**Review of main conclusions of completed relevant projects**

| **Authors**         | Akkermans Lars (BIVV/IBSR)  
                                                   Ivanka Orozova-Bekkevold (DTF) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status and date</strong></td>
<td>Final 15/03/2007</td>
</tr>
<tr>
<td><strong>Dissemination level</strong></td>
<td>Public</td>
</tr>
<tr>
<td><strong>Workpackage</strong></td>
<td>WP2, Model for an enforcement data collection system and associated pilots</td>
</tr>
<tr>
<td><strong>Task</strong></td>
<td>2.1 Listing, characterization and selection of needed data on each link in the enforcement chain</td>
</tr>
<tr>
<td><strong>Project start date and duration</strong></td>
<td>01 March 2006, 30 Months</td>
</tr>
<tr>
<td><strong>File Name:</strong></td>
<td>PEPPER_W1_WP2_20070315.PDF</td>
</tr>
</tbody>
</table>
**PEPPER Project Consortium**

<table>
<thead>
<tr>
<th>No.</th>
<th>Institution</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VTT Technical Research Centre of Finland</td>
<td>FI</td>
</tr>
<tr>
<td>2</td>
<td>4Sight, Ergonomics &amp; Safety</td>
<td>ISR</td>
</tr>
<tr>
<td>3</td>
<td>IBSR-BIVV Institut Belge Pour La Sécurité Routière</td>
<td>BE</td>
</tr>
<tr>
<td>4</td>
<td>KLPD/TISPOL Korps Landelijke Politiiediensten /</td>
<td>NL</td>
</tr>
<tr>
<td>5</td>
<td>bfu Schweizerische Beratungsstelle für Unfallverhütung</td>
<td>CH</td>
</tr>
<tr>
<td>6</td>
<td>CERTH/HIT Hellenic Institute of Transport</td>
<td>GR</td>
</tr>
<tr>
<td>7</td>
<td>BAST Bundesanstalt für Strassenwesen</td>
<td>D</td>
</tr>
<tr>
<td>8</td>
<td>CDV Transport Research Centre</td>
<td>CZ</td>
</tr>
<tr>
<td>9</td>
<td>DTF Danish Transport Research Institute</td>
<td>DK</td>
</tr>
<tr>
<td>10</td>
<td>IBDIM Road and Bridge Research Institute</td>
<td>PL</td>
</tr>
<tr>
<td>11</td>
<td>INRETS Institut National de Recherche sur les Transports et leur Sécurité</td>
<td>FR</td>
</tr>
<tr>
<td>12</td>
<td>KfV Kuratorium für Verkehrssicherheit (Co-ordinator)</td>
<td>AT</td>
</tr>
<tr>
<td>13</td>
<td>SWOV Institute for Road Safety Research</td>
<td>NL</td>
</tr>
<tr>
<td>14</td>
<td>TØI Institute of Transport Economics</td>
<td>NO</td>
</tr>
<tr>
<td>15</td>
<td>TRL Limited</td>
<td>UK</td>
</tr>
<tr>
<td>16</td>
<td>UPM Universidad Politécnica de Madrid</td>
<td>ES</td>
</tr>
<tr>
<td>17</td>
<td>VTI Swedish National Road and Transport Research Institute</td>
<td>SE</td>
</tr>
<tr>
<td>18</td>
<td>ETSC European Transport Safety Council</td>
<td>INT</td>
</tr>
</tbody>
</table>
Abstract


Working Paper 1 of the PEPPER project contains a review of the main conclusions and findings of completed and on-going projects that are related to law enforcement and traffic law enforcement as well as a preliminary list of variables and indicators that can be used to assess Traffic Law Enforcement (TLE) efficiency for the key fields of speeding, drink driving and the use of restraints in vehicles. The objectives of this paper are the presentation of relevant information concerning Law Enforcement from both the EC Recommendations of October 21st, 2003 on enforcement in the field of road safety as well as literature regarding traffic safety and other fields of interest, the identification of groups of stakeholders in the field of TLE and an overview of variables and indicators that could be used to assess TLE-efficiency.

A literature review was performed on literature available from both past and present EU projects as well as literature from other institutions that are linked with law enforcement. The findings are that an extensive amount of literature is available and can be combined in a large questionnaire. The practical usability of such a questionnaire was questioned however and slimming down needs to be considered.
Contents

1 INTRODUCTION ............................................................................................................. 9

2 TRAFFIC LAW ENFORCEMENT AND THE ENFORCEMENT CHAIN ..................... 11
  2.1 Law Enforcement.................................................................................................... 11
  2.2 Traffic Law and Traffic Law Enforcement ............................................................ 12
  2.3 How can Traffic Law Enforcement work?............................................................... 14
     2.3.1 Familiarity with and acceptance of traffic laws ............................................ 16
     2.3.2 Prevention and repression: the influence of objective and subjective risk .... 16
     2.3.3 Prosecution and punishment .......................................................................... 19
     2.3.4 Traffic law enforcement and communication ................................................. 19
  2.4 The enforcement chain ............................................................................................ 20
  2.5 Chapter summary .................................................................................................... 22

3 RELEVANT LITERATURE ........................................................................................... 23
  3.1 Method and selection of literature ........................................................................... 23
  3.2 White paper, European transport policy for 2010: time to decide. ......................... 24
  3.3 Finished projects regarding traffic safety including traffic law enforcement .......... 26
     3.3.1 ESCAPE (Enhanced Safety Coming from Appropriate Police Enforcement) 26
     3.3.2 GADGET (Guarding Automobile Drivers through Guidance Education and
           Technology) ........................................................................................................... 29
     3.3.3 VERA (Video Enforcement for Road Authorities) ........................................... 31
     3.3.4 VERA 2 (Video Enforcement for Road Authorities) ....................................... 32
     3.3.5 SARTRE (Social Attitudes to Road Traffic Risk in Europe) ............................. 34
     3.3.6 ROSEBUD (Road Safety and Environmental Benefit-Cost and Cost-Effectiveness
           Analysis for Use in Decision-Making) ................................................................. 38
     3.3.7 TIS-study: Comparative study of road traffic rules and corresponding
           enforcement actions in the Member States of the European Union ................. 42
     3.3.8 CAPTIVE ........................................................................................................... 44
     3.3.9 FAIR (Fully Automatic Integrated Road Control) ............................................. 46
  3.4 On-going projects regarding traffic safety including traffic law enforcement ........... 47
     3.4.1 SafetyNet .......................................................................................................... 47
     3.4.2 ETSC & enforcement monitoring .................................................................... 50
     3.4.3 SUPREME (Summary and publication of best practices in road safety in the
           EU Member States) ................................................................................................. 52
     3.4.4 CARE (Community database on Accidents on Roads in Europe) .................... 53
     3.4.5 Switzerland: enforcement indicators .................................................................. 54
     3.4.6 TISPOL (European Road Police Network) ......................................................... 55
3.5 Enforcement efficiency: literature from other domains

3.5.1 EuReporting: European system of social indicators

3.5.2 The Policing Performance Assessment Framework (United Kingdom)

3.5.3 VERA Institute of Justice

3.5.4 CEPEJ (European Commission for the Efficiency of Justice)

4 VARIABLES AND INDICATORS

4.1 Indicators from “Commission recommendation of 21 October 2004 on enforcement in the field of road safety (2004/345/EC)”

4.1.1 Speed enforcement

4.1.2 Drink driving enforcement

4.1.3 Restraint (i.e. seat belt) use

4.2 Preliminary list of indicators and variables

4.2.1 Variables and indicators regarding road safety (data available from national statistics, EU projects and databases, etc.)

4.2.2 Variables and indicators regarding the planning of enforcement

4.2.3 Variables and indicators regarding actual enforcement

5 REFERENCES
EXECUTIVE SUMMARY

The working paper 1 (W1) ‘Review of main conclusions of completed relevant projects’ prepared by Work Package 2 (WP2) of the PEPPER project contains a brief introduction to the concept of Traffic Law Enforcement (TLE), a detailed review of literature regarding traffic safety, law enforcement and the possibilities for measuring the efficiency of law enforcement.

The paper gives a preliminary list of variables or indicators that offer an overview on how to measure the efficiency of the different elements of the TLE. This preliminary list can then be used further in the PEPPER project to create a conceptual model for a European TLE monitoring database.

The PEPPER project focussed on TLE the target areas of speeding, use of seat belts and drink driving. The following groups of variables and indicators were identified for each of these target areas:

- Variables and indicators regarding road safety:
  This group contains both general information offering insight in the traffic safety situation in general as well as more detailed information regarding legislation, objective behaviour measures, accident rates and road user attitudes.

- Variables and indicators regarding the planning of enforcement:
  This group contains information regarding national enforcement plans in general as well as information for enforcement plans for each of the three target areas. The information gathered mostly describes the enforcement method used by police or non-police organisations in terms of equipment, man-power, location and timing of traffic checks, etc.

- Variables and indicators regarding actual enforcement:
  This group describes traffic safety related actions in terms of the deployment of the selected enforcement method, the number of violations, sanctions, follow-up procedures, court decisions, etc.

This collection of variables and indicators gives an overview of the information that theoretically can or should be gathered and combined to give a complete overview of the efficiency of different TLE programmes.
List of abbreviations

ASC: automated speed control
BAC: blood alcohol content
TLE: traffic law enforcement
List of Figures

Figure 1. Model of the mechanism of Traffic Law Enforcement ...........................................17
1 INTRODUCTION

The present document is working paper 1 (W1) ‘Review of main conclusions of completed relevant projects’ prepared by Work Package 2 (WP2) of the PEPPER project. The objectives of PEPPER address two of the principal lines identified in the Road Safety Action Programme (European Commission, 2003):

w The harmonisation of penalties and
w Promotion of new technologies to improve road safety.

The PEPPER project is connected with both of these objectives by addressing the safety potential of enforcement in a broader context. The effective implementation of Traffic Law Enforcement (TLE) does remain one of the important aspects in traffic safety. In order to reach the goal of halving the number of traffic fatalities over the period of 2000 – 2010, efficient TLE does offer the prospect of significant improvements in traffic safety (European Commission, 2001). The PEPPER project will investigate the link between TLE and road safety by combining scientifically verified impacts of enforcement, prioritisation of enforcement methods based on cost-effectiveness and data led operations. The project builds on experiences and information gained from previous projects such as GADGET and ESCAPE thus offering a broad view on enforcement and looking at the different actors in the enforcement chain.

Working paper 1 covers the following main questions:

w What information is available in literature regarding traffic safety and actors involved in TLE?

w What information is available in literature from other fields-of-interest regarding efficiency of laws and law enforcement?

w Is it possible to identify a set of variables and indicators that can be used to assess the TLE-efficiency in other projects?

Working paper 1 begins with a brief introduction to TLE (Chapter 2) where a framework for the use of law enforcement in general and traffic law enforcement in particular is presented. This framework contains information regarding the reason why TLE should be looked at when trying to improve traffic flow and traffic safety and the different phases of TLE that must be taken into account. Apart from this, a mechanism is proposed to explain the influence of TLE on intentions, actual driving behaviour and traffic related accidents.

