

**The Safety of Vulnerable Road Users  
in the Southern, Eastern and  
Central European Countries  
(The "SEC Belt")**

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Brussels 2005

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ISBN: 90-76024-18-9

## **Acknowledgements**

ETSC gratefully acknowledges the contributions of the experts (see Appendix) who attended ETSC's Seminars in Madrid, Warsaw and Brno in the course of May 2004 and whose inputs are reflected in this Policy Paper. ETSC also thanks its members and experts for commenting on draft versions of this document.

ETSC is grateful for the financial support provided by Directorate General of Energy and Transport of the European Commission, 3M, BP, KeyMed, Shell International, Ford, Toyota and the Volvo Group. The contents of this publication are the sole responsibility of ETSC and do not necessarily reflect the view of sponsors nor organisations to which research staff participating in the Seminars belong.

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The Council brings together experts of international reputation and representatives of a wide range of national and international organisations with transport safety interests to exchange experience and knowledge and to identify and promote research-based contributions to transport safety.

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## Preface

This ETSC Policy Paper on the protection of vulnerable road users in the EU member states where the risks to road users are higher is part of ETSC's publications series. In addition to the periodic ETSC Monitors, this series comprises the ETSC Reviews, the ETSC Policy Papers and the ETSC Fact Sheets.

**ETSC's Reviews** are drafted by an ETSC Working Party and edited by the Working Party Chairman with support from the ETSC Secretariat. The Reviews are approved by the member organisations of ETSC. The objective of ETSC's Reviews is to contribute to EU transport safety policy making by generating new knowledge on accident prevention and mitigation. The recommendations made by the Reviews are based on sound research and reflect ETSC's independent and rational approach to transport safety policy making. The Reviews are written by experts, for experts.

**ETSC's Policy Papers** are drafted by the ETSC Secretariat and approved by the member organisations of ETSC. The information presented and the policy recommendations made in these papers are the result of a consultation process involving ETSC's pool of independent transport safety experts currently comprising more than 150 individuals from across Europe. The objective of ETSC's Policy Papers is to summarise the State of the Art of solving specific transport safety problems and disseminate this information widely amongst key political decision makers.

**ETSC's Fact Sheets** are compiled by the ETSC Secretariat with the support of ETSC's member organisations. The Fact Sheets provide an overview of the most important aspects of very specific transport safety problems. They gather and present to a wider audience the key facts for understanding and solving such problems.

All of these publications, including the Safety Monitor and its various supplements can be retrieved from ETSC's website at [www.etsc.be](http://www.etsc.be).





# 1 Introduction

The European Commission has set, in its White Paper on the European Transport Policy, an ambitious target of halving road deaths by the end of 2010. The European Transport Safety Council (ETSC) takes an active role in helping to achieve this target by means of its priority based road safety work at European, national, regional and local level.

This ETSC Policy Paper links two kinds of priorities with each other: the protection of vulnerable road users and the need to address road safety problems in the EU member states where the risks to road users are higher. As such, this Policy Paper forms part of ETSC's "SEC Belt Project", aimed at improving road safety in the Southern, Eastern and Central European countries.

## 1.1 Road safety performance in the EU

Before the enlargement of the EU in 2004, road crashes killed every year almost 39,000 EU citizens. They caused over 1.7 million casualties and cost over 180 billion Euros, around twice the total EU budget.

Clearly, road safety is not equally distributed across the EU-15. There is what one can call a "North-South Divide". While Northern European countries have developed and implemented plans and policies that have significantly improved road safety, the South of Europe generally lies below an EU-15-average in relation to almost all safety indicators. In addition to this already existing imbalance, the road safety situation in the 10 new member states suggests the emergence of another divide. Average fatality risk in the EU-10 is higher than 3 times the EU-15 average, slightly higher than Greece (worst performing EU-15 country), and 5 times higher than the UK (best performing EU-15 country). If this trend continues, it will lead to a permanent situation in which the "North-South Divide" is complemented with a "West-East Divide". What evolves is a belt of unsafe countries stretching across Southern, Eastern and Central Europe – the so-called SEC Belt (Fig. 1).



Fig. 1 The SEC Belt - cultivating that, which has fallen dry

## 1.2 The protection of vulnerable road users within the SEC Belt

Within the SEC Belt, the numbers of fatal accidents and serious injuries are significantly higher and citizens are exposed to greater risks than in most North-Western European countries. However, road safety in these countries is not an impossibility, but rather a question of *cultivating that which has fallen dry*. It is this

kind of safety cultivation that ETSC's SEC Belt Project is meant to deliver. The countries within this Belt comprise **Belgium, Cyprus, Czech Republic, Estonia, France, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia and Spain** – all countries that display death rates per billion motor vehicle km above the EU-15 average.

Since a major part of the SEC Belt project is devoted to the needs of vulnerable road users, ETSC has organised, in the course of May 2004, three different Seminars in Spain, Poland and the Czech Republic where leading independent experts from the SEC Belt countries have been asked to identify problems and formulate recommendations on the needs of vulnerable road users from the three traditional pillars of road safety: user behaviour, infrastructure and the vehicle.

### **1.3 Who is a vulnerable road user?**

Vulnerable road users comprise pedestrians, cyclists and motorised two wheelers. Naturally, each categorisation entails a good degree of arbitrariness. Hence, this basic definition might be seen as too restrictive (insofar as it does not explicitly include other vulnerable road actors such as roller-skaters, wheelchair users, young and elderly car passengers as separate categories) or too wide (insofar as it includes motorised two wheelers, who do not always represent the "vulnerable" party). Consequently, this Policy Paper takes account of the fact that vulnerable road users comprise very different groups.

It is in fact clear that, whereas non-motorised users are, with almost no exception, always the weak party in an accident, motorised vehicles (including powered two wheelers) generally create a greater risk in traffic than the non-motorised ones. In **Belgium** this principle was translated into legislation in two different ways. First of all, in the early 90s the car insurance was extended to compensate all physical damage suffered by vulnerable road users in case of an accident, and this also in cases where the vulnerable road user was at fault. This created a greater risk-awareness and made car drivers more aware of their responsibility. Secondly, in 2004 a new principle was introduced in general traffic rules. The "strong" (motorised) road users have an obligation to be very careful towards vulnerable road users, especially towards children, elderly and disabled people. Putting in danger vulnerable road users became a serious offence to be strictly sanctioned.

Recommendation: Without neglecting vulnerable road users' responsibility to abide by traffic rules, legislation should take into account the different risk-creation propensity of motorised and non-motorised road users and make motorised users more aware and more responsible of the risk they create to non-motorised vulnerable road users.

### **1.4 Crash risks for vulnerable road users**

In 2002 almost 18,000 vulnerable road users (pedestrians, cyclists and users of motorised two wheelers) were killed in EU countries as a consequence of road crashes, contributing 36% of all road deaths (IRTAD, 2004). The highest death rate by far in road transport is for the two-wheeled motor vehicle users. Motorcycle or moped travel death risk per kilometre travelled is 20 times higher than for car

travel. The risk of being killed in traffic per kilometre travelled is more than 9 times higher for pedestrians than for car occupants and more than 7 times higher for cyclists than for car occupants (ETSC, 2003c). The severity of injuries suffered by vulnerable road users is also higher than for car occupants.

There are, however, notable differences between countries (for example, the proportion of fatalities who are cyclists is lowest in **Greece, Portugal** and **Spain**), probably partly explained by differences in amounts and patterns of walking and cycling. These, in turn, reflect economic, social, infrastructural, topographical and climatic conditions. More information is needed about levels of pedestrian and cyclist traffic in the EU before crash risk differences can be fully understood.

Recommendation: The EU should encourage Member States to collect exposure data on pedestrian and cyclist travel and include it in the CARE database.

## 1.5 Problems with sources of crash data for pedestrians and cyclists

By far the most important information sources for quantitative statistical crash analyses are data collected by the police or similar agencies at national level. The weaknesses of this source of information for pedestrian and cyclist casualties are well established. There are problems in terms of:

- *Comprehensiveness and quality.* The data are most often based on a limited number of variables describing crash characteristics, and they provide very little information on the injury consequences of crashes such as severity and types of injury, and resulting disabilities. The range of possible factors that can be detected and described on this basis is limited. Furthermore, the quality of statistical crash data in terms of completeness and accuracy is not always satisfactory.
- *Underreporting.* Pedestrian and cyclist crashes are heavily and disproportionately underrepresented in the police crash statistics compared to what hospital records and other studies show (OECD, 1998). A particularly important problem is the substantial proportion of cyclist crashes that do not involve any other vehicle. Even in the case of the more severe injuries, the police very seldom record these crashes; they are therefore not adequately represented in the statistics.

Recommendation: In the case of pedestrians' and cyclists' accidents the level of underreporting needs to be regularly ascertained. Statistical analysis based on standard crash data needs to be complemented by approaches such as direct observation in traffic of events that are valid proxies for crashes (traffic conflict techniques); the observation of particular characteristics of traffic behaviour and analysis of their determinants; and in-depth crash injury research.

The linkage between police data and hospital data is one of the most effective ways of reducing the level of police underreporting<sup>1</sup>. In several EU countries, mostly in the Northern and Western regions, clinical hospital data on traffic injuries are linked with the police reported accident data on a national or regional level. This serves two purposes: (1) establishing the underreporting of registration of injury accidents by the police and (2) adding the detailed injury information to the registered data of accidents.

In Nordic countries, Great Britain, Germany and the Netherlands several studies on linked hospital and police data (OECD, 1994) have revealed that injuries of pedestrians and cyclists are underreported to a varying extent in the official road accident registration systems of these countries. The largest underreporting with respect to all (slight and serious) injuries is generally observed for cyclists. Up to 80 per cent of injured cyclists in traffic accidents are not reported. For the SEC Belt countries, no such studies on the completeness of the official registration of road accident injuries and fatalities are available<sup>2</sup>.

The linkage between police data and hospital data would also enable the monitoring of other types of injuries that are not normally included in the traffic accident statistics, like the pedestrian "solo" accidents. The inclusion of this type of accidents in the traffic accident files is justified by the fact that the road footway maintenance budget (a major factor connected to pedestrian solo accidents) is normally included within the general road maintenance budget. On the other side, the monitoring of pedestrian solo accidents should represent an integral element of any sustainable transport, mobility and accessibility policy.

Recommendation: In the medium term, and with the objective of reducing the level of underreporting of pedestrians' and cyclists' accidents, a linkage system between police based accident databases and hospital databases should be developed.

## **1.6 Conclusion: from policy making to campaigning**

This ETSC Policy Paper on the protection of vulnerable road users in the SEC Belt countries seeks to provide a basic tool for sound road safety policymaking both at EU level and in the 16 member states where the risks to road users are higher. For ETSC, it also provides a corner stone in the fundament of its new *EU-wide Campaign* on protecting pedestrians and bicyclists, called VOICE. With the beginning of 2005 ETSC has commenced an activity that, amongst others, seeks to create a network of NGOs dealing with and promoting the protection of non-motorised vulnerable road users across Europe. This Policy Paper is paving the way for the Europe-wide activities under VOICE.

<sup>1</sup> An example of this approach is the *Swedish Traffic Accident Data Acquisition (STRADA)* system.

<sup>2</sup> In France, in the Rhône area, all medical structures are requested to fill in a file with all the details regarding road accident injuries. This medical register will soon be extended to the whole Rhône-Alpe region.

