist be required to ensure safety levels. This option is not considered by the Commission to be sufficiently demanding in terms of what may be possible technically in the area of passive safety. However, although not further considered as a realistic option, the benefits of the proposal have been evaluated so as to provide comparisons as to its potential value.

- (3) *Provide moderate amendments to the passive safety requirements of Phase II in line with suggestions originally made by the external consultant during the preparation of the feasibility study*

This option is based on some limited modifications to the requirements of Phase II, which were considered in the initial feasibility study<sup>13</sup> as providing a better degree of feasibility for implementation of the second phase. In order to compensate for the reduction in the safety value of these modified requirements, a combination with the mandatory use of active safety systems had been envisaged. However, as a result of further expertise it was recognised that difficulties remained and that, consequently, it would still be challenging to achieve compliance, so that this option was not retained in the recommendations of the completed study. Thus, it has not been considered as fulfilling the need to provide technical feasibility and is not considered further.

- (4) *Provide amendments to the passive safety requirements of Phase II in accordance with the results of the study completed into the feasibility of Phase II*

The feasibility study states that the present passive requirements of Phase II are not technically feasible as required by Directive 2003/102/EC and should therefore be amended. The proposal is to amend the requirements and make them more technically feasible thus ensuring an improvement in vehicle fronts in a feasible manner. However, it is recognised that, as a result, the expected safety value of these passive elements is reduced and this is not in accordance with the requirements of Article 5 of the existing Directive. Thus, as this option would not "afford at least the same level of protection as the existing provisions" it is not considered further.

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<sup>13</sup> [http://ec.europa.eu/enterprise/automotive/pagesbackground/pedestrianprotection/pedestrian\\_protection\\_study.pdf](http://ec.europa.eu/enterprise/automotive/pagesbackground/pedestrianprotection/pedestrian_protection_study.pdf)

- (5) *Provide amendments to the passive safety requirements of Phase II in accordance with the results of the study completed into the feasibility of Phase II, and require the use of additional active safety systems to ensure there is no reduction in the levels of safety provided*

It has been stated and accepted that the existing passive safety requirements are not feasible as required by Directive 2003/102/EC and should therefore be amended. Article 5 of the Directive expressly allows consideration of "either passive or a combination of active and passive measures" to ensure that any amendments proposed are at least equivalent in terms of actual effectiveness. This option is therefore considered by the Commission as a viable one with which to proceed. It implies that the requirements for phase II should be modified and that an active safety system is introduced so as to ensure, and even improve, the level of safety afforded to the vulnerable road user.

Considered value of the three potential proposals:

	Industry Proposal (Option 2)	Passive Proposal (Option 3)	Passive plus BAS (Option 4)
Feasibility	↑	↑	↑
Fatality Reduction	↑	↓	↑↑
Cost benefit	↑	↓	↑↑

↑ Positive      ↑↑ Very Positive      ↓ Negative

N.B. The use of two arrows in place of one does not necessarily indicate a doubling of the value in question.

#### 4. ANALYSIS

##### 4.1 Technical Impact

Having assessed, through the study completed, that the requirements of phase II of the existing Directive are not feasible, the proposal now being made recognises the need for changes to be made.

Accordingly, the proposal, which is based on the four existing tests required under phase II, contains amendments which should now be made to those tests to provide a feasible solution. The proposed amendments to the test parameters are based on the findings of the Commission's feasibility study and other studies, see point 1.3 above, and take into account the results of an open consultation process (see Annex).

A legal requirement for the use of an active safety system, Brake Assist, is introduced in order to maintain and improve the level of safety provided to the vulnerable road user as foreseen in Directive 2003/102/EC. The requirements of phase I of the existing Directive, which recently became effective, will remain in force. In fact, the use of Brake Assist will be required in a shorter timeframe than the passive elements of phase II and its inclusion will thus provide extra and early benefits for the vulnerable road user.

It is recognised that Brake Assist is, even today, installed in some vehicles and is thus already providing some benefit. However, over the last years vehicle shape and styling has also changed and the vehicles on the road today are quite different in design from those on the road when the passive safety requirements were developed. It would thus be considered correct to make comparisons of the benefits to be gained by introducing both active and passive elements of the proposal from a baseline of the vehicles which provided the statistics on which the benefits are derived.