This it then followed by the review of literature (Chapter 3) available from different finished and on-going projects and other initiatives regarding traffic safety, law enforcement and the possibilities for measuring the efficiency of law enforcement. In this review, we’ll pay special attention to information available on traffic law and enforcement. Summarizing all findings regarding TLE will help us to understand better what the exact impact of TLE on road safety is and helps us position the improvements in the field of traffic law enforcement among the vast number of other possible improvements in the fields of vehicle safety, infrastructure, etc.
The final part of this paper (Chapter 4) consists of a preliminary list of variables or indicators that can offer an overview on how to measure the efficiency of the different elements of TLE. This preliminary list will then be used in task 2.1.2 of the PEPPER project where the availability of these variables and indicators along the whole enforcement chain will be checked.

The literature reviews and the list of variables are focused on three primary target areas: speeding, drink driving and non-use of safety restraints (GADGET WP5: Mäkinen, 1999) since, according to cost-benefit calculations, these methods are cost-effective and closely related to accident causation or the mitigation of accident consequences. These target areas have also been identified in the European Commission Recommendation on enforcement data collection (2004/345/EC) in the Member States.

By presenting a literature review and a preliminary list of variables and indicators that can be used for assessing the efficiency of TLE, working paper 1 offers a good foundation for the creation of a questionnaire that is used in preparation for working paper 5 ‘Results of questionnaire in a representative sample of Member States’ and offers a first step towards the creation of a database structure for an enforcement data collection system on speeding, drink driving and restraint systems. This database will eventually allow for the dissemination of good TLE practises between Member States and more rapid adoption of new technologies on enforcement.
2 TRAFFIC LAW ENFORCEMENT AND THE ENFORCEMENT CHAIN

2.1 Law Enforcement

Before looking at Traffic Law Enforcement (TLE) as a very specific application of law enforcement, it is important to provide a relevant description of law enforcement itself, what it contains, and what its goal is. This description is by no means intended to be an exact definition but offers a basic framework in order to situate TLE.

The main objective of any type of law enforcement is achieving compliance with existing laws, either through prevention or repression. In general it can be said that, despite of certain differences between Member States, a significant amount of similarities exist in the actors that are involved in law enforcement. As a first premise, of course, laws have to exist in order to be adhered to. Individual entities can decide to adhere or not to these laws and several types of organisations (both public and non-public) can be given the responsibility to check for law infringements. In a next phase, it can be decided by a public prosecution service to gain more information regarding the violation, drop the charges or press the charges before a court. In the last phase then, a court has to decide whether the charges are upheld and the violation is punished or not.

The laws themselves have a clear goal: ensuring that the well-being and well-functioning of the entity where the laws apply to, is guaranteed. This means that any justification for law enforcement, in all of its possible appearances, lies in the belief that the laws themselves and the enforcement of these laws actually contribute to the entity (country, region, organisation, factory, individual person, etc.). Not only is this social justification important for the justification of laws and enforcement, it is also one of the main conditions for any law to actually successfully influence or regulate targeted behaviour.

Although it might be nice to believe that every single individual perfectly complies with the law and that it would suffice to simply create laws, this wouldn’t be a realistic approach given the large number of infringements that can easily be identified in every-day life. It is very easy and even attractive to commit unlawful behaviour when, for example, the law isn’t easily comprehensible or when the possibilities offered by the law deviate from the goal that one wishes to reach. This delicate link itself has been the subject of research and specialised literature can easily be found describing the link between laws and human behaviour and the various problems that occur when comparing laws and their intentions with the effective human behaviour (i.e. scientific journals like “Law and Human Behaviour”).

In order to make sure that laws are upheld, some organisations have received the responsibility to check for law infringements. These can be police forces but also non-public organisations. Whatever type of organisation, the violator can be the subject of control and his violation can either be noticed or not. Even if it would be interesting for all possible violations to be monitored, this is very unlikely to happen in real life. Therefore, an element of chance in
capturing law infringements is present and it is uncertain that maximum effect or efficiency is obtained in the current situation of law enforcement.

Furthermore, even when a law infringement is actually observed by an organisation that is entitled to perform checks, this doesn’t necessarily mean that punishment will follow or that optimal punishment is achieved. The institution responsible for punishment can decide not to proceed, the punishments can greatly vary without always being clear why and the time elapsed between being caught for a violation and the actual punishment can also vary. All of these are elements that influence the effectiveness of law enforcement.

Because of this, law enforcement in its various forms becomes very interesting and any study concerning law enforcement should contain the whole process of enforcement actors and activities where possible flaws can exist. This effectively means that actions aimed at controlling for unlawful behaviour performed by both police and non-police actors, judicial means such as prosecution and the judicial outcome in the form of punishment or acquittal are included in the enforcement chain. Furthermore, it is also necessary to include the laws themselves that have to be enforced in the law enforcement chain since otherwise it would be virtually impossible to judge whether the outcome of the law enforcement process is beneficial or not.

An important repercussion is then that every actor along the enforcement chain has to be checked for possible flaws such as deviances in credibility, confusion, incomprehensibility, etc. since these can cause an increase in unlawful behaviour. More precisely, this means that virtually every actor involved in legislation, controlling for law compliance, prosecution and sanctioning needs to be checked. It is exactly because of this that the PEPPER project can prove to be a valuable asset in building the descriptive framework for efficient and effective traffic law enforcement.

### 2.2 Traffic Law and Traffic Law Enforcement

As we are well aware off, traffic is one of the rare situations were a large amount of users are clustered in a relatively limited surroundings and each of those users has specific goals they want to achieve (personal visits, work related transportation, leisure, etc.). These goals come with specific and unique demands: getting from point A to point B within a given amount of time. All of these activities take place in the relatively confined space of the available road network. This combination creates a situation where a lot of interpersonal interactions take place and where very often conflicts between road users occur. In order to guarantee a smooth running structure with a minimum of conflicts, road users are provided with various traffic laws that have two specific goals:

- **Traffic safety:** a transfer from location A to location B has to happen without accidents.

- **Mobility:** a transfer from location A to location B has to happen within a certain amount of time.
Traffic laws guarantee a certain amount of traffic safety by providing a framework that can be used to predict the other drivers’ behaviour. Unfortunately, these traffic laws are not always followed by road users and need to be upheld in some way. This is the responsibility of the actors that are involved in traffic law enforcement. A first control mechanism in Member States is provided by various public and non-public organisations. Typically, up to three different police forces can be identified who are responsible for monitoring traffic and checking for traffic law violations (a specialised central traffic police force responsible for main national highways, a second unspecialised police force responsible for rural roads and small communities and a third local police force for larger communities). Parallel to these police forces, some non-public organizations have been empowered in order to check for specific traffic law violations (often violations with only administrative repercussions).

Once a violation has been identified, typically a number of different routes can be followed. Police or public prosecution can decide on dropping charges, pressing charges through an administrative sanction or pressing charges through (criminal) court. It must be noted that this is a very crude representation of the enforcement chain and that differences do exist among Member States.

Despite the presence of a traffic law enforcement chain, various sources indicate that infringements take place on a regular basis: police reports, road accident statistics, self-reported behaviour, etc. all provide evidence that this is the case. Surely, the various laws that were created in order to assure traffic safety and mobility lose a large amount of their efficiency when they are broken that often. It is because of this that our interest turns to the enforcement of traffic laws since valuable insight in road user behaviour and an improved method towards improving traffic safety can be gained when the efficiency of the traffic law enforcement chain is brought under scrutiny.

It should be stressed however that not all traffic law violations and the aberrant driving behaviour that is caused by this are the result of intentional behaviour. Parker et al. (1990) made the distinction between types of aberrant driving behaviours:

- **Lapses**: absent-minded behaviours with consequences mainly for the perpetrator, posing no threat to other road users.
- **Misjudgements and failures of observation** that may be hazardous to others.
- **Violations**: deliberate contraventions of safe driving practice.

Violations are the most obvious target to reduce since they explicitly contain a deliberate choice element that needs to be curbed and it is important to perform research on the influence of traffic law enforcement on traffic law violation reduction and accident reduction. Misjudgements and failures are somewhat more difficult to influence since they happen without a deliberate choice by drivers. However, it can be argued that a good traffic law and the appropriate following of this law decrease the frequency of these events. The same can be said for lapses. These two groups of aberrant driving behaviour are to some amount linked with learned, automated behaviour and it is because of this the influence of TLE remains interesting. Not only can TLE help learn the correct behaviour so that the automatisms are at least
correct, but also can TLE help drivers remain more attentive, thus reducing the number of lapses, misjudgements and failures of observation.

2.3 How can Traffic Law Enforcement work?

The traffic law enforcement chain contains the whole set of measures and methods that are used for preventing violations and enforcing traffic law. These measures can be identified at different levels. Specific traffic safety related measures can be taken at a legislative level by creating relevant traffic laws, at an executive level by enforcing the current traffic law through police or non-police actions or by starting preventive campaigns, or at a judicial law by ensuring that the detection of traffic law violations is followed by swift and proper punishment.

This wide range of measures has previously been of interest when comprehensive traffic safety plans were created. In this process, all the subtleties regarding these measures have to be communicated to the different actors responsible for traffic safety policies. An example hereof is the manual that was created by the Belgian Road Safety Institute: ‘Handboek voor het opstellen van de actieplannen verkeersveiligheid’ (Adriaensen et al., 2004; Manual for the creation of traffic safety action plans). A number of conditions were identified in this manual for achieving maximum efficiency and effectiveness of traffic law enforcement on traffic safety. These measures will be presented here and will be used as a basic structure for this chapter.

The conditions that are necessary for achieving effective and efficient traffic enforcement are:

- Traffic laws have to be known and accepted:
  The first condition for any effect of enforcement to exist is that the laws are known and accepted (or at least acceptable). A social basis for traffic law enforcement can be created when these conditions are fulfilled. If this social basis doesn’t exist, informative campaigns are necessary to clarify the benefit of the traffic laws.

- Prevention precedes repression:
  Traffic law enforcement needs to be aimed at the prevention of traffic violations. This principle is based on the theory that deterrence causes people to not commit violations out of fear for punishment. To achieve this, as much as possible traffic participants need to be confronted with traffic violation checks. As such, general deterrence (reaching as much as people possible) can be considered more important than specific deterrence (reaching only traffic violators).

- Sufficiently high objective risk on being caught for traffic violations:
  The objective risk is related to the actual chance of being caught and this has to be sufficiently high to influence driving behaviour. This has to be sufficiently high in order to achieve the following condition of a sufficiently high subjective risk.

- Sufficiently high subjective risk on being caught for traffic violations:
  Subjective risk is the chance that a road user himself perceives of being caught for a traffic violation. It is commonly thought that this factor is more active in changing
driving behaviour in comparison to the actual, objective risk of being caught. Subjective risk can be influenced in several ways: publicity, high visibility of traffic checks but also a high level of unpredictability for invisible traffic checks, high frequencies, precise selection of time and location of traffic checks, etc.