## 2 Behaviour

Behavioural measures play a pivotal role in the protection of vulnerable road users. An unsafe behaviour can jeopardise in a few seconds all the efforts made in providing a safe vehicle and a forgiving infrastructure. An unsafe behaviour can easily lead to death or permanent disabling injuries.

When talking about behavioural measures, a distinction can be made between measures that are targeted to the vulnerable road users themselves (e.g. the use of protective equipment), measures that are targeted to other road users (speed limits, blood alcohol limits) and measures that are targeted to all road users (education, awareness campaigns, enforcement).

### 2.1 Behavioural measures targeted to vulnerable road users

To begin with, the safety of vulnerable road users is determined to a high extent by their own behaviour. In addition to walking, bicycles, mopeds and motorcycles can provide a valid alternative to the car for short trips. However, given their higher level of risk, it is fundamental that users wear adequate protection. The use of crash helmets (for powered two-wheelers and bicycles) and the adoption of a correct behaviour in traffic can make an important difference in terms of casualty reduction figures.

#### 2.1.1 Helmets

Helmets are a life saving equipment both for bicycles and for motorised two wheelers and their use should therefore be promoted and, where mandatory, enforced.

##### *a) Helmets for users of motorised two-wheelers*

Research shows that the use of crash helmet reduces the incidence of fatal head injuries by 50% (ETSC 2003b). Eighty per cent of the two-wheeled vehicle users killed annually sustain fatal head injuries. According to recent research (MAIDS, 2004), the use of a helmet would be capable of preventing or reducing the head injury sustained by the rider in 68.7% of all cases.

Helmets are mandatory for all motorised two wheelers in all the sixteen countries of the SEC Belt. However, the rates of compliance vary according to the different countries and to the different types of motorised two-wheelers.

Official data of two wheelers' helmet use in the SEC Belt countries are not easily available and in some countries are not collected at all. However, a general pattern can be discerned. When it comes to motorcycles, the helmet usage rate is very high in almost all the SEC Belt countries, with figures being higher than 90%. The situation is less encouraging when considering moped riders where the usage rate is much lower. This is especially true in the Southern regions of the SEC Belt where the large population of moped users seems somewhat reluctant to use helmets, particularly in the hot summer months<sup>3</sup>.

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<sup>3</sup> In Spain moped users tend to wear a helmet mainly outside urban areas where the usage rate was 90% in 2002. This rate was, on the other hand, slightly above 80% in urban areas. Percentages were much lower for moped passengers, being 70% outside urban areas and 60% in urban areas (FITSA, 2004).

Recommendation: The usage rate of crash helmets should be brought to 100% with a mix of stronger enforcement and awareness raising campaigns. Research should be carried out on new models providing adequate ventilation and encouraging use in hot weather conditions.

Although crash helmets are very different in colours, styles and structures, they all must conform to UN-ECE Regulation 22-05. This does not always seem to be the case in the SEC Belt Countries (particularly in **Hungary, Malta and Greece**) and requires timely action from the competent authorities.

Threats to safety also arise in the case of an incorrect use of crash helmets. A study carried out in **Cyprus** at the end of 2002 revealed that 13.2% of those using helmets did not have it properly restrained.

Recommendation: Competent authorities should make sure that only type-approved crash helmets are used and that they are properly restrained. A "safety helmet fitting guidance" should be provided with the helmet. Subject to a positive cost/benefit analysis the EU should also provide the framework for a EuroNHAP (European New Helmet Assessment Programme) to help consumers differentiate between products and to develop an advanced standard for safety helmets.

Recommendation: Further research should be conducted on the different types of motorcycle helmets (full face, half type, open face) and the protection level they offer.

#### *b) Helmets for users of bicycles*

Head and brain injuries sustained by cyclists could be reduced effectively by bringing cycle helmets into general use. Several studies indicate that cycle helmets reduce fatal and serious injury by between 45 and 80% (ETSC 1999a), and a European standard (EN 1708) already exists for them.

The use of bicycle helmets is (with a few notable exceptions) only encouraged in the SEC Belt countries. The exceptions are Malta, Spain, Slovenia, Czech Republic and Portugal.

Bicycle helmets have become mandatory in **Malta** in April 2004 with a law also mandating the use of retroflective clothes. The new rule seems to have been accepted by cyclists even if the compliance rate has not been checked yet.

Cycle helmets are compulsory in **Spain** outside urban areas, with one exception: cyclists do not need to wear an helmet when they are going uphill. Retroflective equipment is also compulsory at night outside urban areas. For the time being, no

compliance information is available regarding cycle helmet and retroreflective equipment use.

In **Slovenia** and the **Czech Republic** cycle helmets are compulsory only for children up to 15 years of age and experience shows that bicyclists stop using them when it is not compulsory any more.

Finally, **Portugal** has introduced compulsory bicycle helmets at the beginning of May 2004 but the timescale for application of the new law is not clear yet.

In the remaining eleven countries of the SEC Belt, which do not require the use of helmets by law, the wearing rate is normally very low (less than 10%). In these countries the use of cycle helmets should be promoted, but mandatory use is not recommended for the time being, because there is evidence that people cycle less if helmet wearing is required (ETSC 1999a). Also, in **Poland** an attempt was made in 2002 to introduce mandatory use but the proposed measure had to face a fierce opposition from the cyclists' organisations who believed such a measure would have constituted a deterrent to bicycle use.

Recommendation: The use of cycle helmets should be strongly encouraged, partly by awareness raising campaigns and partly by making their design more attractive.

Recommendation: Research should be conducted on ways of increasing acceptability of bicycle helmets by cyclists.

### 2.1.2 Improving vulnerable road users' behaviour in traffic.

Pedestrians, cyclists and motorcyclists suffer from particular vulnerabilities in today's traffic system and their behaviour should be adapted accordingly in order to minimise their consequences.

These vulnerabilities are common to all SEC Belt countries, although they may differ in extent. The key factor which underlies the complex mix of reasons for these problems is that the modern traffic system is designed largely from a car-user perspective resulting in a lack of coherent planning of route networks for vulnerable road users.

Pedestrians, cyclists and motorcyclists are vulnerable (even at relatively low impact speed, they receive severe injuries, mainly because their only protection is their clothing and, in some cases, their helmet), unpredictable (a motor vehicle driver can never be sure when or where to expect a vulnerable road user), unstable (they may trip or fall in the traffic environment), and sometimes even invisible (they are difficult to see, they are small compared to a car, and can be hidden by one).

These characteristics pose additional threats to vulnerable road users and should be addressed from the school age. Vulnerable road users should avoid dangerous behaviour that could put them in danger.

Recommendation: With all due precaution, in order not to discourage walking and cycling, road users should be made aware of the danger that being a pedestrian, a cyclist or a motorcyclist may pose to their lives. They should be encouraged to take particular care, to make themselves visible and to scrupulously follow traffic rules. Motorcyclists should be aware of the difficulties other road users (including cyclists and pedestrians) have in motorcycle detection and in the distance and relative speed perception towards a motorcycle.

Vulnerable road users are an important component of road traffic, especially in urban areas. They are not exempted from obeying traffic rules and it is important that they respect them carefully. Vulnerable road users should have a disciplined behaviour by, for example, crossing only when the traffic lights allow this, avoiding taking dangerous shortcuts and making themselves visible.

Recommendation: Member States should adopt an appropriate legal framework for the regulation and enforcement of vulnerable road users' behaviour in traffic.

## **2.2 Behavioural measures targeted to other road users**

Vulnerable road users share the road space with other road users and experience many conflict situations. Hence, the behaviour of other road users in traffic is at least as important as the one of vulnerable road users in order to guarantee a high level of safety. Keeping to the speed limit, taking the wheel only when sober and adopting a calm, non-aggressive style of driving, they all contribute to the safety of vulnerable road users.

### **2.2.1 Speed limits**

Even at relatively low impact speed, pedestrians and cyclists receive severe injuries, mainly because their only protection is their clothing. For cyclists a helmet provides useful protection against head injuries but, as previously indicated, the use of cycle helmets is not very widespread.

Speed plays an important role in determining the severity of the outcome of collisions. If the collision speed exceeds 45 km/h, the likelihood for a pedestrian or cyclist to survive the crash is less than 50%. If the collision speed is less than 30 km/h, more than 90% of those struck survive (Carlsson, 1996).

Speed is one of the most urgent problems of road safety and should therefore be dealt with at EU, national and local level.



Recommendation: The European Union should harmonise general speed limits in urban areas throughout the EU by requiring each Member State to impose its own limit at or below 50 km/h and actively encourage 30 km/h in residential areas.

Recommendation: Drivers' choice of speed should be influenced by imposing and enforcing speed limits, and by educating drivers. Because speeds are chosen by individual drivers, measures to manage speed need to reduce the perceived advantages of excess and inappropriate speed, and increase the perceived disadvantages.

Recommendation: The EU should encourage sharing of international best practice in the enforcement of speed limits, including experience in using speed cameras.

Recommendation: The EU should promote information campaigns at the European level on the consequences of excess and inappropriate speed to encourage better understanding of the need for appropriate speed for safety.

### 2.2.2 Blood alcohol limits

Failing to comply with key legislation on drinking and driving makes an important contribution to the frequency or severity of road crashes involving vulnerable road users. In general, all functions which are important in the safe operation of a motor vehicle can be affected by high levels of alcohol in blood. Alcohol may also decrease motivation to comply with safety standards, which may result in an active search for dangerous situations such as competitive behaviour, or excessive speed.

Blood Alcohol Concentration (BAC) limits vary in the SEC Belt countries. **Cyprus** allows a very high BAC of 0.9 mg/ml (even if there are plans to reduce it to 0.5 mg/ml in the near future). **Belgium, France, Greece, Italy, Latvia, Portugal, Slovenia** and **Spain** have a BAC limit of 0.5 mg/ml. In **Estonia** and **Poland** drivers can take the wheel only if their BAC is less than 0.2 mg/ml. Finally, **Czech Republic, Hungary, Lithuania, Malta** and **Slovakia** consider drinking and driving as two mutually exclusive activities with a BAC of 0 mg/ml.

Recommendation: The EU should legislate to impose that the blood alcohol limit (maximum permitted BAC) should not exceed 0.5 mg/ml (0.2 mg/ml for novice drivers and professional drivers). Countries should be also encouraged to follow the example of the countries that have a 0.2 mg/ml BAC limit.

Blood alcohol limits should not only be set but also enforced. A higher (but strictly enforced) limit is very often much more efficient in reducing casualties than a lower (but poorly enforced) one. SEC Belt countries should exchange best practice experiences with the best performing EU Member States in view of a stronger enforcement of blood alcohol limits.

Recommendation: The EU should encourage Member States to regularly apply random breath testing surveys to determine levels of 'over the limit' drinking and to take appropriate countermeasures.

### **2.2.3 Aggressive behaviour**

Aggressive behaviour is becoming increasingly common on the SEC Belt's roads and is at the origin of many serious accidents involving vulnerable road users.

Running red lights, parking on the footpaths, not stopping at zebra crossings are all very common behaviours that need to be tackled.

Recommendation: Member States need to take appropriate actions to combat aggressive driving and to ensure equal rights for different road users. Drivers need to be educated, their behaviour influenced by targeted campaigns and each episode of this type of misconduct strictly sanctioned.