In addition, it is proposed that the possible use, in the future, of automatic emergency braking or collision avoidance systems would be assessed and evaluated for use in the area of pedestrian safety. This is fully in line with the growing awareness by industry, organisations such as EuroNCAP and legislators in the UN/ECE, Japan and the US, of the safety benefits to be provided by use of new technologies.

#### 4.2 Vehicle Scope

An extension of the scope of vehicles to which the requirements will be applied is also introduced in order to address the recognised concerns associated with the increasing use of larger vehicles in the urban environment. This requirement was already recognised in recital 5 of the existing Directive.

Testing of a range of vehicles by the US has indicated that applying the amended tests to larger vehicles can be feasible while it is also recognised that the weight of the vehicle is not as significant as the shape when considering the impact mechanism<sup>(14)</sup>.

#### 4.3 Economic Impact

The assessment of the costs and benefits of the proposal has been made in all cases with reference to the car fleet before the implementation of the Directive. Indeed the accident databases sourced for the analysis provide details of accidents with a mean accident year ranging between 1991 and 2003.

##### *Costs*

The costs of the amended passive safety requirements in the proposal have been estimated in Section 12 of the final report of the feasibility study. These costs are indicated for different assumptions regarding the adaptations made by manufacturers to different types of vehicle and range between €27 (small family car) and €85 (sports car). If costs are introduced for additional items, such as 'pop-up' bonnets or front spoilers, the estimated costs may increase to a possible €397 (sports car). Based on the simplest assumptions (no pop-up bonnets or spoilers fitted to vehicles), present annual costs for implementation of the amended passive safety requirements are estimated, in Table 12.2 of the report, at €575m, to comply with the proposed Regulation. This is the considered cost for the industry and is translated into a cost of €805m for the consumer (see Table 13.14 of the report).

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14 Informal document No.WP.29-141-25, of the 141st meeting of WP.29 of the UNECE on 13-16 March 2007, agenda item II. 2.5.4. See UNECE website at <http://www.unece.org/trans/doc/2007/wp29/WP29-141-25e.pdf>

Costs are neither provided for implementation of the existing phase II requirements, as they have been considered to be unfeasible, nor for the installation of Brake Assist. Brake Assist is not fitted to vehicles as a discrete system since most of the hardware is shared with the anti-lock braking (ABS) systems and the associated electronic control unit and so the immediate cost, for the basic installation requirements, is considered to be relatively small.

However, it must be remembered that the costs that should be considered for this proposal are the differential costs which are in addition to those for the existing requirements of phase I. Consequently, it must be assumed that this differential cost is substantially lower than that of the full implementation costs mentioned above.

*Benefits*

The benefits of combining amended passive safety requirements with the introduction of active braking systems have been assessed and compared to the existing provisions in the second phase of the Directive.

On a financial effectiveness consideration the proposed measures provide benefits to a value of 182% of those provided by the existing requirements. The following table shows the estimated annual benefit to society, in terms of cost reductions due to savings made in injuries and fatalities, for the present proposal. In addition, the cost estimate used is that made in Table 12.2 of the report for changes to be made to vehicles in order to comply with the requirements, including the use of ‘pop-up’ bonnets on specific vehicles. This is a cost of €711m to industry or €995 as a cost to the consumer. Using these costs, a comparison was made for the following options and the calculated benefit-to-cost ratios are shown in the table below:

- for the existing Directive
- for the Industry proposal which included the use of BAS
- for the present proposal including BAS I
- for the present proposal with BAS II

BAS I represents the first phase of requirements that are to be developed for introduction at a very early stage. BAS II is the expected future development potential of BAS I which would provide more sensitive systems capable of achieving considerably better reaction times.