Prosecution and punishment follows being caught:
Even when the objective and subjective risk of being caught is sufficiently high, this would mean nothing if actual punishment is virtually inexistent. Punishment needs to be swift, adjusted to the violation and correct. This makes communication between the different actors of the enforcement chain even more important.

Combination with communication:
Communication can help achieving more efficient prevention. By using all sorts of media (newspapers, billboards, etc.) the effect of traffic checks is augmented. Communication is a very valuable element in reaching an efficient general deterrence effect.

These six conditions form the central guide through this chapter. The following paragraphs try to elaborate the different concepts mentioned here and offer a first insight in the different aspects of traffic law enforcement that need to be present in order to achieve maximum efficiency.

In general, it can be said that there is a large potential for the improvement of traffic safety available in the whole TLE chain when optimal use is made of the facilities available to the actors in the TLE chain. The potential influence of enforcement on accidents has been the subject of recent theoretical and experimental studies. Theoretical estimates of this influence are fairly high. One of those came to the conclusion that about 50% of traffic accidents in Europe could have been avoided if no traffic violations would have been committed by road users (ETSC, 1999). A similar estimation was presented in the Norwegian Traffic Safety Handbook (Elvik, Mysen and Vaa, 1997) where it was reported that up to 38% of fatalities and up to 17% of other traffic injuries could be saved when fully complying with traffic laws. Furthermore, cost-benefit calculations indicate that in the fields of speeding, drink driving and seat-belt wearing very positive benefit to cost ratios can be achieved (ICF Consulting, 2003).

Individual studies have been the subject of more extensive analyses such as presented by Elvik (et al., 1997) and Zaidel (2002). These analyses offered further evidence for the extensive possibilities that are available for improving traffic safety in the fields of speeding, drink driving and seat-belt wearing when attention is given to TLE. It must be noted however that estimates based on statistical analysis in empirical studies dealing with specific enforcement elements generally suggest much lower estimates. A 10% reduction in accident occurrence was considered to be a relatively high-end gain although some well-implemented and sustained enforcement efforts have reported gains up to 25% (Zaidel, 2002).
2.3.1 Familiarity with and acceptance of traffic laws

Legislation is the first element in the enforcement chain where the cause for such a decrease in accidents can be found. As was stated above, the goals of TLE are (the improving of) traffic safety and mobility by guaranteeing that traffic laws are observed. This implies that TLE itself can only achieve its maximum effect when the relevant legislation offers a good foundation for achieving these goals. This implies that individual drivers can predict the actions of other drivers by relying on the traffic laws. Noordzij (1976) identified five conditions where traffic laws have to comply to in order to guarantee a qualitative legislation. The law should:

- Be easy to understand for all road users.
- Be easy to follow.
- Not be in contradiction or conflict with other laws.
- Not be in conflict with situational prerogatives.
- Make it easy to identify any violation of the law.

When one of these conditions is not fulfilled, it can be expected that a significant increase in traffic violations is caused and, indeed, even an increase in accidents might be expected.

2.3.2 Prevention and repression: the influence of objective and subjective risk

The first way through which TLE helps preventing accidents and improves the chance of proper driving behaviour is easily recognizable by road users. TLE helps maintain traffic and roadway conditions by ensuring that the traffic system is properly managed. Examples hereof are traffic regulations, re-direction of traffic by police, removal of defective vehicles, but also the implementation of traffic regulating equipment such as road segment control (Goldenbeld, 2004). These actions enable less hazardous situations for road users and thus generate fewer risks, fewer errors, fewer conflicts and, as a result, fewer accidents. Furthermore, these actions are clearly visible for road users and offer a clear and visible beneficial effect. This results in an obvious approval from individual road users for the enforcement action that was taken.

The second mechanism through which TLE can help prevent accidents is less tangible in nature and requires two premises to be upheld:

- A link has to exist between non-compliance to traffic laws and accidents.
- A link has to exist between traffic law enforcement and traffic law compliance.

Figure 1 offers a schematic overview of this argumentation. The first premise states that there is a connection between non-compliance to traffic laws and accidents. Evidence hereof is provided by Zaidel (2001b) who collected and analysed data concerning accident risks and traffic violation frequencies. It was concluded that although the traffic violations do promote accidents, this link nevertheless was not very strong or deterministic. However, when ‘road sections’ were used as a measure unit in stead of ‘individual drivers’ behaviour’, a significant increase was found in accident frequencies for roads sections where more speeding violations were measured. These findings indicate that, although the exact causal link between traffic law compliance and accident involvement remains difficult to grasp, a certain link does exist.
The second premise states that a substantial reduction in non-compliance of traffic laws can be achieved through TLE where it matters. Although a relation can be found between violation frequency and accident frequency, it is by no means the case that every violation automatically leads to an accident. Indeed, a great number of traffic law violations do not lead to an accident. Making the step between the influence of TLE on violation reduction and the actual influence of TLE on accident reduction is therefore not as straightforward as it might seem.

Figure 1. Model of the mechanism of Traffic Law Enforcement
A possible explanation heavily depends on two types of risk that are often involved in the processes of prevention and repression: the objective risk and the subjective risk of being caught. The actual, objective risk of detection reflects the real likelihood of detection caused by the actual level of traffic policing activity. This objective risk has a complex relationship with the perceived, subjective risk of detection. The subjective risk of detection results from the road user’s perception of the intensity of enforcement related activities.

A great difference can exist between these two risk levels. In an ideal situation, the subjective risk of detection is equal to or higher than the actual risk of detection. This was reflected by Riley (1991) who found that it is most likely that effective driving behaviour is influenced by the road user’s perception of the possibility that a traffic law violation is detected. A direct result hereof is that the primary focus of most traffic enforcement campaigns should be focused on the increasing of the subjective risk of being caught.

Various psychological theories such as the Theory of Planned Behaviour (Ajzen, 1985, 1991 and 2002), Theory of Reasoned Action (Fishbein, 1967; Ajzen & Fishbein, 1973; Madden et al, 1992) but also the Expectancy Value Theory (Fishbein and Ajzen, 1974) and the Prospect Theory (Kahneman and Tversky, 1979) tackled similar problems while trying to explain human behaviour. Furthermore, the Theory of Planned Behaviour was already used to determine the intention to commit driving violations (Parker et al., 1992).

Based on these theories it can be reasoned that traffic laws and TLE influences individual traffic behaviour in two ways. First of all, a direct link exists between the traffic laws and the actual behaviour: people comply with traffic law without particular fear for enforcement. This can be the case when, for example, traffic laws are clear enough in their intentions and when these laws don’t give problems for achieving the goals that a road user has posed for himself.

The second link between traffic laws and the road behaviour is indirect and includes the prevention of unlawful behaviour through changes in the subjective, perceived risk of being caught and punished when violating traffic laws. According to the theory of planned behaviour, this subjective risk is strongly linked with the actual intention towards complying with traffic law and the eventual driving behaviour and research has pointed in this direction (Parker et al., 1992). Subjective risk itself is influenced by the effective objective risk of being detected and the actions that can be initiated by the different actors in the enforcement chain. Elements such as a higher frequency of traffic controls but also the randomisation of the location where traffic controls influence the subjective risk of being caught. These influences are linked directly with TLE activities. Other influences include the communication of the nature and results of enforcement activities to road users, intention statements regarding effective violation controls and also communication of prosecution measures that are taken and the severity of punishment.

An example of the actual impact of specific enforcement methods has also been the subject of studies in concrete experimental situations. A clear example hereof is the finding that up to 50% less drivers were found driving with punishable blood alcohol content during alcohol-enforcement campaigns in the month of December in comparison to the other months in Belgium (BIVV, 1999). In Belgium, the month of December is known for its sharp increase in
alcohol-related traffic checks. Furthermore, the influence of perceived, subjective risk has explicitly become one of the points of interest for assessing traffic safety in Belgium (Silverans et al., 2005): concrete target percentages for subjective risk assessments regarding speed, driving under influence of alcohol or drugs and seat belt use have been proposed and are measured on a regular basis.

2.3.3 Prosecution and punishment

Even when the objective and subjective risk of being caught is sufficiently high, this would mean nothing if actual punishment is virtually inexistent. Punishment needs to be swift, adjusted to the violation and correct. This makes communication between the different actors of the enforcement chain even more important. The influence of prosecution and punishment has been the subject of many discussions. In general it can be said that prosecution and punishment are essential factors in the determination of the actual “loss” an individual suffers when he is apprehended for a traffic law violation. This mechanism is often explained in studies such as the one performed in the light of the Prospect Theory (Kahneman and Tversky, 1979). Among the major factors with an influence on risk assessment (in terms of “risk of monetary loss”) the chance of being caught and the height of the fine or the height of the high cost of the alternative punishment such as imprisonment were the most significant.

A number of issues that influence the effect of TLE on traffic safety can easily be identified because of this link. These issues were also identified in the discussion paper about the importance of the policy taken by criminal justice on traffic safety (BIVV, 1999). A first issue concerned the diversity of the possible punishments and fines. This creates a feeling of injustice with traffic users and can cause a setback for the effectiveness of TLE on traffic safety.

Furthermore, the link between the violation-behaviour and the punishment has to be sufficiently clear in order to have any deterrent effect. This link has been amply described in studies regarding the psychology of learning and one of the most important elements is the influence of timing. When too much time passes between infringement and punishment, the link between both of them is extremely vague and no immediate effect can be expected because of a diminishment in the subjective, perceived risk. When the judicial services are overloaded it is certainly possible that too much time elapses between violation and sanction; sometimes even the absence of any form of punishment can occur. Obviously, in that case any form of subjective risk might be completely absent.

2.3.4 Traffic law enforcement and communication

The final condition for obtaining efficient traffic law enforcement is communication. By using all sorts of media (newspapers, billboards, etc.) the effect of traffic checks is augmented. Communication is a very valuable element in reaching an efficient general deterrence effect. The use of communication to enhance the effect of TLE has been recognized by the European Commission and they have made an explicit recommendation of it: “Member States ensures that enhanced enforcement actions will be combined with information of the public, which will be given in the form of publicity campaigns aiming at making the public conscious of the
subject concerned, which shall be held for each of the three subjects of enhanced enforcement actions separately, and in the form of roadside information concerning concrete enforcement actions carried out on that road” (EC Recommendation, 2004/345/EC).

An example of the influence of the combination of traffic enforcement programmes and the use of communication is the Belgian BOB programme where special attention is given to the problem of driving under influence. The programme has been active since 1995 and consists of the combination of intense media campaigns (roadside advertising, radio and television commercials, etc.) and intense police checks on alcohol use. The results have been made available on a yearly basis (BIVV, 2006).

2.4 The enforcement chain

The enforcement chain is a very broad structure that can contain many different actors in different Member States. In order to create a framework wherein these different actors can be situated, a number of conditions for the efficient working of the enforcement chain with regard to traffic law enforcement have been identified (Adriaensen et al., 2004):

1. Traffic laws have to be known and accepted.
2. Prevention precedes repression.
3. A sufficiently high objective risk of being caught has to be achieved.
4. A sufficiently high subjective risk of being caught has to be maintained.
5. Prosecution and punishment follow being caught.
6. A combination with communication has to exist.