## **2.3 Behavioural measures targeted to all road users**

Measures such as information, education and training, and awareness raising campaigns also have a role to play in the protection of vulnerable road users, though the demonstrable returns from these countermeasures are sometimes debatable. Finally, a tough enforcement, for all road users, will guarantee that the rules learnt through the educational process are respected.

### **2.3.1 Information, education and training**

Information, education and practical training are essential in acquiring the attitudes, skills and knowledge necessary for a safe road use, both as a driver and as a vulnerable road user, from childhood through to old age, even if it is difficult to quantify their casualty reduction potential.

Training and education are not only for the young: they also have a role to play for experienced road users, for example for those who have committed particular traffic offences or whose changing capabilities require new skills and strategies to cope with daily traffic.

Not only have vulnerable road users to be educated, but also car drivers, parents, the health community and teachers as groups that are able to influence strongly the behaviour and learning of children as pedestrians or cyclists, and those responsible for the formulation of traffic rules, for driver instruction and for

planning and building the traffic environment to be used by pedestrians and cyclists (Wittink, 1998).

In some of the SEC Belt countries, road safety education and training is realised by school teachers in co-operation with the local police. The latter can be necessary for training in real traffic situations. Some countries have specific curricula and timetables for traffic safety education in at least the first few years at school. **Malta**, for example, has created interactive games for children and has organised school visits by safety professionals. **Hungary** dedicates a part of the National Education Programme to road safety education. In **Poland**, road safety is dealt with only in primary school. In **Cyprus**, the police visit schools from time to time and arrange lectures on how to use the road network being a pedestrian or a cyclist. In **Slovenia** traffic education begins in the Kindergarten and continues through primary school. In the **Czech Republic** cycle helmets are promoted in school. In **Italy**, moped drivers have to attend courses organised by the schools before they can pass the examination for obtaining their driving licence. In **France**, a certificate of first education to road safety is given at school and is required before beginning the training in a driving school. In **Greece**, traffic education courses have been organised in fifty schools and special facilities have been provided for the children to practise being good road users.

However, even for these countries, doubts are often expressed about the quality and quantity of this teaching. A major weakness is that traffic safety education is very often not a part of vocational training for teachers and Kindergarten staff. Guidelines on best practice in standards for traffic education and initial and in-service training for professionals would be helpful at EU level.

Recommendation: School education, especially road safety education, should involve explicit time tabled curricula for each grade. Particularly important topics are walking to and from school, using school or public transport and training courses for cyclists and light motorised two-wheelers.

Recommendation: The responsible authorities should rectify the lack and insufficiency of preparation of teachers for the very demanding task of traffic safety education in schools, including behaviour as pedestrians and cyclists.

Recommendation: Research should be conducted on the effects on casualty reduction of particular interventions in the fields of information, education and practical training and on their cost-effectiveness.

### 2.3.2 Driver training

In addition to the knowledge and skills required for safe driving in general, with the safety of vulnerable road users in mind, learner drivers should be trained specifically

to recognise situations in which vulnerable road users may be encountered and placed at risk, and how to respond to these situations in ways that minimise that risk, having particular regard to the limited capabilities of children, elderly people and people with reduced mobility. The initial training given by professional driving instructors should cover this aspect specifically and the instructors should be trained in doing so. This is not the case in many of the SEC Belt countries.

**Portugal's** new National Road Safety Plan pays some attention to drivers' training on the needs of vulnerable road users. Also, in **Latvia** and in **Cyprus** the drivers' education system specifically includes vulnerable road users. In **Slovenia**, a new Road Safety Act has introduced a two-phase driver training model which is expected to improve the safety of vulnerable and high-risk road users.

However, the situation in the SEC Belt countries is far from being satisfactory and action is needed.

Recommendation: The EU should encourage information exchange and develop technical guidelines for professionals on driver training, giving particular emphasis to the integration of vulnerable road users into the traffic system.

### 2.3.3 Awareness raising campaigns

Campaigns have an important role to play in achieving increased awareness about crash risks and increased understanding and acceptance of the need for road safety measures.

Several SEC Belt countries organise awareness raising campaigns targeted to the needs of vulnerable road users.

In **Belgium**, for example, the Belgium Road Safety Institute (IBSR/BIVV) organises one awareness campaign per year targeted to the needs of vulnerable road users<sup>4</sup>. **Portugal** will launch a new campaign (to last until the end of 2005) on pedestrian safety. In **Spain** the General Directorate for Traffic has a long tradition of campaigns on vulnerable road users. In **Estonia** and **Poland** campaigns have been carried out promoting the use of retroreflective clothes and the need to give priority to pedestrians at pedestrian crossings. In other countries, such as **Hungary** and **Latvia**, campaigns are organised in cooperation with the police before the summer holidays and before the beginning of schools. In **Italy**, campaigns are organised at the local level on 7<sup>th</sup> April, the national day for road safety.

Recommendation: The EU should encourage the exchange of best practice guidelines on how to organise and run a successful campaign in favour of vulnerable road users. Campaigns should also receive EU funding and their impact should be formally and independently evaluated.

<sup>4</sup> Recent campaigns include: "Footpaths are not a parking" (2004), "We are not dummies" (2003), "Slow down for Sophie" (2002), "Let life win" (2002), "Foresee the unforeseen" (2000), "Pedestrians are not obstacles" (2000).

Apart from the governmental organisations, user and safety organisations have a role to play in campaigning for a better protection of vulnerable road users. They can assist, for example, with the dissemination of knowledge about traffic rules and regulations<sup>5</sup>. Pedestrians (especially children and elderly people) and cyclists who have not taken a driving test may not be aware of important traffic rules, and all road users encounter unfamiliar rules when they travel to different Member States.

**Recommendation:** The EU should devise and widely disseminate a European Highway Code containing the most important traffic rules from each Member State. The European Highway Code would provide an opportunity to emphasise to drivers throughout Europe that most national highway codes in Europe urge or require them to behave with consideration towards vulnerable road users, especially children, the elderly persons and those with reduced mobility.

Motorised two wheelers represent a particularly vulnerable group and the importance of a good behaviour from them and towards them should also be emphasised<sup>6</sup>. Recent research (MAIDS, 2004) indicates that the majority of powered two wheeler accidents involve a collision with other vehicles (80.2%). All road users, therefore, need to be made aware of the main causes of motorcycle accidents and of the contribution they can make to avoid them<sup>7</sup>.

**Recommendation:** Campaigns should raise awareness on issues such as the limitations of motorcycle's manoeuvrability in slippery conditions and the limited peripheral vision when a helmet is worn.

### 2.3.4 Enforcement

A large proportion of crashes are preceded by one or more traffic offences (Rothengatter and Harper, 1991). On an aggregate level, traffic offences are a major contributory factor to road crashes and injuries.

Intensive enforcement actions addressing the major problems in drivers' behaviour (such as speeding, drink-driving and non-use of helmets) are an important means of enhancing road safety for vulnerable road users. Such actions, if carried out according to best practice standards, can lead to a rapid and massive reduction in deaths and injuries in a very cost-effective way (ETSC, 2003a).

<sup>5</sup> An example is the Belgian Road Safety Institute and its involvement in the CAST-project aiming at studying and disseminating knowledge about campaign strategies and campaign evaluation methodologies. The Belgian Road Safety Institute is also coordinating the preparation of a new website on road safety campaigns: EuroRSweb. This multi-lingual website will present information on campaigns in different member states.

<sup>6</sup> The Fédération Internationale de Motocyclisme (FIM) has been involved in the past with Spanish and EU authorities as a partner in safety campaigns. The FIM is also developing a new website ([www.fim-cmt.org](http://www.fim-cmt.org)) containing positive messages about road safety.

<sup>7</sup> In 2005 a voluntary behavioural code with agreements between car and truck drivers on the one side and motorcyclists on the other side will be established in **Belgium**.

Yet, much more should be done to prevent road users from committing offences. In view of the many other pressing problems facing police forces, road traffic regulation enforcement typically has low priority. While traffic levels continue to rise, several SEC Belt countries appear to be devoting fewer resources to traffic policing than they were several years ago. Moreover, the resources of the enforcement process are often used for other purposes and do not go in the road safety budget<sup>8</sup>.

Recommendation: Member States should, on the basis of detailed crash data analysis, set specific targets for compliance with key traffic rules which influence the safety of vulnerable road users. These targets should specify the offences to be enforced and the progressively increasing compliance level for each offence. After the targets have been set, enough enforcement resources should be assigned with a view to their achievement.

Recommendation: The revenues from traffic fines should be earmarked to the improvement of road safety. Enforcement activities should primarily serve as a deterrent to road users inclined to commit traffic offences.

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<sup>8</sup> In **Belgium**, on the other hand, police forces have increased enforcement activities. This has resulted in a higher perceived and actual risk of apprehension for traffic offenders. About 350 red light and speed cameras have been put in place at high risk sites and higher sanctions (introduced by a new traffic law in March 2004) have made the deterrent effect of enforcement stronger. Moreover, a part of the resources coming from the enforcement activities is paid back to the local police forces and is re-invested in road safety measures.

## **3 Infrastructure**

For the purposes of this work, the analysis of infrastructure measures targeted to the needs of vulnerable road users will be divided into three parts: measures to be adopted in rural roads, measures to be adopted in urban areas and measures which will show their effects on both types of road.

### **3.1 Infrastructure measures in rural roads**

Rural roads pose specific dangers to vulnerable road users of the SEC Belt countries: they present a dangerous mix of different categories of traffic, they are usually of a poorer quality and with a lower level of maintenance than the urban roads and they are often characterised by unforgiving roadsides.

#### **3.1.1 Reducing the effects of shared space in rural roads**

Single carriageway rural roads include many different types of road, ranging from traditional, winding local roads to modern high quality roads with gentle curves and full cross sections.

At present, many rural roads in the SEC Belt countries are multifunctional and used by pedestrians, cyclists, motorised two wheelers and other types of vehicle users with substantial differences in speed, mass of vehicle and degree of protection.

On rural roads, unlike in urban areas where a certain level of traffic segregation is possible, vulnerable road users are often forced to mix with other categories of traffic. The differences between vulnerable road users and other categories of traffic would point to adopting physical separation of footpaths or cycle lanes from the carriageway. Alternatively, if physical separation is not possible, line markings should clearly delimit the space dedicated to vulnerable road users. These options are, however, difficult to put in practice: rural roads of the SEC Belt countries are very often two-lane single carriageways whose width would not be enough to provide adequate space on both sides of the road. The cost of land expropriation, moreover, would represent a hard constraint on the already limited budgets the SEC Belt countries seem to devote to rural roads. Finally, larger roads could represent an incentive to exceeding speed limits thus creating opposite results to the ones originally intended.

For many rural single carriageway roads, therefore, other options should be chosen in order to increase the protection of vulnerable road users. These options include improving hazard perception by means of road lighting at junctions and roundabouts, improving vertical alignment, introducing advisory speed limits at sharp bends, introducing regular speed limit signs and introducing deterrents to high speed such as rumble strips.

Recommendation: In designing (or redesigning) rural roads, a range of engineering measures should be adopted to encourage a steady, safe speed and to make hazards perceptible.

### 3.1.2 Improving the level of finishing and maintenance of rural roads

Rural roads in the SEC Belt countries are very often of a poorer quality than the urban roads and the level of maintenance is below standard.