<b>Financial Benefit (€ million)</b>						
	<b>Existing Directive</b>	<b>Industry Proposal</b>		<b>Commission Proposal</b>		
		<b>Without BAS</b>	<b>With BAS</b>	<b>Without BAS</b>	<b>With BAS I</b>	<b>With BAS II</b>
Benefit Value (m€)	4855 <sup>1</sup> (100%)	3107 (64%)	8438 <sup>1</sup> (174%)	3398 (70%)	8849 <sup>1</sup> (182%)	11,509 <sup>2</sup> (237%)
Ratio to Industry Cost of 711m€ <sup>3</sup>	6.8:1	4.4:1	11.8:1	4.8:1	12.4:1	16.1:1
Ratio to Consumer Cost of 995m€ <sup>4</sup>	4.9:1	3.1:1	8.5:1	3.4:1	8.9:1	11.5:1

- <sup>1,2</sup> based on assessed numbers of fatalities and injuries and on casualty costs of €2.021.999 per fatality, €227199 per serious injury, and €17.513 per slight injury. No discounting has been applied.
- <sup>3</sup> assuming costs for all vehicles including 'pop-up' bonnets for some categories  
- see Table 12.2 of the report.
- <sup>4</sup> allowing for commercial mark-up to consumer.  
- from Table 13.14 of the report.

Two issues contribute to these increased benefits: the present proposal actually brings forward the requirement for 100% installation of Brake Assist systems by as much as five years, compared to the full implementation of the passive elements of phase II; and the proposal also requires passenger vehicles above the previous weight limit of 2,500 kg weight to comply with all the requirements.

There is one further subject which requires consideration in that the proposal extends the test requirements to all passenger cars of M<sub>1</sub> category and, with certain considerations for shape, to all N<sub>1</sub> vehicles. It will be important to ensure that all relevant vehicles of N<sub>1</sub> category are included and that use of the tests is a suitable approach for all larger vehicles. The report estimates that such an extension of scope, which is included in the overall estimates, provides 3% of the benefits achieved.

The additional consideration of BAS II is made on the basis of an improvement made to the technology used in the BAS itself. Thus, in the report, it is assumed that the control of the system is improved by providing a shortened timeframe in which full braking is achieved, which, in turn, will provide a reduction either in impact speed or a complete avoidance of impact altogether. Further examination of the system components and operation are considered as possible to provide improved braking effectiveness in the future, *e.g.* better system pressure regulation.

It may be noted, in addition, that if the implementation of phase I is considered to be the starting point for the application of the present proposal, the resulting benefits for vulnerable road users would provide cost benefit ratios to industry and consumers of 8:1 and 5.7:1 respectively.

#### 4.4 Social Impact

In the examination of the existing directive (i.e. the 'do-nothing' option) it was indicated, in Table 13.9 of the report, that the expected reduction in fatalities for the EU-25 would be in the order of 626 and, for serious injuries, the reduction could be as much as 32,000. In comparison, the respective figures for the presently proposed, and feasible, requirements including Brake Assist I, increase to 1128 and 46,000 respectively. This provides increases to 180% and 144% respectively compared to the existing Directive. By moving, in the future, to BAS II the figures would indicate an increased level of protection of 242% for fatalities and 177% for serious injuries saved. It is thus seen that, in all cases, the proposal will provide additional safety levels for the vulnerable road user over and above that to be expected from the existing requirements.

The following table provides details of the calculated numbers of fatalities and serious injuries saved and as presented in Tables 13.9 and 13.25 of the report.

Numbers of Fatalities and Serious Injuries <b>Saved</b>							
Calculated for phase II conditions.							
Existing Directive		Industry Proposal (incl. BAS)		Present Proposal (incl. BAS I)		Present Proposal (incl. BAS II)	
Fatal	Serious	Fatal	Serious	Fatal	Serious	Fatal	Serious
626 100%	32,246 100%	1079 (172%)	44061 (137%)	1,128 (180%)	46,550 (144%)	1514 (242%)	57046 (177%)

#### 4.5 Environmental impact

A concern expressed has been the issue of fuel consumption and effects on the Community's targets for CO<sub>2</sub> emissions. If, to achieve certain safety levels for pedestrian impact, it is necessary to permanently provide more space under the bonnet of the vehicle, in order to cushion the impact of a head before it meets the hard engine parts, it may be necessary to construct the bonnet at a slightly higher level. This, in turn, would require the seating and windscreen to be higher to ensure forward visibility and would raise the height of the roof thus requiring more fuel to overcome the increased wind resistance. Nevertheless, recent experience indicates that manufacturers have been able to avoid increasing their CO<sub>2</sub> emissions despite the entry into force of phase I of Directive 2003/102/EC in October 2005.