These conditions will now be used to form a rough structure that can be used for the future identification of the involved actors and for offering a clearer overview of the variables and indicators that could be used to measure the efficiency of traffic law enforcement. In an ideal situation, several of the actors active in the enforcement chain or conditions that can be identified for efficient traffic law enforcement interact with each other. Where possible, examples will be given of this interaction. This has to be kept in mind when reading this text or analysing the variables and indicators that are suggested in chapter 4.

The first condition is related to the familiarity with and acceptance of traffic laws. Broadly viewed, two perspectives can be identified where information on this subject should be gained. From one side, it can easily be argued that for any traffic law to be applied in practice, it first has to be known and supported by the road user. This means that it can be interesting to gain information from various projects regarding the knowledge readily available with road users. Projects such as SARTRE but also national initiatives such as the set of efficiency indicators published by in Switzerland provide information.

Another perspective however was offered by Noordzij (1976) who, as was stated earlier, correctly argued that the laws themselves must also fulfil some criteria in order to maximize their effect. Five such criteria were identified: the law should be easy to understand for all road users, easy to follow, not in contradiction or conflict with other laws, not in conflict with situational prerogatives and, lastly, make it easy to identify any violation of the law.
A first step towards exploring these criteria has been made with the Clifford Chance study (2003). In order to fulfil these criteria, one can also expect that some requirements need to apply to the legislators. For example, it must be clear which legislator is responsible for which domain and what the exact scope (national, regional, local, etc.) is where the law applies to or that the legislator must be capable of quickly solving new judicial problems. It is therefore important to identify the national, regional or local governmental actors that create traffic laws so that one can ascertain that some conditions regarding quality are fulfilled.

The second (prevention), the third (high rate of detection) and the forth (high subjective risk of being caught) condition can be classified under the function of controlling whether the traffic laws are complied to. This function has recently been one of the main subjects of various European studies (ESCAPE: Mäkinen et al., 2003; GADGET: Christ et al., 1999; but also the Clifford Chance study, 2003) and two groups of actors can be identified who have responsibilities concerning traffic checks. The first group contains governmental, police based actors while, in some cases, also a second group of non-police based actors can be identified. This second group creates a special situation where typically both the control for traffic violations as well as the effective administrative application of punishment is merged. In order to analyse what concrete actions are best taken in order to prevent unlawful behaviour, the different actors on this level have to be identified for each Member State. Naturally, in order for laws to be upheld by any actors, these actors themselves should be clearly informed about i.e. law changes, implications, etc.

The fifth condition deals with prosecution and punishment. At this level it is decided whether or not a punishment is in order and as such all actors that decide whether a follow-up on the identification of a concrete violation should happen are involved. The importance of this level cannot be underestimated since a large part of the psychological effect of “being caught for a violation” depends on the swiftness, justness and fairness of punishment. As was stated higher, actors that can be identified here include public prosecution services, courts, but also public or non-public organisations that are by law invested with the power of administering administrative fines or other punishment.

Furthermore, significant links should exist between the actors on this level and the legislators. Although one of the main functions public prosecution and courts clearly involves dealing punishment, it is also exactly on this level where valuable information can be gained on, for example, the clearness of the law, possible conflicts with other laws or the inappropriateness of certain laws in a given infrastructural setting. Because of this, feedback between actors involved in dealing punishment and actors involved in law-making should exist and both of them should be under constant scrutiny in order to achieve maximum efficiency.

The sixth condition requires communication to be a part of efficient traffic law enforcement. Apart from very specific organisations who deal with traffic campaigns, this is also the responsibility of the different actors that were identified above. Each actor has specific information available on either legislation, traffic checks, punishment that can influence the drivers’ behaviour through the mechanisms mentioned in this chapter. Obviously, significant changes in perceived, subjective risk assessments can be caused by communicating this information to the road user.
2.5 Chapter summary

In this chapter, a basic framework was presented for the identification of the different actors that can be found in the field of traffic law enforcement. Furthermore, a model was sketched explaining a possible link between traffic law enforcement and driver behaviour and accident frequency.

Six important conditions were identified as necessary for efficient traffic law enforcement programmes. These conditions were used to provide a guideline for the identification of actors that are relevant for traffic law enforcement.

This structure was used as a guide, together with the recommendations made by the European Commission in their white paper, for filtering information out of the literature that is presented in chapter 3.
3 RELEVANT LITERATURE

3.1 Method and selection of literature

The literature review that is presented in this chapter is the result of information gathered by the different project partners regarding relevant literature for the description and measurement of the efficiency of traffic law enforcement. Information was exchanged in particular with the partners involved in Work Package 4 ‘Strategic, legal, administrative and social context of Traffic Law Enforcement in Member States’.

After a first selection based on relevance and recentness the literature was divided into three groups:

- Finished projects regarding traffic safety including traffic law enforcement.
- On-going projects regarding traffic safety including traffic law enforcement.
- Enforcement efficiency: literature from other domains.

The presentation of these three groups will be preceded by a short summary of the goals that were stated by the White Paper presented by the European Commission (2001) in order to reach the goal of a halving the number of traffic related deaths over a period from 2000 to 2010. By doing this, a background is presented for the presentation of the projects that are taken onboard in this literature study.

The first group contains information regarding the project that can be considered the direct predecessor of the PEPPER project, namely ESCAPE, and the results and conclusions from this project will be presented extensively. The relevant conclusions and findings from other finished projects, such as GADGET, VERA, VERA 2, SARTRE, PROMISING, CARE, ROSEBUD and the TIS-study on road traffic rules and corresponding enforcement actions in the Member States will also be presented.

The second literature group contains information regarding on-going projects that are related to traffic safety and TLE such as SAFETYNET, CAST, SUPREME, CAPTIVE and the recently introduced …. Furthermore, information from several other sources such as the Parliamentary Advisory Council for Transport Safety (PACTS, UK) will be presented and reviewed.

The third group was created because of the broad scope that was taken with regards to the enforcement chain, the different levels and actors that are involved in TLE and the particular problems encountered with finding literature regarding the legislative level of TLE. The literature study started with focussing on literature that was available within the field of traffic safety without much success. In order to find sufficient information regarding the proper measurement of the efficiency of laws and the legislative level, other fields of interest were brought under scrutiny. As a result of this, relevant information was found with several instances such as the World Health Organisation (WHO) who provide governance indicators but also with the European Commission for the Efficiency of Justice (CEPEJ).
Because of the broad field where information sources were found, it remains important to realise that the different projects and organisations involved tried to solve similar problems starting from different premises and a different viewpoint. With this literature review, it was tried to present the best of the different worlds in order to present a more comprehensive and complete understanding regarding the possibilities of the TLE chain and the different methods of identifying the most efficient methods of TLE and the TLE chain.

Furthermore, three target areas were selected for the PEPPER project to focus upon:

- speeding
- drink driving
- seat-belt use

This selection was made because of the large influence of these elements on both the frequency of accidents as the outcome of accidents (ETSC, 1999). Excess speed has been the scope of various studies and clear evidence has already been found of the possible beneficial influence of specific enforcement methods on accident frequencies and outcomes. Depending on method, location and timing, a reduction of up to 28% in casualties could be found when inappropriate speed was checked.

While drink driving is relatively infrequent, compared to other traffic offences, it is highly dangerous. For the EU as a whole a rough average of about 3 per cent of journeys are associated with an illegal blood alcohol content, but about 30 per cent of injured drivers are under the influence of alcohol. Alcohol is one of the major causes of crashes and can increase the severity of injury outcomes (ETSC, 1999). Because of this, drink driving deserves to be one of the target areas for traffic law enforcement.

Although seat belt wearing is mandatory in all Member States in the front and rear seats of passenger cars in European countries, usage levels vary widely from one country to the next. Between 59% and 97% of front seat occupants and 21% and 90% of rear seat passengers reported using seat belt. In most countries rear seat belt use was substantially less. If every car occupant had used existing seat belts 6000 deaths and 380,000 injuries could be saved every year (ICT Consulting, 2003). This makes the wearing of seat belts a third important target area for the PEPPER project.

In order to present as much as information possible while still remaining readable enough, a more or less fixed schedule was used. In practice this means that for each project or information source the main goals were presented as well as their relevance for the PEPPER project. This is then followed by an overview of the findings and conclusions of the reviewed piece of literature and, where possible, by suggestions for controlling or enhancing the efficiency of traffic law enforcement.

3.2 White paper, European transport policy for 2010: time to decide.

The EC Recommendations on Enforcement of Road Safety (2004/345/EC) presented a number of recommendations for the Member States to achieve in order to reach the goal of halv-
ing the number of traffic related deaths over a period from 2000 until 2010. The European commission commits itself to produce a report on the implementation of the recommendations across the Member States every two years in order to evaluate (after the 1st reporting period) whether improvements in road safety have been achieved. If no improvements were achieved, the European Commission will submit a proposal for a directive aiming at reaching the objective of 50% reduction.

One of the goals of the PEPPER project is to compare what the current state of the art is of available variables and indicators relating to the measurement of the efficiency of traffic law enforcement and to create a database where indicators are collected from different member states in order to effectively measure that efficiency. A first step then is giving a brief overview of what the demands of the European Commission are. In a second step, the demands of the European Commission can be incorporated in the development of a preliminary list of variables and indicators (chapter 4) wherefore the availability needs to be checked in task 2.1.2 of the PEPPER project.

In short, the recommendations of the European Commission (European Commission, 2004/345/EC) to the Member States are:

\[ \text{w} \text{ Set up a National Enforcement Plan: what is known to be the best practice in the areas of speed, drink driving and seat belt use? This should include:} \]

\text{• With respect to the planning of speed enforcement:}
- An inventory of stretches of road in the Member State were speed enforcement is most appropriate.
- The planning of the application of automated speed enforcement equipment in the above mentioned road stretches.
- The date on which the use of automated speed equipment will start.
- The date when all the stretches will be covered by such equipment.

\text{• With respect to the planning of random breath testing:}
- A generic description in the Member State of the places and the times for which random breath testing is most appropriate.
- The planning of the frequency of the application of random breath testing.

\text{• With respect to the planning of enforcement of restraint use:}
- A generic description in the Member State of the places where restraint use checking is most appropriate.
- The planning of the application of intensive restraint use enforcement actions in the selected places above, their timing and duration and the number of times per year that they will be held.

\text{w} A regular evaluation and adaptation of the National Enforcement Plan.

\text{w} Inform the public about enforcement actions.
Speed control should be done by Automated Speed Control systems (technical device is triggered automatically when the speed limit is exceeded, so that information about the violation vehicle is recorded) on motorways, secondary and urban roads.

Create procedures to ensure all the automated registrations of speed violations are followed-up. The followed-up procedures must be able to cope with large number of violations.

Drink driving should be checked by random breath test with alcohol screening devices. Use should also be made of evidential breath testing devices.

Seat belt and child restraint usage should be enforced by intensive actions with duration of minimum two weeks at least three times per year.

The general policy should be that the violations detected are followed-up by the infliction and execution of a sanction or a remedial measure.