However, good construction standards and high level of maintenance are essential to guarantee lasting visibility and a skid resistance ensuring an adequate protection, particularly to vulnerable road users. Relatively minor defects in the riding surface can be a real safety hazard for cyclists or motorcyclists whereas they may merely represent an inconvenience for motorists. Good winter maintenance and the use of anti-skid surfaces are equally important.

Road marking must also be of the highest quality in order to guarantee a skid resistance as good as the one of the adjacent road surface. Discontinuity of the surface or raised edge of the road marking or adverse camber created when completing road markings could cause handling problems for motorcyclists and cyclists.

Finally, as cyclists tend to use the edge of the carriageway, efficient drainage is important.

Recommendation: Responsible authorities should give priority to achieving a situation in which rural roads are constructed according to good construction standards and are regularly maintained by removing debris and loose materials, correcting defects in the riding surface, guaranteeing efficient drainage and using anti-skid road markings.

### 3.1.3 Forgiving roadsides

Collisions between cars and motorised two wheelers (and, to a lesser extent, cyclists) and unforgiving roadside objects such as trees, poles, road signs and other street furniture represent an important safety problem<sup>9</sup>.

Research and experience indicate that the positioning and design of off-road objects can play a major role in reducing such collisions and the severe consequences that are typically associated with them.

In **Portugal**, a new law has introduced a programme of implementation of motorcycle-friendly safety barriers. A similar safety barrier upgrade scheme exists in **Spain** where there is also a protocol for the development of crash tests measuring the impact between a dummy (head, neck and shoulder) and a safety barrier. A number of measures were taken in **Cyprus** in the last few years for the creation of forgiving roadsides, including the paving of road shoulders, the installation of guard rail and the safer design of new roads. In **France**, a programme of implementation of safety barriers adapted to powered two wheelers has been introduced.

<sup>9</sup> The MAIDS Report (2004) concluded that roadside barriers, though working quite effectively for passenger cars, represent significant obstacles when struck by powered two wheeler riders.



However, the general situation in the SEC Belt countries concerning forgiving roadsides is far from being satisfactory. The principles for minimising the occurrence and mitigating the severity of injury in collisions with street furniture in rural roads are not yet being widely applied.

Recommendation: The EU should adapt to technical progress the Community standards applicable to road equipment and should require their adoption on all EU funded infrastructure.

Ideally, roads should be designed without dangerous off-road objects. However, this is clearly not possible in all situations and most of the interventions will have to be made on already existing roads. In such a case, objects should be removed, made more forgiving or protected with crash barriers where none of the other options are possible.

Recommendation: In designing new infrastructure, responsible authorities should make sure that new roads are built without dangerous street furniture and, when this is not possible, street furniture should be designed to be more forgiving. Mandatory road safety audits should remove roadside hazards within the design stages of a scheme.

Recommendation: On existing infrastructure responsible authorities should eliminate unnecessary obstacles, move (where possible) obstacles away from the roadside or, in the last resort, isolate existing obstacles by means of an energy absorbing barrier. Mandatory road safety inspections should help identifying and removing existing roadside hazards.

## **3.2 Infrastructure measures in urban areas**

Vulnerable road users (pedestrians and cyclists in particular) make the majority of their trips in the urban environment, an environment in which there are a lot of interfaces between vulnerable road users and other users. In order to reduce their casualties it is therefore important that road conditions in urban areas are made particularly safe for vulnerable road users.

Dedicated facilities may be the solution in some instances, traffic restraint and speed reduction in others. A combination of measures will usually deliver the most effective results.

### **3.2.1 Road hierarchy in urban areas**

Taking account of different road functions by defining a road hierarchy is an important step towards the improvement of the safety of vulnerable road users in urban areas.

At present, many urban roads in the SEC Belt countries are multifunctional and used by vulnerable road users and different types of vehicle users with substantial differences in speed, mass of vehicle and degree of protection. In many residential areas and on many main urban roads this produces an imbalance between the mobility of motor vehicle users and the safety of vulnerable road users.

A road hierarchy can be established according to functions, taking account of land use, location of accidents, vehicle and pedestrian flows, and safety objectives including management of speed. This helps in the detailed design of each road to increase safety, in particular by encouraging appropriate choice of speed<sup>10</sup>.

In such a system three main traffic functions can be distinguished:

- *Flow function*: allowing efficient throughput of traffic. Quality of flow is helped by continuity of design characteristics making higher speeds appropriate. Few urban roads (such as ring roads) perform the flow function.
- *Distributor function*: making residential and other areas easily accessible. Quality of distribution is helped by intersections and connections, which give rise to discontinuities in flow and make relatively low speeds appropriate. The distributor function is important in all extensive built-up areas.
- *Access function*: allowing properties along the road to be reached. Frequent and diverse accesses and the proximity of surrounding development make low speeds appropriate.

Where a road performs a mixture of functions, the appropriate speed is normally the lowest of the speeds appropriate to the individual functions. The design of the road concerned should unambiguously and consistently indicate this speed to the user and the speed limit should be set accordingly. Compliance will then be the natural choice for most drivers.

Recommendation: Responsible authorities should identify a road hierarchy according to the functions of different roads. Roads serving mainly a flow function should be relieved of all other functions, whereas roads serving mainly access or residential functions should be relieved of flow and distributor functions. Inconsistencies between design and function should be minimised and where they occur they should be properly signed.

Recommendation: On local distributor and access roads different categories of user should be separated where this is practicable. Design should achieve levels of speed that are compatible with local activity, even when there is little traffic.

<sup>10</sup> The Dutch policy of Sustainable safety was pioneer in the classification of roads according to their function and in setting their speed accordingly (CROW, 1997).

### 3.2.2 Traffic calming and speed reduction measures

Speed of motor vehicles is critical to the safety of vulnerable road users. At low speeds drivers have more time to react to the unexpected and avoid collisions.

Traffic calming reduces the speed of motor vehicles by various physical modifications: vertical and horizontal deflections, changes in surface colour and texture, a reduction in overall carriageway area, and signs and other symbols to convey to drivers that they need to have greater awareness of vulnerable road users. Gateways may indicate entries into traffic calmed areas.

Some of the SEC Belt countries have taken action in reducing speed in some parts of their urban areas. In **Belgium**, for example, the cities of Gent, Mons and Kortrijk have developed large "Zone 30" areas and all the areas around schools are "Zone 30"<sup>11</sup>. In **France**, "Zone 30" areas are developing in most city centres. In **Poland**, Krakow, Gdansk and Warsaw have implemented "Zone 30" in some parts of the urban perimeter. In **Slovenia**, the systematic implementation of "Zone 30" in residential areas is taking shape. In **Hungary**, "Zone 30" areas (coupled with the use of road humps) have started to be very common in the city centres. In **Cyprus**, traffic calming measures (mainly road humps) have been introduced in the recent years: these measures were implemented mainly outside schools but also on trunk roads through villages and at locations where high speeds coupled with the crossing of vulnerable road users.

However, a comprehensive approach to urban speed management is still lacking in many of the SEC Belt countries and prompt action is strongly needed.

Recommendation: Traffic calming measures, based upon physical measures such as roundabouts, road narrowings, chicanes and road humps, should be introduced as part of area-wide urban safety management. Speed limit zones of 30 km/h should become widespread in urban areas.

Recommendation: The European Union should develop technical parameters (on the width of road cross section, pedestrian traffic, number of lanes) for the establishment of Zones 30.

### 3.2.3 Safer routes for pedestrians and cyclists

The creation of networks of connected and convenient pedestrian and cyclist routes can lead to greater safety for vulnerable road users. Safer routes will typically consist of footpaths or cycle tracks separate from any carriageway, pedestrian-only areas and areas with mixed access of pedestrians and cyclists.

Cyclists can mix safely with traffic at speeds below 30 km/h. They can also mix safely with traffic at speeds between 30 km/h and 50 km/h unless there are significant numbers of lorries or child cyclists. Additional lane width is desirable where traffic

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<sup>11</sup> The city of Gent has one of Europe's largest pedestrian areas, including the whole city centre.

flows are heavy. Where traffic speeds are above 50 km/h, segregation or additional lane width is necessary.

Some efforts are being made in the SEC Belt countries, with the creation of pedestrian areas and the construction of cycle lanes. In **Poland**, for example, the town of Warsaw has more than 150 km of cycle lanes; in **Belgium** almost all one way streets allow cyclists to go in the opposite direction<sup>12</sup>; in **Portugal** the National Road Safety Plan has introduced a manual of good practice for design and implementation of safe pedestrian corridors; in **Hungary** about 30 km of bicycle lanes are being built every year; in **Greece** guidelines for cycle lanes have been developed and bikes have been allowed to use bus lanes; in **Latvia** the town of Ventspils has distinguished itself for the particular attention its authorities have dedicated to the needs of vulnerable road users by the provision of pedestrian zones and cycle lanes; in **Italy**, the Ministry of Transport and Infrastructure has provided incentives for construction of cycle lanes since 1998 and has issued a decree with geometric guidelines for constructing them.

However, the situation is far from being satisfactory and vulnerable road users are too often forced to mix with other categories of traffic and to encounter very dangerous situations. As an example, **Cyprus** shows a lack of pavements on secondary urban roads and in villages and existing pavements are very often occupied by parked vehicles, trees with wide foliage, commercial signs and merchandise.

Recommendation: Local authorities should provide shorter and safer routes for pedestrians and cyclists by ensuring that trips are short and routes direct and that the quickest routes are also the safest. In order to promote safer route choice, travel time should be increased on unsafe, undesired routes and decreased on safe, desired routes. "Safe routes to school" schemes should be developed in order to increase the safety of children.

### 3.2.4 Pedestrian crossings

When pedestrian or cycle routes cross significant flows of motor vehicle traffic, the location and design of the crossing point need special attention<sup>13</sup>. Pedestrian crossings are very often poorly located and also poorly endowed with adequate provisions for disabled people. In **Cyprus**, for example, there is a lack of sufficient pedestrian crossing facilities in urban roads and on the main roads in villages.

<sup>12</sup> Exceptions are only made for safety reasons, when visibility is poor or when the street is too narrow. When cyclists are authorised to ride in the opposite direction in one way streets, this is clearly indicated by traffic signs.

<sup>13</sup> **Latvia**, for example, has developed a register of pedestrian crossings in order to acknowledge which ones are unsafe and in need of supplemental measures (such as barriers, lighting, refuges). The register is also used for the identification of areas where new crossings should be built.

**Recommendation:** The location and design of pedestrian crossings should be the object of accurate analysis. Pedestrian safety should be increased by installing refuge islands or a continuous central reservation. Dropped kerbs at crossings should be provided to assist those with physical impairments whereas tactile surfaces should be foreseen for those with visual disabilities. On roads with higher traffic levels signal-controlled crossings should be the rule.

Vulnerable road users are particularly at risk when crossing heavily trafficked roads or roads with speed limits of 60 Km/h or above. In these circumstances, grade-separated crossings (either by footbridges or subways) would improve the safety of pedestrians and cyclists. In many cases, physical barriers to prevent crossing outside the new grade-separated crossings might be required to achieve the maximum level of safety.

**Recommendation:** In order to make them user-friendly, grade-separated crossings should be without steps or troublesome ramps and should keep vulnerable road users on their natural desire-line whilst motor vehicles undergo the changes in grade and level. Subways should be brightly lit, regularly cleaned, have good through visibility and be consistently overlooked.