#### 4.6 Uncertainties

The requirements proposed in the present proposal are seen as necessary in order to allow for a vehicle construction which is capable of complying with the tests with an acceptable degree of certainty. Under the option proposed there is a need to make a number of constructional changes to the front structures of vehicles and the manner by which these changes are made may have the potential to conflict with other objectives, notably the needs to comply with other legislation. For example, existing type-approval legislation includes a requirement to withstand a level of frontal impact force, and the manufacturer must ensure that any changes needed to accommodate the requirements of providing protection for the vulnerable road user do not have a detrimental effect on the ability of the resulting structures to sufficiently withstand the forces of a frontal impact. The concerns here are in attempting to produce a structure which provides a balance between being strong enough to withstand the high impact forces experienced in a crash, or even those forces experienced in normal use, and soft enough to exert a low level of force when in contact with the vulnerable road user. It also has to be assured that changes made do not interfere with the efficient operation of other safety systems, such as the triggering of airbags, or systems necessary for the proper and required functioning of the vehicle. In the 'do-nothing' option (maintain the existing phase II) it does not seem possible to achieve this balance in a feasible manner, whereas to completely withdraw the requirements, as an option, would provide no increase in protection for the vulnerable road user. The benefits to the consumer in terms of reduced fatalities and injuries are provided in figures which are based on estimates and probabilities which are made from accident records.

To be sure of the final result from changes made, it must be possible to measure and compare the situation now with the situation as it changes over the coming years resulting from the proposed measures. The problem with the use of accident data is that it is reasonably known that not all necessary instances of death and injury will be recorded and uniformly detailed. Thus it may be that the road toll will be reduced but it may not be possible, in all cases, to attribute savings to the measures taken as a result of a particular piece of legislation.

The study considered uncertainties in the calculation of the benefits and the possibilities of over-estimation, - however, it also recognised that some benefits may have been underestimated, or even not estimated at all. On the other hand, the cost estimates seem quite robust and not subject to major uncertainties. On balance it is therefore considered that the estimates of costs and benefits are realistic. In this context the report concludes that, despite the uncertainties referred to above, "brake assist systems are capable of providing valuable additional benefits for pedestrians and other road users" and makes a strong recommendation that brake assist systems should be mandated as part of the requirements for phase II<sup>(15)</sup>.

#### 4.7 Technical Advances and Market Forces

It is suggested that a percentage of vehicles presently on the road are now equipped with new safety technologies and that, consequently, the overall effect of enforcing the use of such technologies through legislation may be reduced. It must be noted, however, that it is not certain that those vehicles which are now equipped with such systems would comply with any legislative requirements specified. In addition, experience has shown that the use of such technologies, when new, is often restricted to the high-value luxury end of the market and much time is needed to allow the benefits to permeate down to all vehicles unless there is a stated requirement. An example to be taken is the installation of ABS in all vehicles (under 2,500kg gross vehicle weight, by industry agreement) which has taken as long as 25 years to accomplish and, even then, it could be argued that it is so only due to the possibility of legislation as part of the legislative proposals resulting from the voluntary agreement on pedestrian protection.

This same argument has been made with respect to the use of brake assist and a perceived reduction in the value of mandating its requirement through legislation. Although it is true that BAS is presently available it is not considered that there are many vehicle types, outside the high-end luxury market, which have a system installed as yet. However, since the additional cost of fitting BAS on vehicles already equipped with ABS is estimated to be very small, more rapid market diffusion is likely. For this reason, a sensitivity analysis has been made below. It takes into account that it is not known or acknowledged that these systems would be capable of complying with the performance requirements to be laid down under the proposed Regulation.

The passive safety measures proposed and the tools specified have been developed and their effectiveness measured with reference to vehicles which are on the roads for numbers of years. The statistical analysis on injuries caused by these vehicles under the proposed passive safety measures is based on accident records spanning a period, mostly in the '90s when the newer technologies were not available. More recent vehicles would already provide increased levels of passive safety and thus potentially reduce the perceived gains to be had even from the passive safety measures proposed. It is therefore more correct to ensure that the values attributed to the different aspects of the proposal, active and passive, are measured against the same reference baseline in terms of time and development.

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<sup>15</sup> [http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/summary\\_on\\_feasibility.pdf](http://ec.europa.eu/comm/enterprise/automotive/pagesbackground/pedestrianprotection/summary_on_feasibility.pdf), p. 258.