The Member States should assist each other in enforcement coordination and information exchange.

Serious or repeated violations committed by non-resident should be reported to the State where the vehicle is registered and/or the driver is residing.

The Member State where serious or repeated violations committed by non-residents were registered should ask the competent authorities in the State where the vehicle is registered and/or the driver is residing to take appropriate measures against the offender.

Communicate the relevant enforcement information to the European Commission every second year.

Examine after the first reporting period the effectiveness of the national enforcement measures.

The following literature study has been largely made with these recommendations in mind.

3.3 Finished projects regarding traffic safety including traffic law enforcement

3.3.1 ESCAPE (Enhanced Safety Coming from Appropriate Police Enforcement)

Summary and objectives

The objectives of the project were to identify important issues of traffic law enforcement in the EU, examine traditional and innovative enforcement approaches and tools, and assess their potential to improve compliance for increased safety on roads. The following main is-
sues were addressed: the extent of non-compliance with traffic laws and its contribution to accidents; how enforcement is organised and carried out in practice in EU countries; traffic law enforcement needs, issues and constraints, old and new; the potential for new approaches, technologies and tools to improve compliance through more efficient enforcement (Mäkinen et al., 2003).

Similar to the PEPPER project, emphasis was put on speeding, drink driving and the non-use of personal safety devices although also “aggressive driving” was targeted. With regard to the traffic law enforcement chain, the emphasis of ESCAPE lay more on the policing function and less attention was given to the legal functions. However, organisational and legal issues were incorporated in the project.

The methods used in ESCAPE were mostly qualitative because of the complexity of the systems, their social context and the lack of reliable quantitative data in many countries. This last element is precisely one of the main topics where PEPPER is active. Despite the lack of reliable quantitative data, valuable insight was won in the functioning of the entire traffic law enforcement chain and its efficiency.

Furthermore, three specific practical tools were adapted for enforcement purposes:

- A simplified cost-benefit analysis tool for assessing the effectiveness of specified enforcement methods.
- Guidelines for monitoring routine enforcement efforts, outcomes and non-compliance levels.
- A list of innovative traffic law enforcement ideas addressing different enforcement needs.

**Overview of relevant findings**

Generally speaking, the different EU Member States have different legal system and different ways of organising internal security and policing functions. With regard to the legal and judicial system, a similar range of sanctions can be imposed on offenders through a similar process of adjudication but important differences do exist in the level of decriminalisation of traffic offences. Nevertheless, most countries have developed a system where the judicial process is streamlined by, for example, imposing fixed fines or assuming drivers admit guilt unless they request a trial. Nevertheless, legal systems in most countries lag behind the fast technological developments that would enable new enforcement methods and help reduce the workload of the judicial level. In addition to fines and imprisonment, most countries enabled the possibility to impose other punishment such as licence suspension, rehabilitation programs, medical and psychological tests.

Similar findings can be made regarding policing: a general structure can be found in most EU countries. This structure generally consists of a specialised central traffic police force responsible for main national highways, a second unspecialised police force responsible for rural roads and small communities and a third local police force for larger communities. Individual
countries have however different degrees of centralisation, autonomy and specialisation in traffic control. Furthermore, it proves difficult to obtain accurate and complete data of the size an effort of police forces dedicated to traffic with only rough estimates of 7 to 10% of police personnel on average being dictated to traffic control.

With regards to the analysis of police enforcement, typically three frames of reference that determine basic parameters are offered: the road safety situation, the law compliance by road users and the resources and tasks of police forces. These three information sources are typically situated in different governmental agencies and co-operation that would enable to maximize the impact of the combination of these three frames of reference is scarce.

A basic need thus exists to quantify the relation between enforcement campaigns and compliance with traffic law. A first step to measure this is to obtain compliancy data. These data do not exist for most violations with the exception of speeding, drink driving and non-use of safety belts and for these three fields some initial findings concerning the influence of enforcement campaigns can be made. Regarding speeding violations, an influence can be found in the immediate space and time vicinity of the surveillance source. This is known as a so-called halo-effect. Non-compliance with drink driving laws is very low in most EU counties and it was suggested that countries with an enforcement strategy based on large scale, random or quasi-random breath screening tests and evidential breathalysers scored best. With regards to non-compliance with safety belt laws a great variation in rates was found among countries, regions, types of roads and types of vehicles. Also, citation rates vary considerably and it is suggested that an increase in citation rates would be beneficial.

In general, the severity of sanctions does not have a clear-cut effect on compliance: no general positive effect was found on recidivism or deterrence. The extent of police enforcement does seem to be correlated to changes in the number of severity of traffic incidents with more enforcement being associated with fewer accidents. However, many factors influence the correlation size: the method of enforcement, type of roads, baseline of compliance, target behaviours and size of project all have an influence.

In order to ascertain which enforcement methods would give the best cost-benefit ratio an analysis was carried out on Norwegian data for several methods. It was found that an increase in all types of enforcement was cost effective with marginal benefits exceeding marginal costs in all fields. However, more information is needed to form solid policy decisions.

Another important information source for looking at the influence of traffic law enforcement is offered by measurements of public support. Although relatively strong support was found for strict traffic laws and enforcement actions with regards to drink-driving and the use of safety belts, less support was found for stronger legislation with regard to speeding. In general though, support levels for more police enforcement ranged from 60% to 80% of people questioned.

Suggestions relevant for TLE and PEPPER

The need for information, based on more that singular studies related to enforcement, does exist. These studies need to bear in mind that local, short-term studies often
aren’t realistic because of a short and sudden increase in the volume of enforcement that can not be sustained.

W The evidence that is available suggests that evidence based on deterrence is cost effective. These cost-benefit studies can provide valid information regarding the efficiency of traffic law enforcement projects.

W The identification of legal bottle-necks and the streamlining of the judicial level remain important. This is highlighted by the fact that a need for massive deterrence-based enforcement systems indicates a disintegration of the transport safety system.

W Automated enforcement methods should however be incorporated in modern traffic law enforcement systems.

W Enforcement itself is only one part of the whole traffic safety solution. Enforcement and the laws that are enforced should be in line with technical and infrastructural possibilities.

W Enforcement is indeed the responsibility of more than only the police. Different authorities at different levels bear responsibility and an effort should be made to increase the enforcement activities on all of those levels.

3.3.2 GADGET (Guarding Automobile Drivers through Guidance Education and Technology)

Summary and objectives

The GADGET project focussed on the wide range of safety measures in order to assist in the dissemination of good practice and provide a basis for a regulatory framework related to changes in driver behaviour resulting from the introduction of in-vehicle safety devices, visual modifications to the road environment, educational, training and legal measures, and safety campaigns (Christ et al., 1999). Because of this wide range, a distinction was made between the technical standards regarding vehicle and environment (engineering), drivers’ attitudes and opinions, drivers’ skill and know how (education), and the probability of detection of errors and violations and the consequences of misbehaviour in traffic (enforcement).

Because of this very wide range of influences on driving behaviour, a large number of relevant goals and methods were stated:

- The listing of all known traffic safety measures that target driver behaviour.

W The listing of all known evaluation studies and description of the results.

W The development of a theoretic background for each approach.

W The providing of an interpretation for the results of evaluation studies based on that theoretic background.

W The description of research strategies and needs.
The development of an assessment tool.

A comparison of safety effects and an assessment of net effects and interaction effects of safety measures.

The citing of cost-benefit ratios, identification of obstacles and opportunities for the implementation of safety measures.

The study of the legal measures and enforcement is where the GADGET and PEPPER projects meet each other. The objective of the WP in GADGET responsible for this task was the elaboration of the needs in improving legal measures and enforcement influencing driver behaviour in Europe (Mäkinen, 1999). This was achieved by selecting four target areas (alcohol, safety belts, speed and young drivers) and gathering information covering legislation and enforcement. By gathering literature, analysing data and executing surveys the authorities responsible were identified and recommendations for the best practices regarding legal measures were proposed.

Overview of relevant findings

Mäkinen et al. (1999) found that flaws could easily be identified in each link of the legal measures’ chain and that considerable space was available for the better application of legal measures. Certain key areas can be found where uniform regulations and uniform ways of enforcing these regulations are necessary for the European legal measures’ systems to be effective.

A very detailed description of the SORC model (Stimuli-Organisms-Reactions-Consequences) was presented with different mechanisms that were translated towards the context of traffic safety. Based on this model, seven different categories of errors are identified and the benefits and side-effects of legal measures and enforcement for each of these categories were identified. In summary it was found that legislation and enforcement offer both direct and indirect possibilities to enhance the current traffic safety situation.

Furthermore, a comparison between countries with respect to committed violations revealed large differences in the way the violation is dealt with in each country. As a result of differences in the law and differences in the application by the police a varying influence on deterrence is possible. A very practical concern is raised then regarding the good comparison between countries: for data to be compared on an identical basis, it is a prerogative for the data to be made comparable. That is to say: the data have to be accurate measures of the same subject and identical definitions, reporting methods and measurements have to be possible across countries.

With regards to the target areas it was found that for speeding more automated methods are needed for speed enforcement to be effective. As far as alcohol is concerned, random breath testing where police officers randomly stop motorist and conduct breath tests are recommended. The third field of interest, seat belt wearing, should become more important and enforcement programs concentrating only on this element should exist.
Another important finding is presented by Delhomme et al. (1999). Following the meta-analysis of a large sample of data, it was found that overall effect of safety campaigns on reduction of the number of accidents was significant (8.5% during the campaign period and 14.8 after the campaign period). It was pointed out most emphatically that these results could not only be attributed to the media campaign itself but to all of the components of the campaign. This means that the combination of the media campaign with enforcement, reward, legislation, educational programs, etc. are recognised as a very useful combination.

**Suggestions relevant for TLE and PEPPER**

- It remains important to clearly identify all the actors available along the enforcement chain and identify their objectives and demands.

- Strive for a situation where as much as possible laws and enforcement methods are as identical as possible in the different Member States.

- Provide clear information regarding the different available methods that can be used for improving traffic safety.

- The need for exact information, both on media campaigns as well as enforcement campaigns does exist. This information remains important for the evaluation and selection of the optimal method for improving traffic safety and it was suggested that governments and local authorities should no longer be willing to spend taxation on campaigns that do not include a report of the rationale and detailed results of the campaign.

- Co-operation between police makers, safety researchers and communication practitioners must be encouraged leading to better evaluation of future campaigns.

### 3.3.3 VERA (Video Enforcement for Road Authorities)

**Summary and objectives**

The VERA project has explored issues and opportunities arising through the use of digital systems for enforcing road traffic laws and regulations. The goals of the project were the making of recommendations and the development of a set of common functional specifications for the use of digital enforcement equipment and for enforcing violators across national borders as well as preparing guidelines for the evaluation of digital enforcement system trials (Malenstein, 2000b).