### **3.2.5 Roundabouts**

Roundabouts are often designed with the motor vehicles in mind and are very difficult to use safely by vulnerable road users. Large roundabouts and gyratories are the feature of the road network most feared by cyclists due to the increased possibility of a car-cyclist crash in a roundabout. Crossing a roundabout over the central island can also prove to be a very dangerous exercise for pedestrians.

**Recommendation:** Responsible authorities should make roundabouts safer for vulnerable road users by reducing the width of the circulatory carriageway, increasing deflection on entry and improving signing, road markings and conspicuity. Physical barriers to prevent crossing over central islands should also be installed.

## **3.3 Other infrastructure measures**

This section will deal with infrastructure measures that are not always specifically targeted to vulnerable road users. However, these measures can be very effective in minimising potential conflicts between motor vehicles and vulnerable road users on both rural and urban roads.

Safety audits of existing infrastructure and planned construction, the treatment of high risk sites by means of low cost/high return measures and the EuroRAP programme will be considered.

### 3.3.1 Road safety audit and safety impact assessment

Road safety audit is a formal procedure for independent assessment of the accident potential and likely safety performance of a specific design for a road or traffic scheme, whether new construction or an alteration to an existing road. The basis for safety audit is the methodological application of safety principles to prevent future accidents occurring or to reduce their severity.

Road safety impact assessment is a formal procedure for independent assessment of the likely effects of proposed road or traffic schemes upon accident occurrence not only on the proposed road or traffic schemes but throughout the whole road network affected by the schemes.

Well-documented experience in Europe and elsewhere shows that formal systematic safety audit and safety impact assessment procedures are a demonstrably effective and cost-beneficial tool to improve road safety (ETSC 1997). But they are used so far by only a minority of the SEC Belt countries and scattered approaches are more common than a coherent strategy. **Italy**, for example, has developed in 2001 recommendations on road safety audit and road safety impact assessment. However, these recommendations are not compulsory and audits and assessments are not applied systematically. In **Spain**, road safety audits have been implemented in some regions but not at the national level and, while they are mandatory in upgrade works in the existing federal road network, they are not mandatory for new road constructions in the same federal network<sup>14</sup>. In **Poland**, road safety audits were introduced in May 2004 but only for national roads. In **Greece**, there are pilot schemes for road safety audits and safety impact assessment but no legislation or guidelines have been introduced. In **Hungary**, road safety audits are on the way to being introduced but the manuals are still under preparation and there is still no legislative proposal regarding their introduction. In **Belgium** there is no systematic use of road safety audits. Road safety audits are not practiced in **Cyprus** but their introduction is being considered for new major schemes and major improvements. In the **Czech Republic**, the methodology for road safety audits has been developed and some pilot projects carried out. However, the proposal to introduce compulsory safety audits has been presented to the Parliament only in May 2004.

Recommendation: The EU should draw up technical guidelines concerning safety audit and safety impact assessment methods and require their adoption on all EU funded infrastructure. As a second step, the EU should introduce a Directive requiring that all major new road schemes be subject to an independent safety audit.

<sup>14</sup> In the framework of its "Road Safety Plan 2005-2007", the Spanish Autonomous Community of Catalonia is organising, for the first time in Spain, a comprehensive two week training programme dedicated to road safety audits.

Recommendation: Member States should examine their own procedures for the assessment of safety in road infrastructure projects to see how they can be made more effective in the light of practice in other Member States. In time, they should extend formal procedures to smaller schemes and the safety checking of existing roads. The needs of vulnerable road users should receive high consideration in the course of the process.

Recommendation: Road safety audits and safety impact assessments should be carried out independently of the design team. They should be undertaken by a team of adequately trained professionals who have experience and up-to-date expertise in road safety engineering and accident investigation.

### 3.3.2 Low cost measures for the treatment of high risk sites

Low cost road and traffic engineering measures comprise those physical measures, taken specifically to enhance the safety of the road system, that can be undertaken over the existing road platform and therefore have low capital cost, can be implemented quickly, and offer high ratios of benefit to cost. The application of low cost measures is a highly cost-effective method of reducing road accidents and casualties at high risk sites and on high risk route sections.

Examples of low cost measures include small physical changes to roads to make them safer, the installation of central refuges and islands, changes in the operation of junctions and improved lighting, signs and markings.

In **Poland**, a map of high risk sites is published on a website and a programme for the identification and elimination of high risk sites has been initiated. In **Portugal**, the National Road Safety Plan has introduced a high risk sites treatment programme. In **Belgium**, multidisciplinary working groups have been set up to analyse high risk sites in the three regions. In **France**, the treatment of high risk sites has been in place since the '70s. **Malta** has developed a system of high risk sites identification and makes use of advance warning signs in order to reduce accidents at those sites. Whenever possible, low cost measures are implemented to eliminate the problem. In **Spain**, the elimination of links with high accident risk has been constant during the last two decades. **Estonia** has developed and introduced a system of GPS and GIS tools for the accurate localisation of high risk sites. In **Hungary**, a programme for the treatment of high risk sites has been developed. **Latvia** has developed a map of high risk sites providing very useful information to the drivers. A high risk site treatment programme is implemented in **Cyprus** every 3-4 years. In **Greece** a big campaign for the identification and treatment of high risk sites was launched in the period 1983-1985. Some interventions were realised but no evaluation was made and the effort did not have a follow-up. In **Slovenia**, a systematic high risk sites treatment is established only on national roads. Accident location on local roads is not possible. In **Italy**, the National Road Safety Plan has promoted the development of projects for road

safety with special actions for vulnerable users. These actions include traffic calming measures at high risk sites.

As it can be seen from the examples above, the identification of high risk sites and their treatment with low cost measures is slowly becoming current practice in the SEC Belt countries. However, these interventions are rarely targeted to the specific needs of vulnerable road users, are not characterised by a systemic approach to the problem, and present substantial differences from one country to the other.

Recommendation: The EU should draw up technical guidelines concerning the harmonised management of high risk sites by means of low cost measures. Systematic and periodic road safety inspections should be undertaken for the detection of high risk sites.

Recommendation: Member States should examine their own procedures for the application of low cost measures to see how they can be made more effective in the light of practice in other Member States, in respect of data systems, decision making, implementation and evaluation. The needs of vulnerable road users should receive high consideration in the course of the process.

Recommendation: Regional and local authorities should be ready to share their experience of applying low cost measures with their counterparts in other Member States and to learn from them in return, especially by contributing to and drawing upon the EU's documentation of best practice and by exchange of visits by road safety engineers and managers.

### **3.3.3 The European Road Assessment Programme (EuroRAP)**

The European Road Assessment Programme (EuroRAP) rates European roads against harmonised safety protocols. The aim of EuroRAP is to provide a Europe-wide safety rating for roads across Europe: crash risks (number of killed and seriously injured road users per km driven) are shown on a colour-coded road map. Roads will also be rated using a (still under development) Road Protection Score (RPS). The RPS will look at the road protection potential in case of four different crash types: head-on collisions, run-off the road crashes, impacts at intersections and accidents with vulnerable road users. This will generate consumer information for the public and give road engineers and planners vital benchmarking information to show them how well, or badly, their roads are performing compared with others, both in their own and other countries.

The primary objective of EuroRAP is to rapidly reduce death and serious injury on European roads through a programme of systematic testing of risk that identifies



major safety shortcomings which can be addressed by practical road improvement measures.

For the time being, only the safety of British roads (trunk and primary routes), Dutch roads, Swedish roads and Spanish roads (federal roads and roads in Catalonia) have been rated. There are, however, plans to add roads from other European countries (Austria, Germany, Finland, Ireland, Italy, Switzerland) in the near future.

Recommendation: EuroRAP should work towards strengthening the representation of Member States from the SEC Belt countries and should continue improving the methodological soundness and acceptability of the Road Protection Score and of the crash risk mapping. The safety of vulnerable road users should be further developed when rating European roads.

## 4. Vehicle

Vehicle design rules, for which the EU has exclusive competence, play a major role in the protection of vulnerable road users by avoiding accidents (active safety) and by providing protection when accidents occur (passive safety).

Most pedestrians and cyclists are killed or injured after having been struck by a motor vehicle. At the same time, the very high risk associated with motorised two wheelers requires new efforts to understand what action is needed on the design of these categories of vehicles in order to increase their safety.

For the purposes of this work, the analysis of vehicle measures for the protection of vulnerable road users will be divided into three parts: accident prevention (or active safety) measures, accident protection (or passive safety) measures and consumer information measures.

### 4.1 Accident prevention or active safety

Accident prevention or active safety aims at preventing accidents from occurring and more and more often relies on information and communication technologies (eSafety technologies and intelligent transport systems or ITS). Very few ITS applications have been designed for vulnerable road users. However, many of these applications can still have a positive effect on the safety of this category of road users.

It also needs to be mentioned, however, that new technology has potential to save thousands of lives on European roads but can also be part of the problem. Research shows that, if poorly designed, new technology can create hazards for the driver and other road users and active safety measures might not always be used in the intended way.

#### 4.1.1 Alcolocks

Failing to comply with key legislation on drinking and driving makes an important contribution to the frequency or severity of road crashes involving vulnerable road users. In general, all functions which are important in the safe operation of a motor vehicle can be affected by high levels of alcohol in blood. Alcohol may also decrease motivation to comply with safety standards, which may result in an active search for dangerous situations such as competitive behaviour, or excessive speed.

Alcohol ignition interlocks (Alcolocks) are automatic control systems that are designed to prevent drivers from starting their car if their BAC level is over the legal limit. They require the driver to take a breath test before starting the car. If the driver fails the test, the device locks the ignition so the engine will not start.

A targeted implementation of Alcolock technologies to the vehicles of frequent offenders and to certain categories of professional drivers would reduce the number of alcohol-related accidents and, in urban areas, could indirectly improve the safety of vulnerable road users<sup>15</sup>.

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<sup>15</sup> In **Belgium**, Alcolocks are tested on recidivist drink-drivers and on alcohol-dependent persons in the framework of a European research project carried out in several countries by the IBSR-BIVV, BAsT, SWOV, TOI and the University of Valladolid.

Recommendation: The EU should work towards the implementation of Alcolocks and require their use by high risk excess alcohol offenders and by certain categories of professional drivers. This could eventually be developed into a mandatory specification for all drivers.

#### 4.1.2 Vision enhancement technologies

Telematics could contribute to reducing crashes, including collisions with vulnerable road users, through the use of vision enhancement systems such as radar, infrared cameras, image recognition technologies and head-up displays. Systems assisting car drivers in detecting motorcycles and incorporating this function in various safety warning systems could improve motorcycle safety (Hsu, 1997).

Vision enhancement technologies would be particularly helpful in supporting the driver at night and in bad weather conditions. Although only at research stage, these technologies are very promising, in particular for their safety improvement potential in urban areas.

However, some of these devices may lead drivers to adapt their behaviour, for example by driving faster when driver vision is improved. The extent of the road safety impact of such systems will therefore depend on how drivers will adapt their behaviour to the increased visibility conditions.

Recommendation: The EU should pursue and support research efforts on specific devices capable of alerting the driver of a risk of a collision with a vulnerable road user. Behavioural research should also be carried out before wide-scale implementation of this type of measures in order to avoid dangerous adaptative behaviours.