However, in terms of sensitivity analysis, the following calculations from the figures provided in the report give some indication of the value to be gained by requiring the mandatory use of BAS under the proposal. Different hypothetical levels of installation rates of BAS would provide improvements to safety levels as indicated in the following table.

<b>Effect of present proposal including BAS I in comparison with the present Phase II requirements</b>				
Assumed Installation level for BAS	Assumed installation compliant with BAS I	Fatalities saved	Serious injuries saved	Financial benefit
0%	0%	181%	144%	182%
10%	5%	175%	140%	176%
35%	17.5%	159%	132%	162%
50%	25%	150%	126%	154%

No attempt has been made to quantify the benefits of the present proposal with BAS II as none of the existing systems would qualify as BAS II.

The Table shows that the present proposal will still lead to a considerable improvement in the level of protection provided to vulnerable road users, whatever the level of existing installation of BAS. Moreover, it is worth noting that Article 5(2) of Directive 2003/102/EC requires that the present proposal affords at least the same level of protection as the existing provisions. The figures provided show that this requirement will not only be met but exceeded. In this context it is of little relevance that a small part of Brake Assist installation is due to market forces. It is clear that legislation will anyway be needed to ensure an installation level of 100%.

#### 4.8 Impacts inside and outside the EU

The effect of the proposal now being made is that it will provide comparable, and even improved, benefits, in a more feasible and achievable way, in comparison to the existing Directive. The result would be a reduction in the potential cost of producing a vehicle to comply with this proposal whilst improving the benefits in terms of a reduction in fatalities and serious injuries.

Vehicles imported into the EU market will, of course, have to comply with the proposal. Presently, the main source of imported vehicles which come under the scope of the regulation is Japan, with Korea providing a sizeable number also. The Japanese government has also put forward a regulation for pedestrian protection which is not as ambitious as the present proposal - it only considers the head impact with the vehicle.



Japan, however, is anxious to have a completed regulation in place covering all aspects of protection for pedestrians and has actively contributed to the drafting of a global technical regulation (GTR) under the UN/ECE in Geneva, in cooperation with the Commission, the United States, Canada, Korea and certain member states. All those members of the working group relating to the development of the draft GTR have been very concerned to ensure harmonisation between this work and the present proposal for a revision to the second phase of the EU directive. The US has actively supported the work on the development of the GTR and has recently been under-taking tests to examine the application of the tests to the larger vehicles in their fleet. To date it has been shown that the tests can equally well be applied to larger dimensioned vehicles irrespective of weight<sup>(15)</sup>.

The present version of the draft global technical regulation which has been developed by this working group also uses the passive safety requirements contained in the present Commission proposal and recognises that they are both challenging and provide feasible solutions. If this harmonised approach is successful, the requirements of the proposed global technical regulation would be applied by the contracting parties of the UN/ECE 1998 agreement, thereby providing a level playing field for the passive safety requirements that extends far beyond the European Union.

#### 4.9 Impacts likely to change over time

There are two basic elements of the revised proposal - an existing passive safety solution which is now being revised for feasibility reasons and the introduction of an active safety system. The use of new passive safety systems for the protection of vulnerable road users is recent so that significant benefits can still be expected. However, has seen a decreasing benefit in recent times as car designs continually improve the levels of safety provided and, with the pace of development of the newer technologies, the safety value of active systems has been increasing. As a result it is likely that, over time, the relative impact of improvements to passive safety provisions will reduce with increasing use being made of reliable active systems for detection and avoidance. The present proposal takes this development fully into account by placing considerable emphasis on the use of Brake Assist.

With the increasing use of larger SUV-type vehicles in the urban environment it has already been acknowledged in the existing Directive<sup>(16)</sup> that some consideration should be given to them in the future. In accordance with this recognition the present proposal now extends the application of the test requirements to all passenger cars and requires the inclusion of certain cargo vehicles.

#### 4.10 Potential obstacles to compliance

With the proposal being made for changes to the existing Directive requirements, in order to account for feasibility problems, and although these requirements are demanding, there are no obstacles foreseen to compliance in this regard. The requirements in the proposed regulation are quite clear and it is a straight pass or fail alternative offered. The industry is presently working hard on achieving compliance in time for the application of feasible requirements in the second phase and, although it may be difficult to achieve, there is no consideration of failure to comply.