Furthermore, VERA has been very active in the examination of a harmonised approach to the enforcement of traffic laws across Europe using digital imaging techniques and the promotion of acceptance of digital records as evidence in court. As such, VERA offers a very interesting information source for the PEPPER project for the problems related to the automation of significant parts of the enforcement chain for the interest field of speeding.
Overview of relevant findings

Although automated enforcement systems have some major benefits that can help the enforcement of traffic laws, some problems do exist that have to be countered. One of those points of interest is the question of driver versus owner responsibility. A great difference can be found over the Member States and even within a single country, the responsibility can change depending on the violation type. This situation needs to be solved in order to maximize the efficiency of the use of automated enforcement systems. Jäger et al. (1999) identified two reasons that are in favour of owner responsibility:

- The identification of the driver cannot happen automatically or semi-automatically.
- Present digital cameras do not allow for the driver’s face and the complete traffic situation with appropriate resolution in one picture.

Furthermore, privacy is an issue for cross border enforcement but also when non-police private or public bodies are active in the field of enforcement. However, this should not be a problem when the procedures that are used in all countries are in line with the EU directive on privacy and national privacy legislation (European Parliament and Council Directive 95/46/EC). Because of this, a highly secured information network where all the actors in the enforcement chain are included has to be guaranteed.

Suggestions relevant for TLE and PEPPER

- A uniform solution over Member States has to be found for the question of driver versus owner responsibility.
- A uniform legislation over Member States regarding privacy has to be found.
- A good overview of the current legal situation and the actors active in the enforcement chain is presented in Deliverable 3.2 (Jäger et al., 1999).
- A questionnaire was used for Deliverable 3.2 (Jäger et al., 1999) with items aimed specifically at the legal issues concerning automated traffic law enforcement. The information gathered there can be reused.

3.3.4 VERA 2 (Video Enforcement for Road Authorities)

Summary and objectives

The VERA2 project focuses on the practicalities of cross-border enforcement in Europe and builds on one of the main subjects of the previously mentioned VERA project. VERA2 examined the legal basis for cross-border enforcement and proposed a draft text for a directive on cross-border enforcement which can provide a basis for resolving many of the legal, organisational and technical issues (Wilson et al., 2004).

VERA already stated that wide variation exists in the way that cross-border violations are dealt with by Member States and that this situation is not beneficial for traffic law enforce-
ment. To solve this issue, VERA2 has developed the context of a cross border data exchange network for enforcement (eENFORCE: Hammond et al., 2004). This network contains most of the agencies and organisations in different Member States that are capable of carrying out the responsibilities associated with cross-border enforcement and data exchange. These public and non-public organisations have three responsibilities:

- Conducting enforcement activity on violators as they cross borders.
- Conducting enforcement activity in another’s country, region or area.
- Enforcing the penalties for violators who do not live or work in the country where the violation was committed.

Furthermore, basic principles within which cross border enforcement should take place were drawn together. These basic principles state that in order to invoke the enforcement of penalty for a violation across Member States’ borders, all legal processes (including appeals) have to be concluded in the Member State where the violation took place. If, once these processes are complete, the penalty incurred cannot be enacted on the vehicle owner/driver responsible, the power to enforce the penalty can be delegated to the Member State where the vehicle owner/driver is resident.

As such, eENFORCE fulfils the following key functions:

- Provides a mechanism of secure violation data exchange between its members.
- Provides a translation facility for violation notices and penalty certificates from the language the violation took place into the language of the violator.
- Provides a facility to electronically exchange the penalty certificate as identified by the Framework Decision on the Mutual Recognition of Financial Penalties and the Vera 2 Directive when agreed.
- Provides the notification of arrival, completion or return of that certificate
- Deals with any money that the penalty certificate may attract.
- Collects statistics as required for the Enforcement Recommendations.
- Provides performance data on the eENFORCE Network and its members.

Future plans include an eENFORCE Plus extension with added values such as:

- Providing a linkage to the Registration Databases of its members.
- Providing a linkage to the driver information from Registration Authorities.
- Compiling an intelligence facility to meet the Enforcement Recommendations on repeat offenders.
- Providing the possibility for additional functions as agreed and required by its members.
Overview of relevant findings

The VERA2 project offered an extensive elaboration of the issues regarding cross border enforcement that were identified in the VERA project. As such, its goal wasn’t to produce new findings based on literature or research. VERA2 did however create a blueprint for a structure in eNFORCE that addresses, among others, the issue of member state differences in traffic law and enforcement, driver versus owner responsibility and the use of automated traffic law enforcement equipment.

Suggestions relevant for TLE and PEPPER

- Future law enforcement will have to work with an increasing number of automated traffic law enforcement methods. This has to be made possible at all involved levels (legislative, executive and judicial).
- For TLE to be effective across borders, actors involved in each member state have to be capable of taking the above mentioned responsibilities.
- For TLE to be maintained over a long period and in the different Member States, it has to prove to be efficient. In order to achieve this, a number of variables and indicators have to be collected.

3.3.5 SARTRE (Social Attitudes to Road Traffic Risk in Europe)

Summary and objectives

The SARTRE project first started in 1991 and conducted driver surveys in representative samples of the active driver population in 15 countries from October 1991 to June 1992. Its goal was to study and report the opinions and reported behaviours of car drivers for each European member state. The first project was followed in 1996 by SARTRE 2 where driver surveys in 19 countries were collected from October 1996 to April 1997 and finally by SARTRE 3 which collected driver surveys in 23 countries from September 2002 until December 2003. The SARTRE studies aimed at improving road safety by performing research on the drivers’ attitudes and reported behaviours. These studies make it possible to look for the influence of different traffic laws and different attitudes towards these laws on traffic safety.

The underlying rationale of the SARTRE projects is the fact that different countries obtain different success rates with their own policies to reduce road traffic risk. In order to understand this, a comparative study was made to learn best practices from each member state. Contrary to other studies where actual behaviour was measured to some extent, the SARTRE study focuses on the drivers’ attitudes and reported behaviours to capture the effect of the different regulations in Member States with regards to the key areas of speeding, driving under the influence of alcohol and seat belt wearing.

This is done because the influence of human factors on road accidents was recognised. It is argued that exactly though measuring drivers’ attitudes and reported behaviours, one might be
capable of making a distinction between different social and cultural factors regarding their approval or disapproval of measures taken since this can lead to different behaviours in terms of risk taking and actual driving behaviour. It has already been argued that it are exactly factors like this that underlie human behaviour (Ajzen, 1991; Reason et al, 1990).

Furthermore, these studies help detect different trends in drivers’ attitudes and reported behaviour. This is necessary in order to identify whether the situation in different countries is improving or deteriorating and helps guide choices made with regards to the selection of interest points and the influence of traffic safety measures taken.

The present review is based on the literature available from the SARTRE 3 project. This was done because of the relative large amount of time that passed between the endings of the original SARTRE and SARTRE 2 projects and that it could be argued that a number of relevant changes have taken place over the period in between. Nevertheless, the data of all of the SARTRE studies remain interesting for the PEPPER project because they offer a very valuable insight in the psychological mechanisms that are active in each individual driver. They offer a useful insight regarding the possible influence of the elements that determine the efficiency of any enforcement action as were described in chapter 2 of this working paper.

*Overview of relevant findings*

With regards to alcohol, the results published in the SARTRE 3 study indicate that European car drivers are quite aware of the problem of drinking and driving, as there is a high consensus for alcohol as being a cause for car accidents across all European countries (SARTRE 3 consortium, 2004a).

In all countries surveyed there is a very wide agreement that penalties for drink driving offences should be more severe. Accordingly, the majority of drivers share the opinion that people should not be allowed to decide for themselves how much they can drink before driving.

Generally, European car drivers show a rather careful estimation of how much alcohol they can drink to not exceed the legal limit. However, there is a tendency, that drivers of countries with a higher BAC limit guess that they can drink more alcohol than those with a lower limit. Especially in countries where drinking is frequent, the optimism about the allowed quantity is exaggerated. The admission to have exceeded these optimistic limits is frequent, and police controls continue to be the lowest.

An European Union wide introduction of a maximum alcohol limit of 0.5 g/l is favoured by the majority of drivers, however, the more the legal limit of a country differs from 0.5 –either higher or lower – the less favoured is a maximum BAC of 0.5 g/l. This reflects that the acceptance of legal measures seems to be strongly influences by habituation effects, meaning that as a new legislation is introduced, the acceptance will grow as time passes. Also the suggestion of a 0.0 BAC limit for novice drivers receives very strong support from car drivers across all countries.
Enforcement activity, i.e. alcohol checks, seems to be rare all over Europe although there is high awareness of the drink-driving problem in European car drivers. The vast majority of drivers have not been checked for alcohol during the last three years and accordingly the likelihood of being checked for alcohol is estimated to be very low. However, in those countries that allow random breath testing drivers estimate the probability to be checked higher (as indeed it is) which indicates that random alcohol checks might be a good mean of deterrence and of injury prevention. The perception that alcohol is often not a primary target of enforcement is also underlined by the fact that for most of the participating countries there is no official data available of the number of drivers checked for alcohol.

With regards to speeding, SARTRE 3 found that marked difference could be found between countries (both member and non-Member States) but that nevertheless some general conclusions could be made. One of those is that, in comparison with the SARTRE 2 study in 1996, drivers present a better understanding of the role of speeding in road accidents and are keener for all types of road safety measures focussing in decreasing speeding. Nevertheless, drivers do not appreciate that speed is associated with risk as far as their driving is concerned. Also noteworthy is the fact that most drivers think that it are other drivers that break the speed limit. This perception of other driver’s speeding behaviour is likely to strongly influence a driver’s general speed behaviour.

A widespread support for the installation of speed limiting devices and “black boxes” (which would record speed and could be used to prosecute speeders) in vehicles was identified. Additionally, this support for road safety countermeasures such as speed limiters and advertising restrictions appears to be increasing over time. However, it is worth mentioning that while there is strong support – over 50% on average for European Union countries – for the introduction of speed limiters as a road safety countermeasure, the level of support varies widely by country.

As far as experience and expectation of speed enforcement is concerned, analysis of survey results revealed that nearly one out of five European Union drivers have been penalised for speeding in the last 3 years. However, there are major differences between countries both in terms of the perceived likelihood of being monitored for speed and in the actual experience of being “fined, or punished” for speed related offences. The correlation between the perceptions of speed enforcement and actual experience is not strong; with some countries reporting a high perceived likelihood of being monitored but where a low percentage of the driving population actually admitted to having incurred speed related sanctions (and vice-versa).

While there is a high level of general support for increased speed enforcement and harsher penalties, the level of support varies considerably (between 39% and 80%) between countries. Furthermore, the survey showed a high degree of support for automated camera speed detection and for enforcement by public authorities but much less support for enforcement by private organisations.

With regard to seat belt wearing, SARTRE 3 found that the usage rate of seat belts remains low. This is especially the case for build-up areas. A particular programme for the use of seat belts should be designed for rapid improvement. This programme would include efficient en-
forcement of seat belt wearing in built-up areas and could possibly include alternative rewards for improving them further.