#### 4.1.3 Intelligent Speed Adaptation (ISA)

Compliance with speed limits will have a significant impact on the safety of vulnerable road users. Respecting the posted speed limits will, in many cases, help the driver to avoid an accident. If the collision is unavoidable, the consequences of the accident will be less severe if the driver is driving at a low speed.

New information and communication technologies offer the possibility of Intelligent Speed Adaptation (ISA). ISA is the global name for systems that “know” the permitted maximum speed and use that knowledge to inform the driver and/or intervene in the vehicle’s control to prevent it from being driven faster than the permitted limit <sup>16</sup>.

<sup>16</sup> Intelligent speed adaptation was tested in **Belgium**, in the city of Gent. The aims were scientific as well as promotional and the results were very satisfying with 90% of the volunteer private drivers wanting to keep ISA as they found it very adequate in helping the driver to adjust speed and to allow a more relaxed style of driving. Experimental trials of ISA (LAVIA) are also underway in **France**.

There are three types of ISA in terms of the degree of intervention of the system. The lowest level is informative or *Advisory* ISA. Next is voluntary or *Driver Select* ISA: here the information on speed limit is linked to the vehicle controls but the driver can choose whether or not to have the control enabled. Finally, there is *Mandatory* ISA where speed limiting is enforced.

Knowledge of the speed limit could come from roadside beacons or from a modified navigation system in the form of an enhanced on-board digital road map coded with speed limits for each road combined with a GPS-based location system. The latter is the so-called autonomous version of ISA which does not require extensive investment in roadside infrastructure.

A widespread implementation of ISA technologies would reduce the number of speed-related accidents, especially in speed-sensitive locations with vulnerable road users such as urban areas.

However, a number of steps have to be taken before ISA can be implemented:

- Agreement needs to be reached on standards for such aspects as: road maps, driver interface, vehicle control and, for Dynamic ISA, communications. This needs to be harmonised at a European level to enable a pan-European capability<sup>17</sup>.
- ISA-capable cars need to be put into manufacture.
- Before mandatory use can be considered, a majority of the vehicle fleet should be equipped.
- Public and political acceptance should be properly addressed<sup>18</sup>.

Recommendation: Work is required to develop harmonised standards for ISA systems towards eventual universal fitment. This could start at the simpler voluntary systems but would be capable of being developed into an eventual mandatory specification.

Recommendation: Encouragement should be given to manufacturers providing ISA systems via the European New Car Assessment Programme to enable the consumer to start benefiting from a voluntary system.

#### 4.1.4 ABS and CBS for motorcycles

Under current EU requirements, motorcycles' manufacturers are not obliged to fit ABS (Anti-lock Braking Systems, detecting when a wheel is about to lock-up and releasing the brakes slightly on that wheel ensuring that it maintains its grip on the

<sup>17</sup> An EC project on these issues ("Speedalert") is currently under way.

<sup>18</sup> Another important issue regards the responsibility of the update and maintenance of the speed limit database. A first option would see the road administration pay for the establishment, maintenance and update of the speed limit database. In alternative, the road user would support these costs.

road) or CBS (Combined Braking Systems, whereby front and rear brakes are applied by a single means of control).

On modern motorbikes, the powerful front wheel brake systems are, on the one hand, important to keep the enhanced driving performance in check, but on the other hand, in case of emergency braking, they cause the front wheel to lock and the driver to fall off the motorcycle.

Modern braking systems featuring ABS and CBS could avoid such falls and could improve motorcyclists' stability and safety under braking. However, taking advantage of new technology in motorcycle braking requires training for new and existing riders.

Recommendation: Anti-locking braking systems and combined braking systems should be mandatorily fitted to motorcycles. Manufacturers and retailers should be encouraged to provide advice to customers on the safe operation of such systems.

#### **4.1.5 Daytime running lights**

The use of daytime running lights (DRL) involves the illumination of lights (whether multi-purpose or specially designed) on the front of a vehicle during daylight hours to increase its conspicuity.

##### *a) Daytime running lights for cars*

A meta-analysis of the effects of daytime running lights in cars has shown that the measure contributes substantially to reducing the number of pedestrians and cyclists hit by cars, by respectively 15% and 10% (Elvik and Vaa, 2004). Although the effectiveness of DRL use is greater in countries which lie closer to the poles, results from studies indicate that there are still mostly positive effects to be gained in other countries.

Users of motorised two wheelers have expressed concerns that DRL use on cars could reduce the visibility of motorcyclists. They see a risk of the conspicuity of motorcycles already using DRL being reduced by a mandatory introduction of DRL for all motor vehicles. Research has suggested that such a negative effect (for which there is no empirical evidence so far) would however be offset by the benefits to powered two wheelers of increased car visibility (PROMISING, 2001 and Koornstra et al., 1997). As a matter of fact, generalised DRL use would increase the perception of cars by motorcyclists and would reduce the number of multiparty daytime accidents involving motorcyclists.

A mandatory fitment for daytime running lights in cars would therefore be beneficial for the safety of vulnerable road users.

##### *b) Daytime running lights for powered two wheelers*

Nearly all studies show that the use of motorcycle daytime running lights is even more effective than daytime running lights for cars, because the conspicuity of

motorcycles is less than that of cars. Recent studies have concluded that motorcyclists who use daytime running lights have a crash rate that is about 10% lower than that of motorcyclists who do not (PROMISING, 2001).

The use of daytime running lights for motorcycles is compulsory in several Member States. Some of these require action on the part of users to switch on headlamps and usage levels are around 90%. In other countries their use is encouraged and usage is often less than 70%.

Since motorcyclists have the highest risk, by far, of all road users, a European mandatory fitment standard should be introduced as soon as possible.

Recommendation: The EU should give early consideration to a mandatory fitment requirement of daytime running lights to all motorised road vehicles.

#### **4.1.6 Lights for bicycles**

The visibility of the cycle and its user is an important factor in preventing crashes. Many cycle crashes occurring at night or in twilight could be avoided if cycle lighting worked properly.

Ideally, cycle lamps should be visible at a distance of 300 m and front, rear and wheel reflectors should be fitted. The quality and use of lights could be improved by enabling the storage of separate light systems or by designing the lighting into the cycle frame.

Recommendation: Bicycles should be equipped with lamps and reflectors in order to improve the visibility of the bicycle to other road users and to reduce potential crashes at night and in dark weather conditions.

Recommendation: Research on the technical characteristics of lighting and reflector systems for bicycles should be undertaken.

#### **4.1.7 Enhanced mirror systems in trucks**

Every year a large number of vulnerable road users are killed or severely injured because of trucks turning right. The main cause of these accidents is the bad visibility field of the truck driver on the right side of the vehicle.

The mirror systems for trucks were first regulated in the Council Directive 71/127/EEC. Trucks with a gross weight over 7.5 tonnes had to be equipped with two mirrors outside (left and right), one mirror outside with a wide angle and one special mirror for the right side to recognise bicycle riders or pedestrians. Based on real accident investigations it became apparent that the view out of trucks,

especially to see pedestrians and bicycle riders was still restricted. Furthermore, there was a high potential danger whilst manoeuvring or reversing a truck.

In November 2003, the European Parliament and Council adopted Directive 2003/97/EC on rear view mirrors and supplementary indirect vision systems for motor vehicles. This Directive will improve vulnerable road users' safety by upgrading the performance of rear view mirrors and by accelerating the introduction of new technologies that increase the field of indirect vision for drivers. The first effect of these new rules should start to be seen on new models from 2005 onwards.

The European Commission has also assessed the benefits and costs of retrofitting such systems to existing vehicles and the benefits are approximately four times higher than the costs of retrofitting lateral blind spot mirrors to existing goods vehicles over 3.5 t.

Recommendation: The European Commission should propose a Directive mandating the retrofitting of lateral blind spot mirrors to the existing fleet of goods vehicles over 3.5 t.

## **4.2 Accident protection or passive safety**

As indicated in the previous section, vehicle engineering improvements for safety can either be achieved by modifying the vehicle to help the driver avoid accidents (active safety) or by providing protection against injury in the event of a crash (passive safety).

Although much can be done to stop some accidents from happening, many of the active safety improvements are still volatile with safety value and their feasibility and public acceptability still need to be demonstrated. A British study (Broughton et al., 2000) reviewed the effectiveness of casualty reduction measures nationally between the early 1980s and the mid-1990s and demonstrated that the greatest reduction was from vehicle crash protection. Reducing injury risk in accidents must therefore remain a priority as passive safety measures have still a large potential for the safety benefit of vulnerable road users.

### **4.2.1 Safer car fronts**

In most of their collisions with motor vehicles, pedestrians and cyclists are hit by the front of a passenger car. By 1994 the European Enhanced Vehicle-safety Committee (EEVC) had developed a complete series of tests to assess the injuriousness of the fronts of passenger cars. Crash dummy parts used in these tests represent an adult leg, upper leg and head, and a child head. These are used to evaluate respectively the bumper, the bonnet leading edge and the bonnet top of the passenger car in respect of the level of injury reduction achieved by their design. The EEVC test methods were further improved in 1998.

Cars can be designed to be less injurious to vulnerable road users who, despite all efforts to minimise the risk of this, are struck by them. If all cars on the road today were designed to pass the EEVC tests, up to 20% of deaths and serious injuries to pedestrians and cyclists could be prevented annually in the pre-enlargement EU.

Requiring new cars to pass EEVC tests is one of the most important actions that the EU could take to improve road safety.

However, the pedestrian protection Directive (2003/102/EC) fails to implement with certainty the 22-years research-based EEVC crash tests. The Directive mandates, in a first phase, only weaker tests offering 70% less protection than EEVC. EEVC tests will only be implemented in a later stage (starting in 2010) and subject to a feasibility study to be carried out in 2004.

The feasibility study required under the terms of the 2003 Directive on pedestrian protection has now been completed. The study examines the feasibility of Phase II provisions and any possible alternative measures, whether passive or a combination of both active and passive, which would be at least equivalent in terms of actual effectiveness.

Before proposing any amendments, the Commission wishes to complete its review by holding a public stakeholder consultation on the study and its implications. Following the consultation the Commission may present a proposal for amendment of the Directive, where appropriate.

Recommendation: The Commission should amend the current weak Directive on pedestrian protection and mandate the immediate adoption of the full EEVC crash tests leading to safer car fronts for pedestrians and cyclists.

#### **4.2.2 Bull bars**

Originally, bull bars were meant to protect cars against animal strike. However, animal strike is rather unlikely in most countries of Europe where bull bars have been increasingly used in recent years as a “cosmetic” accessory.

EEVC WG 10 has performed a series of tests on vehicles equipped with bull bars and has shown that these bent and welded steel tubes are very unfriendly to vulnerable road users. If bull bars continue to be used, the number of fatalities and the severity of injuries are expected to increase in the coming years.

European, Japanese and Korean carmakers committed in 2001 to stop installing “rigid” bull bars on new cars from 2002. Despite this voluntary commitment, the European Parliament called for a complete ban of such bull bars, which are also supplied as aftermarket equipment, by legislation. The Commission then proposed a Directive to ensure that all frontal protection systems satisfy a series of safety tests akin to the EEVC tests.

However, the application of a derivative of EEVC tests is not enough to ensure a high level of protection as this would still allow “aggressive” bull bars to be fitted on vehicles, thus potentially causing severe damage to vulnerable road users. Only the application of the full EEVC tests to all bull bars, including retrofitted ones, would prevent any harmful design of bull bars.