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<sup>16</sup> Directive 2003/102/EC, Recital 5. "The Commission should examine the feasibility of extending the scope of this Directive to vehicles with a maximum mass of up to 3,5 tonnes, and report its findings to the European Parliament and to the Council."

#### 4.11 Application Dates

In placing requirements on the construction of automotive vehicles it has always been recognised that, depending on the design implications raised, there is a reasonable engineering lead-time required to ensure that the intended result can be achieved. As the requirements under this proposal will have effect on some features in the very basic design of a vehicle, and since the presentation of the legislative proposal took more time than originally envisaged, it is recognised that some of the existing dates of application require revision to ensure sufficient lead-time for the introduction of the passive safety measures. On the other hand, the lead-time for the introduction of Brake Assist is relatively short as this requires fewer changes in the design of the vehicle.

### **5. Monitoring and evaluation**

The proposed Regulation will take effect through the vehicle type-approval process. Vehicle manufacturers will need to demonstrate that vehicles comply with – amongst other things – the test requirements specified in order to receive a type-approval certificate.

Monitoring of the effect of the Regulation is effectively undertaken by type-approval authorities who oversee in-use compliance processes to ensure that the requirements of the Regulation are met. More generally, monitoring data, which is required on those tests specified for monitoring purposes only, will provide the necessary data for further development of requirements, while also giving an indication of the wider success of the policy.

### **6. Procedural issues and consultation of interested parties**

The proposed draft regulation proposal was placed on the internet under a call for consultation which closed on the 22<sup>nd</sup> of July 2005. In addition, a consultation meeting also took place on the 26<sup>th</sup> of July 2005 with representatives of the European, Japanese and Korean automotive manufacturers.

A total of seventeen replies have been received with respect to the internet consultation<sup>17</sup>. These have come from government representation, industry, consumer groups and others. The details are provided in the Annex.

The great majority of replies, as reviewed, indicate a high level of support for the use of active safety systems, in this case Brake Assist. In addition, although the use of automatic emergency braking or collision avoidance systems is recognised as being in the future, there is a good level of agreement on the use of such systems when they become available.

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<sup>17</sup> The replies are available under :  
[http://europa.eu.int/comm/enterprise/automotive/pagesbackground/pedestrianprotection/stakeholder\\_consultation/index.htm](http://europa.eu.int/comm/enterprise/automotive/pagesbackground/pedestrianprotection/stakeholder_consultation/index.htm)

## **Annex: Results of internet consultation**

Among the points that have been raised in the submissions are the following:

dates of application

impact area relaxation zones for headforms

recognition of existing vehicles

definition of a high bumper for the legform test

### 1. Results

The results of the internet consultation are summarised as follows:

A total of seventeen replies were received to the request for comment. Of these the breakdown of source is:

Government	2
Industry	7
NGO	5
Other	3

### 2. Issues Identified

The following provides a summary of the main issues raised by the correspondents:

2.1: Adult/Child headform test relaxation zones.

*(7 replies - 2 Gov, 5 Ind.)*

#### Comment:

The draft proposes that the relaxation zones to be allowed for both child and adult headforms would be one third of the individual designated test areas.

Replies from industry request that the one third of the area should be based on the combined test areas. Two replies added the consideration that the child headform relaxation area should have an individual maximum.

Response:

It is recognised that certain areas, which may not be clearly defined, are required on a vehicle which may present a higher result for the head impact and which must be present to provide safety and integrity for the vehicle construction. Resulting from this there is an allowance for a percentage of the test area of the bonnet top to be accepted where the head performance criterion is relaxed.

As a result of concern that all relaxation areas may migrate to the child test area and thus reduce the protection provided for children, it is now proposed that the relaxation areas may be a maximum of one third of the total combined test areas with the provision that a maximum of only one half of the child test area may be considered.

2.2: Concern with application date for BAS.

*(7 replies - 1 Gov, 6 Ind.)*

Comment:

The point is made that to require all vehicles to be fitted with Brake Assist in 2008 would be too demanding and may even require the withdrawal of some models from the market. The majority of comments considered that 2010 would be achievable for all vehicles with one comment suggesting 2008 for new types. It was also noted that there was some inconsistency in the intended application dates in the proposal.

Response:

In response to this concern the proposal now being made is that new vehicle types shall be fitted with Brake Assist starting nine months after publication of the Regulation and new vehicles thirty months after publication. The expectation is that this will mean installation requirements in the years 2009 and 2011 respectively.