Overall, attitudes towards seat belts were positive. For example, a great majority of drivers in each country agreed that in most accidents seat belts reduce the risk of serious injury for drivers and passengers. In addition, the results showed that this attitude does not depend on the frequency of belt use. This finding suggests that drivers accept seat belts very well. However, too many drivers underestimate the necessity of wearing belts if one drives carefully and overestimate the risk of being trapped by the belt in case of emergency. These findings suggest that better education and information campaigns should be launched to improve understanding of the substantial benefits of seat belt wearing.

With regard to enforcement in general, the SARTRE 3 study noted that support extends to favouring more controls and higher penalties, especially for drink-drive offences. This support may partly be a result of the general widespread concern about road safety and the recognition that driver behaviour is a very major contributory factor in road accidents. However, some precautions need to be taken since a number of influences could have contaminated this data (social desirability, influence of local enforcement situation,…).

The results made it possible to compare what proportions of drivers had experienced enforcement (that is they were actually detected and punished in the last three years) for different types of offence. They revealed that speeding was the most frequent violation enforced by the police; although this varied considerably from country to country. Seatbelt violations were the next most frequent, although this was understandably low in those countries having high wearing rates. In comparison relatively few drink-drive violations were reported. Overall, there were around 4 times as many speeding violations reported as seat-belt violations, while there were correspondingly four times as many seat-belt violations as drink-drive violations. These results suggest that the police are targeting ‘easy’ violations rather than those that might be more directed towards safety. It is much easier, and cheaper, to detect a speeding driver automatically with a speed camera than to recognise, stop and breathalyse a driver over the limit – unless they are breathalysed as a result of being involved in an accident, as is done automatically in some countries.

If public support for enforcement is to be maintained it is important that it is perceived positively by road users as a way of improving safety and protecting them from dangerous driving – any public perception that is it simply a way of ‘raising revenue’ needs to be strongly countered. With this in mind it is important that enforcement activity is ‘transparent’ (and widely publicised) rather than being secret (such as using speed ‘guns’ from hidden positions). Enforcement should be used to influence the many rather than to catch and punish the few. The use of enforcement is a vital ‘tool’ for improving road safety. However, it must be used appropriately and needs to have the general support of the public. This means that any enforcement activity should be accompanied by education and publicity programmes to alert and inform the public. This also means that enforcement programmes, if they are to be effective, should include surveys that collect and monitor information on public attitudes.
Suggestions relevant for TLE and PEPPER

W Despite the positive results concerning drinking and driving, a very large amount of traffic accidents and traffic deaths remains related with alcohol (European commission, 2001b). The EC recommends a EU wide introduction of a maximum blood-alcohol content limit of 0.5 g/l (0.2 g/l for novice drivers, professional drivers and two wheel motor vehicles) and the introduction of random breath testing.

W Furthermore, legal measures need to be harmonised across the Member States regarding BAC limits, random breath testing and the increase of enforcement.

W European drivers believe that the risk of their own speeding is low and consequently road safety campaigns could be redesigned, focusing on passing the message that exceeding speed limits is also their concern.

W Self reported speeding is higher on faster roads (outside built-up area) and consequently, any speeding related action (campaigns, enforcement, etc.) should primarily focus on drivers on these faster roads. Additionally, widespread recognition for the need of lower speeds in built-up areas indicates that less effort should be put in this direction.

W The introduction of specific speeding countermeasures, like speed limiters and advertising restrictions, has a high degree of acceptance and consequently, decision makers should exploit the opportunity to further promote the introduction of such speeding countermeasures.

W In countries, with low degree of acceptance of speed enforcement, information campaigns should precede and accompany the enforcement intensification.

W Usage of seat belt rates is too low in many countries, especially in built-up areas. Consequently, more efficient enforcement of seat belt wearing laws is needed.

W The combination of enforcement with other measures such as education and information campaigns, belt reminders, intervening systems or other innovative methods should be implemented.

W Communication about enforcement activities remains very important. Not only can it change the reported enforcement likelihood, it also helps gain public support for enforcement measures.

3.3.6 ROSEBUD (Road Safety and Environmental Benefit-Cost and Cost-Effectiveness Analysis for Use in Decision-Making)

Summary and objectives

ROSEBUD is a thematic network of the European Commission headed by the German Federal Highway Research Institute and intended to rate the efficiency of traffic safety measures.
Its participants comprise 14 institutions from 13 EU and non-EU nations as well as further experts and users. ROSEBUD has the following objectives:

- To determine the current knowledge base available for evaluating the profitability of traffic safety measures.
- To prepare proposals for surmounting obstacles and barriers in the way of such evaluations.
- To advance existing techniques of evaluating traffic safety measures.
- To test/plan the implementation of evaluation techniques at the European level.

In view of limited public funds and ever greater challenges posed to a reduction in the number and consequences of traffic accidents, a monetary evaluation of traffic safety projects constitutes an important instrument for facilitating crucial decision-making by the European Community when it comes to traffic. It maximizes efficiency and effectiveness in utilizing public funds to achieve agreed objectives. ROSEBUD merges internationally available knowledge and experience gathered in the application of monetary evaluation techniques by scientists, politicians and practitioners, thus providing the user with information essential for a fulfilment of objectives.

The ROSEBUD project collected a large number of road safety measures wherefore cost-benefit analyses were made. These measures included infrastructural changes, educational programmes, vehicle safety measures, accident analyses and enforcement programmes. In this project, it was tried to assess the efficiency of each road safety measure from a relative strict monetary point of view with either cost-benefit analyses or cost-effectiveness analyses. This approach offers valuable information for the PEPPER project since the cost of the project remains one of the main limitations for any road safety programme. Obviously, the cost is then one of the factors that have to be taken into account when one tries to achieve maximum efficiency (ROSEBUD WP1, 2003).

Apart from the strict analyses of road safety measures, the ROSEBUD project also focuses on the possible barriers (Elvik & Veisten, 2004) and solutions (Hakkert & Wesemann, 2004) that exist when using cost-benefit or cost-effectiveness analyses as a method for policy decisions. Since a significant amount of decisions that are made on a political level are based at least partially on these analyses, it is worth knowing what can be expected from these analyses.

Furthermore, a number of road safety measures were selected and analysed with standardised techniques that were created to measure the efficiency (Winkelbauer & Stefan, 2005). These tools basically consisted of a cost-benefit or analyses where several factors were taken into account such as:

- The safety effect (a percentage of accidents or casualties that were avoided by implementing the measure).
- The implementation unit (a road section, car, etc).
The target accidents (the accidents, injury group, population, etc that are targeted by a safety measure).

The accident costs (medical costs, cost of lost productive capacity, valuation of lost quality of life, costs of property damage, administrative costs).

The implementation costs (the social costs of all means of production that are employed to implement the measure).

With regards to the PEPPER project, special attention was given to the assessment of road safety measures that involved traffic law enforcement.

**Overview of relevant findings**

As was mentioned earlier, cost-benefit and cost-effectiveness analyses have a lot to offer in a situation where limited resources are available but nevertheless a choice has to be made. One of the most obvious points of interest is the actual selection of indicators that are to be used to measure the cost or benefit.

The efficacy of road safety measures ought to be quantified in terms of reduced accident figures, e.g. number respectively severity of accidents. The number and severity of accidents depend on a lot of influencing factors. The effect of an implemented road safety measure is one of all the influencing factors only. For measuring the efficacy of a safety measure, their influence has to be separated from all other influences. The estimation of effects shall quantify how accidents can be influenced by road safety measures. The number and severity of accidents can be characterised by standardised categories:

- fatality
- severe injury
- slight injury
- property damage only

There are a lot of proven methods for solving this problem (see chapter 5.3.4 from ROSEBUD WP1 deliverable). Nevertheless, the premises for applying these instruments are often lacking. Therefore, surrogate measures respectively indicators have to be alternatively applied. Observing the development of “performance indicators”, can be a reasonable mean for measuring the efficacy of a road safety measure. Performance indicators are intermediate variables with specific effect on the accident variables. For measures which could not be directly linked to the accidents (traffic education etc.) an effort to establish a relationship between performance indicators and accident indicator should be made.

Performance indicators can be expressed in qualitative and quantitative terms. Clearly, an advantage of a quantitative figure is, that the measure can be more exactly characterised and described in its intensity. Thus a more detailed quantitative connection between measure and
effect can be established. As mentioned above, effects can not always be measured directly in these categories. Intermediate performance variables have to be introduced: e.g.

- change of average speed
- share of seat belt wearing rate
- provision with airbags
- etc.

Performance variables must be chosen in a way that they represent the road safety measure correctly. On the other hand they must offer the possibility to draw conclusions on the accidents.

Apart from the choice of indicators, a significant barrier can exist on the part of the end-user of these cost-benefit or cost-effectiveness analyses. Elvik et al. (2003) identified 4 different groups of barriers:

- Fundamental barriers (objections to the use of efficiency assessment tools).
- Barriers related to the organisation of policy making (institutional factors).
- Barriers inherent in efficiency assessment tools (lack of knowledge, uncertainties, etc.).
- Barriers related to the implementation of efficient road safety measures.

However serious these barriers might seem, solutions can be found for at least some of these barriers. Fundamental barriers and barriers related to the organisation of policy making were not possible to solve within the scope of ROSEBUD and indeed can be considered external barriers. The barriers that are inherent to the efficiency assessment tools however can be countered by performing a good analysis of the problem. Not only can this help in making a correct choice in method, but it also gives aid in choosing the variables that are needed and enabling a thorough analysis and quality control.

As a result of these technical remarks, the ROSEBUD project was capable of performing a thorough analysis on a limited set of road safety measures. Eighteen case-studies were carried out covering the wide range of traffic safety measures (infrastructure-related, vehicle-related, user-related).

It was found that enforcement-related measures appear to be more cost-effective than other measures, obviously due to lower implementation costs. The efficiency of other user-related measures and of vehicle-related measures is also relatively high due to the same reason (low implementation costs per unit of implementation). On the other hand, the efficiency of infrastructure-related measures varies widely, depending both on the construction costs and safety effects of the measures.
Suggestions relevant for TLE and PEPPER

When comparing traffic safety measures, TLE is found to be more cost-effective than other measures. This is mostly due to lower implementation costs.

A careful selection has to be made regarding the choice of method for assessing the safety measures’ efficiency. Cost-benefit and cost-effectiveness analyses do share a common ground but have different implications and need different amounts of data to start with.

For any analysis to be executed correctly, the correct data has to be present. A number of questions arise because of the difficulty of quantifying and predicting the results of a treatment:

- Do the data exist relative to that type of measure?
- Were the data estimated properly, taking into account the influence of confounding factors?
- To what extent is it correct to use data from other studies when data in a specific situation doesn’t exist?
- To what extent is it possible to predict the variability of important quantities such as the volume of traffic, etc?

3.3.7 TIS-study: Comparative study of road traffic rules and corresponding enforcement actions in the Member States of the European Union.

Summary and objectives

The TIS-study provided information and made a comparative analysis of road traffic rules and corresponding enforcement in 15 Member States of the European Union (EU15) thus providing one of the first steps towards harmonisation of traffic law (TIS, 2003). Considering the wide scoped coverage of national legislation, the TIS-study has concentrated on topics that are, either within the competencies of the EU or where the EU action might potentially add value, namely where the establishment of policies may be done more effectively at the EU level, rather than at a national or sub national level.