Recommendation: The EU should require that bull bars to be fitted on vehicles are subjected to the full EEVC tests.

#### **4.2.3 Sport Utility Vehicles (SUVs)**

The proliferation of Sport Utility Vehicles (SUVs) in urban areas is causing increasing concern to the safety community as this category of motor vehicles can have very negative impacts on the safety of vulnerable road users.

As a matter of fact, the vehicle mass of SUVs poses additional threats to vulnerable road users. Increased use in urban areas produces an unfair balance between the SUV riders' right to mobility and the vulnerable road users' right to safety.

Recommendation: The EU should examine the impact of SUVs on the safety of vulnerable road users. Policies (such as taxes, charges, penalties or restrictions) are needed to limit the use of these vehicles in urban areas.

#### **4.2.4 Side underrun protection in trucks**

When heavy goods vehicles and vulnerable road users are side by side and the vehicle turns in their direction, the vulnerable road users are at risk of being run over by the vehicle.

Trucks and trailers have to be equipped with a protection system at the side as defined in the Council Directive 89/297/EEC. Apart from protecting car occupants in case of lateral collision with a truck, side underrun protection systems are also aimed at preventing pedestrians, bicycle riders and motorcyclists from falling under the wheels of the truck when it turns. The protection system fills the open space between the wheels: however, current legislation accepts an "open" frame (e.g. two planks on the side with a maximum distance of 30 cm). Therefore, under some circumstances, pedestrians and bicycle riders could be caught by such a side underrun protection system. Furthermore, for side collisions with motorbikes, the strength of current side underrun protection systems is insufficient.

It would be desirable for the existing requirements to be updated and to specify full area side underrun protection systems. Investigations have shown that improved side underrun protection systems could reduce fatalities to pedestrians and cyclists in such situations by about 45% (ETSC 2001b). In addition the strength requirement should be increased to accommodate side collisions with motorbikes.

Recommendation: Side underrun protection legislative requirements need to be amended to respond to the new needs identified by accident research. Side protection which closes off the open space between the wheels of the heavy goods vehicle should become mandatory for all new heavy goods vehicles.

#### 4.2.5 Passive safety for motorcycles

Of all road users, motorcyclists have by far the highest injury risks. If an accident occurs, 98% of motorcyclists sustain injuries (ETSC 2001b). Accident studies show that the major body regions for injury risk beside the head are the leg, shoulder, elbows, and pelvis. The two main areas where passive safety measures could deliver benefits to motorcycle safety are leg protectors and air bag systems.

##### *a) Motorcycle leg protection*

Injuries to the legs of the motorcyclist occur in approximately 80% of all accidents. However, the kinematics differ depending on the type of collision. In all collisions in which the motorcyclist is hit in the side by a car or other party, the forces involved impact the legs directly. Leg protectors could help to reduce such injuries. Studies show different possibilities for optimising leg protection (Otte, 1994).

In collisions in which the motorcyclist crashes into another party, there is only a secondary impact of force on the legs. In this case, the head and upper torso are the first to make contact with the other party. In this situation, crash test results have indicated that motorcycle leg protectors, while effectively protecting the lower extremities, could have a negative effect on the risk of head injury by influencing the path of movement.

Recommendation: Further research is needed to determine motorcyclists' seating positions with a relatively high seat elevation and upright body position to reduce the possibility of entrapment of the lower extremities.

Recommendation: Further research is needed to provide leg protection to protect the motorcyclist from the impact of external forces and to serve as an element that affects the trajectory in a positive way.

##### *b) Airbags*

Studies with airbags have been carried out in the past (Spornier et al., 1990) and have shown the potential for airbags to reduce injuries to motorcyclists involved in frontal impacts. However, motorised two wheelers' organisations have expressed concerns about the airbags' limited potential in some accidents and their negative effect in others.

Recommendation: Further research is needed on the development of airbag systems for motorcycles and on their effects on riders' safety.

### *c) Full framed chassis motorcycles*

Full framed chassis motorcycles have shown that it is possible to greatly enhance the passive safety of motorcyclists without jeopardizing the maneuverability and small space requirements of motorcycles. Furthermore, the absence of helmet requirements helps motorcyclists to have full lateral vision as other road users.

## **4.3 Consumer information programmes**

People buying a car or a motorcycle need objective information on their safety performance in order to be able to make an informed choice.

The availability of safety information has an effect on buying decisions and encourages manufacturers to innovate in safety and to put safety designs on the market in advance of the entry into force of legislative standards.

### **4.3.1 The European New Car Assessment Programme (EuroNCAP)**

The European New Car Assessment Programme (EuroNCAP), which aims at testing and publishing new car safety against harmonised testing protocols, was introduced to complement the EU type-approval system. This programme aims to develop consumer awareness concerning the safety performance of new cars in various test conditions which are representative of severe injury producing impacts and has made Europe a leading market for safety.

EuroNCAP tests the crashworthiness of new cars by rating them with respect to front and side impact, pedestrian test and child protection. Results are stated in terms of stars: five stars (four in the case of the pedestrian test) represent the best performance, zero stars the worst. Since the end of 1996, the EEVC tests have been used in EuroNCAP to test the level of pedestrian protection of new cars.

There is no doubt that EuroNCAP has dramatically improved car safety with a consumer focussed approach: in recent years, it has become almost commonplace for EuroNCAP-tested vehicles to achieve either four stars or the top rating of five stars for occupant safety in front and side impact crashes.

However, most manufacturers have, as yet, made little progress in improving pedestrian protection. Results show that current car designs do not fulfil EEVC pedestrian protection requirements and that swift action is needed if new models have to guarantee an acceptable level of pedestrian protection. No vehicle has ever been awarded the four stars top rating for pedestrian protection and only very few cars have achieved three stars. Most cars score one or two stars and some of them have scored zero.

EuroNCAP needs to continue to evolve to provide manufacturers an incentive to improve all aspects of car safety. Awarding an overall safety rating to cars, incorporating all the different EuroNCAP safety factors, would give manufacturers a genuine consumer focussed incentive to improve all aspects of car safety and not just for the occupants.

The test results must take into account the overall safety of cars. In other words, an independent consumer information programme should not attribute five stars to a car which performed poorly in pedestrian protection.

Recommendation: The EU should actively encourage EuroNCAP to combine pedestrian and child restraint performance with occupant ratings and to award an overall safety rating to the tested cars.

The European Commission provides financial support and takes part in the technical decisions of EuroNCAP. Five member states and a Spanish region are also members. It would, however, be important to encourage more countries to join EuroNCAP: joining the programme will give member countries an enhanced basis for providing consumer information and would provide more funds for EuroNCAP's work. It is relevant that, out of 16 SEC Belt countries, only one (France) is a member of the EuroNCAP consortium.

Recommendation: EuroNCAP should work towards strengthening the representation of Member States, especially from the SEC Belt countries, in the programme. Member States, in turn, should improve the dissemination of EuroNCAP results.

#### **4.3.2 The European New Motorcycle Assessment Programme (EuroNMAP)**

The success of the EuroNCAP system in providing improved protection to car occupants has already been acknowledged in the previous section. The safety improvements resulting from this programme are clearly demonstrated by the higher rating achieved by newer models compared to equivalent models when testing began.

A large amount of work has already been developed by the International Organisation for Standardization to establish the technical basis for motorcycle crash tests (ISO, 1996) but more research is needed to explore whether a similar system (EuroNMAP, European New Motorcycle Assessment Programme) could be implemented to inform motorcyclists on the safety performance of different motorcycles.

Recommendation: The EU should undertake some exploratory work to assess the feasibility of a European New Motorcycle Assessment Programme (EuroNMAP) and to identify primary and secondary safety areas where realistic assessments could be made as part of a consumer information programme.

## **5. Summary of recommendations**

### **5.1 General**

- Without neglecting vulnerable road users' responsibility to abide by traffic rules, legislation should take into account the different risk-creation propensity of motorised and non-motorised road users and make motorised users more aware and more responsible of the risk they create to non-motorised vulnerable road users.
- The EU should encourage Member States to collect exposure data on pedestrian and cyclist travel and include it in the CARE database.
- In the case of pedestrians' and cyclists' accidents the level of underreporting needs to be regularly ascertained. Statistical analysis based on standard crash data needs to be complemented by approaches such as direct observation in traffic of events that are valid proxies for crashes (traffic conflict techniques); the observation of particular characteristics of traffic behaviour and analysis of their determinants; and in-depth crash injury research.
- In the medium term, and with the objective of reducing the level of underreporting of pedestrians' and cyclists' accidents, a linkage system between police based accident databases and hospital databases should be developed.

### **5.2 Behaviour**

- The usage rate of crash helmets should be brought to 100% with a mix of stronger enforcement and awareness raising campaigns. Research should be carried out on new models providing adequate ventilation and encouraging use in hot weather conditions.
- Competent authorities should make sure that only type-approved crash helmets are used and that they are properly restrained. A "safety helmet fitting guidance" should be provided with the helmet. Subject to a positive cost/benefit analysis the EU should also provide the framework for a EuroNHAP (European New Helmet Assessment Programme) to help consumers differentiate between products and to develop an advanced standard for safety helmets.
- Further research should be conducted on the different types of motorcycle helmets (full face, half type, open face) and the protection level they offer.
- The use of cycle helmets should be strongly encouraged, partly by awareness raising campaigns and partly by making their design more attractive.
- Research should be conducted on ways of increasing acceptability of bicycle helmets by cyclists.
- With all due precaution, in order not to discourage walking and cycling, road users should be made aware of the danger that being a pedestrian, a cyclist or a motorcyclist may pose to their lives. They should be encouraged to take particular care, to make themselves visible and to scrupulously follow traffic rules. Motorcyclists should be aware of the difficulties other road users (including

cyclists and pedestrians) have in motorcycle detection and in the distance and relative speed perception towards a motorcycle.

- Member States should adopt an appropriate legal framework for the regulation and enforcement of vulnerable road users' behaviour in traffic.
- The European Union should harmonise general speed limits in urban areas throughout the EU by requiring each Member State to impose its own limit at or below 50 km/h and actively encourage 30 km/h in residential areas.
- Drivers' choice of speed should be influenced by imposing and enforcing speed limits, and by educating drivers. Because speeds are chosen by individual drivers, measures to manage speed need to reduce the perceived advantages of excess and inappropriate speed, and increase the perceived disadvantages.
- The EU should encourage sharing of international best practice in the enforcement of speed limits, including experience in using speed cameras.
- The EU should promote information campaigns at the European level on the consequences of excess and inappropriate speed to encourage better understanding of the need for appropriate speed for safety.
- The EU should legislate to impose that the blood alcohol limit (maximum permitted BAC) should not exceed 0.5 mg/ml (0.2 mg/ml for novice drivers and professional drivers). Countries should be also encouraged to follow the example of countries that have a 0.2 mg/ml BAC limit.
- The EU should encourage Member States to regularly apply random breath testing surveys to determine levels of 'over the limit' drinking and to take appropriate countermeasures.
- Member States need to take appropriate actions to combat aggressive driving and to ensure equal rights for different road users. Drivers need to be educated, their behaviour influenced by targeted campaigns and each episode of this type of misconduct strictly sanctioned.
- School education, especially road safety education, should involve explicit time tabled curricula for each grade. Particularly important topics are walking to and from school, using school or public transport and training courses for cyclists and light motorised two-wheelers.
- The responsible authorities should rectify the lack and insufficiency of preparation of teachers for the very demanding task of traffic safety education in schools, including behaviour as pedestrians and cyclists.
- Research should be conducted on the effects on casualty reduction of particular interventions in the fields of information, education and practical training and on their cost-effectiveness.
- The EU should encourage information exchange and develop technical guidelines for professionals on driver training, giving particular emphasis to the integration of vulnerable road users into the traffic system.