2.3: Provide requirement for future amendments.

*(5 replies - 1 Gov, 4 NGO)*

Comment:

The main concern is that where certain issues are monitored within the proposal there should be a stated requirement to review and update the requirements accordingly.

Response:

It is always the intention to maintain a review of the requirements of the Regulation and ensure that changes in design, technology and vehicle use are taken into account. In the present proposal this will be considered as an additional Article providing dates for reporting which are relevant for the purposes.

2.4: Reliability issue for BAS.

*(5 replies - 1 Gov, 4 Ind.)*

Comment:

The question was raised of how issues of the reliability of Brake Assist should be dealt with.

Response:

The text has been changed in order to allow the proper development of reliability requirements.

2.5: Allowance for transition between phase I and phase II.

*(4 replies - 1 Gov, 3 Ind.)*

Comment:

The request in each case is to ensure that there may be no retroactive application of the requirements.

Response:

A statement on this was included in the present Directive to allay the genuine fears of the industry with respect to possible retroactive application of requirements. In a similar way a further statement will be included to provide the same confidence in the transition between phase I and phase II.

2.6: Headform test Speeds.

*(4 replies - 4 NGO)*

Comment:

All replies on this subject contained the stated preference for retention of the 40km/h test speed for the head impact tests.

Response:

The opinion of the expert group of the International Harmonised Research Activities (IHRA) on pedestrian protection is that the headform test speeds show a variation depending on the vehicle type, the stiffness of the vehicle front end and the posture of the pedestrian and that a mean speed for impact is, in fact, 32km/h. Presently, Japan is the only other country with legislation on pedestrian protection and the required test speed for head impact is set at a requirement of 32 km/h. There has been some discussion of the validity of the model used in simulating the impacts and the derivation of this figure and the Commission has now concluded that a somewhat more ambitious speed of 35km/h is appropriate. This opinion is shared by the expert group for the development of a global technical regulation under the UN/ECE. Thus the impact speed of 35 km/h is about to become the internationally accepted test speed for headform testing. The proposal accepts this under conditions of feasibility and in combination with the use of Brake Assist.

2.7: Clarification required on use of Collision Avoidance.

*(4 replies - 2 Gov, 1 NGO, 1 Ind.)*

Comment:

Replies question the potential use of such a technology as an alternative to passive measures and stress the need for full validation before acceptance for use.

Response:

It is indeed the intention of the Regulation that any future use to be made of either Collision Avoidance technologies or Advanced Emergency Braking systems will be subject to a full approval process ensuring the requirements of a high level of performance.

2.8: Provide test specification for Brake Assist.

*(3 replies - 1 Gov, 1 Ind., 1 NGO)*

Comment:

The provision of requirements for testing and verification of Brake Assist systems was requested.

Response:

The means by which these systems are evaluated and verified have been proposed and will be included in the Commission Decision document which will accompany this proposed Regulation. Including these requirements in the Decision will allow the proper development of them.

2.9: General application dates.

*(2 replies - 2 NGO)*

Comment:

Requests to bring the application dates of all requirements forward of those dates in the existing Directive.

Response:

Changes to the existing dates are not being considered under this proposal as it has always been recognised that the requirements for development of the vehicles require sufficient lead times, which are reflected in the present dates.

2.10: Requirement for high bumper test.

*(2 replies - 2 Ind.)*

Comment:

Replies request that the definition for a high bumper vehicle, and subsequent requirement for the legform test, should be changed.

Response:

Concern has been raised that with the present definition of high bumper, and with the requirement to use an alternative test there is the potential to force the high bumpers on some vehicles even higher. The definition of a high bumper vehicle for test purposes is not included in the proposed Regulation and will be considered as part of the requirements to be included in the Commission Decision and allow consideration of these concerns.

2.11: Correspondence with global technical regulation (GTR).

*(2 replies - 1 Gov, 1 Ind.)*

Comment:

Requests are made to ensure correspondence with the work on-going to develop a global technical regulation under the UN/ECE in Geneva.

Response:

It is the intention that all aspects of the proposal and those requirements which will be contained in the Commission Decision will, wherever possible, provide the greatest correspondence with the proposed GTR being developed under the UN/ECE.