- The EU should encourage the exchange of best practice guidelines on how to organise and run a successful campaign in favour of vulnerable road users. Campaigns should also receive EU funding and their impact should be formally and independently evaluated.
- The EU should devise and widely disseminate a European Highway Code containing the most important traffic rules from each Member State. The European Highway Code would provide an opportunity to emphasise to drivers throughout Europe that most national highway codes in Europe urge or require them to behave with consideration towards vulnerable road users, especially children, the elderly persons and those with reduced mobility.
- Campaigns should raise awareness on issues such as the limitations of motorcycle's manoeuvrability in slippery conditions and the limited peripheral vision when a helmet is worn.
- Member States should, on the basis of detailed crash data analysis, set specific targets for compliance with key traffic rules which influence the safety of vulnerable road users. These targets should specify the offences to be enforced and the progressively increasing compliance level for each offence. After the targets have been set, enough enforcement resources should be assigned with a view to their achievement.
- The revenues from traffic fines should be earmarked to the improvement of road safety. Enforcement activities should primarily serve as a deterrent to road users inclined to commit traffic offences.

### **5.3 Infrastructure**

- In designing (or redesigning) rural roads, a range of engineering measures should be adopted to encourage a steady, safe speed and to make hazards perceptible.
- Responsible authorities should give priority to achieving a situation in which rural roads are constructed according to good construction standards and are regularly maintained by removing debris and loose materials, correcting defects in the riding surface, guaranteeing efficient drainage and using anti-skid road markings.
- The EU should adapt to technical progress the Community standards applicable to road equipment and should require their adoption on all EU funded infrastructure.
- In designing new infrastructure, responsible authorities should make sure that new roads are built without dangerous street furniture and, when this is not possible, street furniture should be designed to be more forgiving. Mandatory road safety audits should remove roadside hazards within the design stages of a scheme.
- On existing infrastructure responsible authorities should eliminate unnecessary obstacles, move (where possible) obstacles away from the roadside or, in the last resort, isolate existing obstacles by means of an energy absorbing barrier.

Mandatory road safety inspections should help identifying and removing existing roadside hazards.

- Responsible authorities should identify a road hierarchy according to the functions of different roads. Roads serving mainly a flow function should be relieved of all other functions, whereas roads serving mainly access or residential functions should be relieved of flow and distributor functions. Inconsistencies between design and function should be minimised and where they occur they should be properly signed.
- On local distributor and access roads different categories of user should be separated where this is practicable. Design should achieve levels of speed that are compatible with local activity, even when there is little traffic.
- Traffic calming measures, based upon physical measures such as roundabouts, road narrowings, chicanes and road humps, should be introduced as part of area-wide urban safety management. Speed limit zones of 30 km/h should become widespread in urban areas.
- The European Union should develop technical parameters (on the width of road cross section, pedestrian traffic, number of lanes) for the establishment of Zones 30.
- Local authorities should provide shorter and safer routes for pedestrians and cyclists by ensuring that trips are short and routes direct and that the quickest routes are also the safest. In order to promote safer route choice, travel time should be increased on unsafe, undesired routes and decreased on safe, desired routes. "Safe routes to school" schemes should be developed in order to increase the safety of children.
- The location and design of pedestrian crossings should be the object of accurate analysis. Pedestrian safety should be increased by installing refuge islands or a continuous central reservation. Dropped kerbs at crossings should be provided to assist those with physical impairments whereas tactile surfaces should be foreseen for those with visual disabilities. On roads with higher traffic levels signal-controlled crossings should be the rule.
- In order to make them user-friendly, grade-separated crossings should be without steps or troublesome ramps and should keep vulnerable road users on their natural desire-line whilst motor vehicles undergo the changes in grade and level. Subways should be brightly lit, regularly cleaned, have good through visibility and be consistently overlooked.
- Responsible authorities should make roundabouts safer for vulnerable road users by reducing the width of the circulatory carriageway, increasing deflection on entry and improving signing, road markings and conspicuity. Physical barriers to prevent crossing over central islands should also be installed.
- The EU should draw up technical guidelines concerning safety audit and safety impact assessment methods and require their adoption on all EU funded infrastructure. As a second step, the EU should introduce a Directive requiring that all major new road schemes be subject to an independent safety audit.



- Member States should examine their own procedures for the assessment of safety in road infrastructure projects to see how they can be made more effective in the light of practice in other Member States. In time, they should extend formal procedures to smaller schemes and the safety checking of existing roads. The needs of vulnerable road users should receive high consideration in the course of the process.
- Road safety audits and safety impact assessments should be carried out independently of the design team. They should be undertaken by a team of adequately trained professionals who have experience and up-to-date expertise in road safety engineering and accident investigation.
- The EU should draw up technical guidelines concerning the harmonised management of high risk sites by means of low cost measures. Systematic and periodic road safety inspections should be undertaken for the detection of high risk sites.
- Member States should examine their own procedures for the application of low cost measures to see how they can be made more effective in the light of practice in other Member States, in respect of data systems, decision making, implementation and evaluation. The needs of vulnerable road users should receive high consideration in the course of the process.
- Regional and local authorities should be ready to share their experience of applying low cost measures with their counterparts in other Member States and to learn from them in return, especially by contributing to and drawing upon the EU's documentation of best practice and by exchange of visits by road safety engineers and managers.
- EuroRAP should work towards strengthening the representation of Member States from the SEC Belt countries and should continue improving the methodological soundness and acceptability of the Road Protection Score and of the crash risk mapping. The safety of vulnerable road users should be further developed when rating European roads.

## **5.4 Vehicle**

- The EU should work towards the implementation of Alcolocks and require their use by high risk excess alcohol offenders and by certain categories of professional drivers. This could eventually be developed into a mandatory specification for all drivers.
- The EU should pursue and support research efforts on specific devices capable of alerting the driver of a risk of a collision with a vulnerable road user. Behavioural research should also be carried out before wide-scale implementation of this type of measures in order to avoid dangerous adaptive behaviours.
- Work is required to develop harmonised standards for ISA systems towards eventual universal fitment. This could start at the simpler voluntary systems but would be capable of being developed into an eventual mandatory specification.

- Encouragement should be given to manufacturers providing ISA systems via the European New Car Assessment Programme to enable the consumer to start benefiting from a voluntary system.
- Anti-locking braking systems and combined braking systems should be mandatorily fitted to motorcycles. Manufacturers and retailers should be encouraged to provide advice to customers on the safe operation of such systems.
- The EU should give early consideration to a mandatory fitment requirement of daytime running lights to all motorised road vehicles.
- Bicycles should be equipped with lamps and reflectors in order to improve the visibility of the bicycle to other road users and to reduce potential crashes at night and in dark weather conditions.
- Research on the technical characteristics of lighting and reflector systems for bicycles should be undertaken.
- The European Commission should propose a Directive mandating the retrofitting of lateral blind spot mirrors to the existing fleet of goods vehicles over 3.5 t.
- The Commission should amend the current weak Directive on pedestrian protection and mandate the immediate adoption of the full EEVC crash tests leading to safer car fronts for pedestrians and cyclists.
- The EU should require that bull bars to be fitted on vehicles are subjected to the full EEVC tests.
- The EU should examine the impact of SUVs on the safety of vulnerable road users. Policies (such as taxes, charges, penalties or restrictions) are needed to limit the use of these vehicles in urban areas.
- Side underrun protection legislative requirements need to be amended to respond to the new needs identified by accident research. Side protection which closes off the open space between the wheels of the heavy goods vehicle should become mandatory for all new heavy goods vehicles.
- Further research is needed to determine motorcyclists' seating positions with a relatively high seat elevation and upright body position to reduce the possibility of entrapment of the lower extremities.
- Further research is needed to provide leg protection to protect the motorcyclist from the impact of external forces and to serve as an element that affects the trajectory in a positive way.
- Further research is needed on the development of airbag systems for motorcycles and on their effects on riders' safety.
- The EU should actively encourage EuroNCAP to combine pedestrian and child restraint performance with occupant ratings and to award an overall safety rating to the tested cars.

- EuroNCAP should work towards strengthening the representation of Member States, especially from the SEC Belt countries, in the programme. Member States, in turn, should improve the dissemination of EuroNCAP results.
- The EU should undertake some exploratory work to assess the feasibility of a European New Motorcycle Assessment Programme (EuroNMAP) and to identify primary and secondary safety areas where realistic assessments could be made as part of a consumer information programme.

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# Appendix

Participants to the ETSC Seminars of May 2004 in Madrid, Warsaw, Brno

Dago Antov	Stratum	Estonia
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Joao Cardoso	LNEC	Portugal
Dominique Cesari	INRETS	France
Elena de la Peña	Spanish Road Association	Spain
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Maria Dobesova	LUCIDO	Slovakia
Lorenzo Domenichini	University of Florence	Italy
Harris Evripidou	Traffic Unit Cyprus Police	Cyprus
Harri Kuusk	Estonian Road Administration	Estonia
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Yannis Handanos	Institute of Transportation Engineers	Greece
Jaroslav Heinrich	CDV	Czech Republic
Péter Lányi	Ministry of Economy and Transport	Hungary
Jüri Lavrentjev	University of Tallinn	Estonia
Ziedonis Lazda	Ministry of Transport	Latvia
Gundars Liberts	Riga Technical University	Latvia
Panagiotis Kalaitzis	Ministry of Communications and Works	Cyprus
Vratislav Kelnar	CDV	Czech Republic
Gilles Malaterre	INRETS	France
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George Morfakis	Ministry of Communications and Works	Cyprus
Aristotelis Naniopoulos	University of Thessalonica	Greece
Irén Papp	Psychologist	Hungary
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Marko Polič	University of Ljubljana	Slovenia
Wojciech Przybylski	Motor Transport Institute	Poland
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Austrian Road Safety Board (KfV)  
Automobile and Travelclub Germany (ARCD)  
Belgian Road Safety Institute (IBSR/BIVV)  
Birmingham Accident Research Centre, University of Birmingham  
Centro Studi Città Amica (CeSCAM), University of Brescia  
Chalmers University of Technology  
Comité Européen des Assurances (CEA)  
Commission Internationale des Examens de Conduite Automobile (CIECA)  
Czech Transport Research Centre (CDV)  
Deutscher Verkehrssicherheitsrat (DVR)  
Dutch Transport Safety Board (RvTV)  
European Federation of Road Accident Victims (FEVR)  
Fédération Internationale de Motocyclisme (FIM)  
Finnish Vehicle Administration Centre (AKE)  
Folksam Research  
Fundación Instituto Tecnológico para la Seguridad del Automóvil (FITSA)  
Motor Transport Institute (ITS)  
Nordic Traffic Safety Committee  
Parliamentary Advisory Council for Transport Safety (PACTS)  
Prévention Routière  
Swedish National Society for Road Safety (NTF)  
Swiss Council for Accident Prevention (bfu)  
Traffic Safety Committee, Federation of Finnish Insurance Companies (VALT)  
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