The four main objectives of the study were:

- To provide detailed information on road traffic rules and respective sanction regimes, in order to contribute to the EC work on the harmonisation of traffic rules and enforcement practices.
- To provide information on best results achieved in the field of legislation issuing and enforcement strategies, to the decision makers, enabling the detection of eventual best practices in specific issues.
To inform the general public, raising awareness on the need for legal harmonisation and contributing for the social acceptance of future legislative initiatives or measures.

To supply useful information to the European road user, increasing the knowledge of the rules to be followed within his own country and when travelling, by road, to other Member State.

Information was collected through a survey study in 15 Member States and made available in a database. An integrated analysis was then performed on these data where both top-down (taking into account the key features of relevant legislative and law enforcement bodies) and bottom-up (covering the detail of the rules and respective enforcement) perspectives were integrated.

**Overview of relevant findings**

It was difficult for the TIS-study to assess the rules and enforcement at a national level because of the characteristics and limitations of the data that was collected. In general, high dispersion of data between different institutions makes the process of identification of who is responsible for what data very difficult. This isn’t made easier because of the complexity of the legal and organisational framework and the problems in identifying what the actual text law is that is in force.

Furthermore, no common rule for collection, codification and presentation of information on infringements and applications of sanctions exists on a national level. This aspect is even more prominent when different police forces are in charge of the road traffic control. Apart from that, not all Member States made data available related with the control of the main traffic rules. These elements hindered a good cross comparison between Member States, especially with respect to enforcement. However, it is also proven that harmonisation of enforcement can be achieved: EC legislation took care of the harmonisation of enforcement in the field of commercial road transport.

Because of these setbacks, the need rises to develop an integrated information system for Traffic Rules in Europe. Such a database was conceived in a first form for the TIS-study and needs further improvements. This system should provide dynamic information on the legal, organisational and regulatory frameworks for road traffic rules and enforcement as well as detailed aspects of road traffic rules and enforcement. This would enable a swifter understanding of data on road traffic rules and respective enforcement, a possible harmonisation of concepts and methodology for data collection and the offering of structured information for flexible benchmarking. If such a database were linked with a database such as the CARE database which provides quantitative data on accidents, the analysis of the relationship between legal and enforcement frameworks and the performance in terms of road safety would become more feasible.

Special attention needs to be given to the harmonisation of concepts and methodology for data collection since the validity of any type of comparison stands or falls with the basic concepts that are used. This harmonisation can take place at three different levels:
Concise and common definitions for the rules to be analysed (i.e. what is considered overtaking?).

Levels of severity of sanctions to be applied to infringements (i.e. definition of a standardised framework for the classification of the sanction regime for a given rule infringement).

Definition of indicators to be used in the assessment of police control enforcement and legal system performance.

**Suggestions relevant for TLE and PEPPER**

As was stated above, a clear definition of indicators for the assessment of police control enforcement and legal system performance needs to be provided. This should also include clear definitions of the terminology and traffic rules since they will influence the actual enforcement indicators.

The structure that is chosen for containing information in a database needs to be capable of swift comparison with information provided by databases such as the CARE database.

Benchmarking should be the next step that is possible though the use of such a database. Because of the large amount of relevant data needed for benchmarking enforcement practices, this data can be hard to obtain and the actors along the enforcement chain that can provide valid data need to be identified.

A gradual convergence of main traffic rules and the effective enforcement of road traffic rules need to be supported.

**3.3.8 CAPTIVE**

**Summary and objectives**

CAPTIVE is a European Commission DGTREN project examining the current state of play in cross-border enforcement of road traffic laws within the European Union. The project builds on the work of the Video Enforcement for Road Authorities (VERA and VERA2) projects by examining bilateral/multilateral agreements and other instruments (such as Directives and Conventions) which address the cross-border enforcement of road traffic offences.

Strategies to improve compliance with road traffic laws typically involve three aspects: driver education, road engineering and enforcement. When education and engineering do not have the desired impact on compliance, enforcement becomes a necessary sanction. The deterrent effect of penalties imposed through the enforcement process aims to change driver behaviour and ultimately, achieve a greater degree of compliance.

The imposition and enforcement of penalties has to be applied equally to all drivers regardless of where they live, work or are recognized to have citizenship. The foundation of the Euro-
pean Union on 1 May 1993 presented EU citizens with new opportunities for mobility. This increased mobility has had many positive effects.

However, from an enforcement perspective, the growth in cross-border traffic throughout Europe has meant that agencies have to deal with an increasing number of road traffic violations committed by drivers of vehicles registered in other States. Agencies also have to deal with drivers who change their residential status to evade the effects of penalties imposed on them by other Member States (for example, by changing their residency and obtaining new driving licenses to negate bans or restrictions placed on them in States where they previously resided).

Enforcing penalties on these so-called ‘non-resident violators’ raises many legal, organizational and procedural issues and as a consequence, penalties are rarely enforced.

The overall objective of the CAPTIVE project is to formulate policy-oriented recommendations and proposals for measures to be taken at a European level to facilitate the implementation of effective cross-border enforcement strategies for road traffic violations.

**Overview of relevant findings**

Cross-border enforcement became more important with an increasing number of cross-border traffic violations. Implementing the same enforcement regime used for resident violators raises many legal, organisational, procedural and penalty-specific issues which in many cases are difficult to successfully address.

Three elements were identified that can guarantee the common approach that would be necessary to guarantee effective cross-border enforcement:

- **Common operational procedures** that have to be carried out the same way in each Member State and which facilitate State-State cooperation.
- **Transitional elements** which will allow State’s national enforcement procedures to work seamlessly with the common operational procedures.
- **Common standards of operation** which specify the minimum standard to which the common operational procedures must be performed by all States.

Multiple actions have to be undertaken at different levels (ie pan-EU, regional, national and local) by different stakeholders and with a range of different timescales. A five-year Implementation Plan was conceived with actions in five key areas:

- **Preparatory and support actions.**
- **Defining and agreeing the common approach.**
- **Providing a legal framework for the common approach.**
- **Defining and developing standards and tools to support the common approach.**
Implementing, operating and monitoring the common approach in each State.

**Suggestions relevant for TLE and PEPPER**

- Consistent, effective and structured cross-border cooperation between Member States needs to be achieved. This requires States to adopt a ‘common approach’ to cross-border enforcement.

- A clear definition of cross-border enforcement was presented: The application of operational procedures and standards to allow the imposition and enforcement of penalties on violators of road traffic laws who do not reside in the State where they committed the violation, whose vehicle is not registered in the State where the violation was committed or whose driving/operating licence is not issued by the State where the violation was committed.

- The five-year Implementation Plan can provide valuable information on how differences in the Member State’s legislation and enforcement chain can be identified, analysed and brought together.

### 3.3.9 FAIR (Fully Automatic Integrated Road Control)

**Summary and objectives**

FAIR is a European Commission DGTRN project that looked at the optimal possibilities for the integration of technologies and practices for monitoring, supervising, recording, reporting and the execution of enforcement for avoiding major traffic violations on priority road networks. FAIR looked at achieving higher safety levels on roads by performing research towards a new integrated and efficient approach.

The approach that was chosen for this project was the integration and combination of different sensors and shared infrastructure for automated enforcement so that a large number of potentially dangerous traffic violations could be detected. In practice, this would mean integrating the systems for speed control, section control, overload control of wheels, axles and trucks and trailers, toll collection control, overtaking control, distance keeping, driving time, automatic wanted list, safety belt usage and more.

Furthermore, an extensive cost benefit analysis was performed. It was found that a significantly high cost benefit ratio could be found meaning that the general benefits outweigh the costs, both with or without taking an increase in revenues into account. When comparing to the today enforcement with the different scenarios of FAIR, extremely much higher revenues have the effect that any scenario of FAIR is worth realizing and reasonable.

As a result of the FAIR study, two test sites (one in Bavaria, Germany and one near Vuosaari, Finland) were proposed that are going to be designed and built in the near future (time frame 2007-2010). These sites will be used for testing and operational investigation of new technologies and enforcement systems. This is done during the follow-up project FAIR II.
Suggestions relevant for TLE and PEPPER

Since a very technical and integrated approach was taken for the FAIR project, a significant amount of information could be found regarding the automated enforcement of relevant traffic legislations.

For the areas of speeding and safety belt usage, information can be collected from the FAIR project that is particularly interesting for PEPPER.

3.4 On-going projects regarding traffic safety including traffic law enforcement

3.4.1 SafetyNet

Summary and objectives

The EU target of a 50% reduction in fatalities by 2010 relies on the existence of basic knowledge of crashes and their causation and the availability of road safety data to monitor and assess performance. It will only be achieved by the introduction of the most effective countermeasures. The EC has expressed the demand for a "Road Safety Observatory" in its 2001 White Paper and other public documents. The SafetyNet project is an integrated project that meets those demands. Safetynet brings together all of the most experienced organisations within the EU to assemble a co-ordinated set of data resources that together will meet the EC needs for policy support.

The main work areas are:

- Further enhancement and exploitation of the CARE database including extension to the 10 new Member States, the so called CAREPLUS 10.

- A new methodology to gather risk/exposure data and integrate it to datasets incorporating the CAREXPO project.

- The design and implementation of a Europe-wide network for periodical measurements of Safety Performance Indicators.

- Recommendations for independent road accident investigation.

- A new fatal accident database at intermediate level and an in-depth accident causation database.

- Provision of a Safety Information System as a gateway for the complete set of information gathered.

- Validation and analysis of the data.

SafetyNet makes use of the following databases:
European databases: CARE, CHILD, EACS, ECBOS, ECMT, ETAC, Eurostat, MAIDS, PENDANT, RISER.
The CARE Database contains information on road safety in 14 EU countries (Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Sweden, and United Kingdom); a number of databases concern data of specific road users or at specific locations: CHILD (children), ECBOS (coach and bus occupants), ETAC (truck accidents), MAIDS (motorcyclists), RISER (highways accidents).

Global databases: IRF, IRTAD, UNECE.
The IRF database contains aggregated data for 84 countries; The IRTAD database includes data on injury accidents, road fatalities, injured and hospitalised road users, as well as relevant exposure data such as population, car park, network length, vehicle kilometrage and seatbelt wearing rates from 29 countries, covering every year since 1970. Moreover, key road safety indicators are compiled on a monthly basis. The following countries are currently included in the IRTAD database: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States. The UN-commission UNECE (Economic Commission for Europe) Database contains data on accidents and victims are presented, with data on road length, traffic volumes, number of registered vehicles and population. There are 55 countries in the UNECE data file.

National databases for five countries (Finland, France, Germany, Italy, Netherlands), provide information how data are collected and processed, the parties responsible for collection and maintenance of the data, and the availability of data to other parties.

The data collected and used in SafetyNet, as described on the project’s web site (http://www.erso.eu/), are as follows:

- Time series of the pedestrians, occupants of pedal cycles, mopeds and motorcycles.
- Annual number of fatalities by age.

Suggestions relevant for TLE and PEPPER

Safetynet focuses on a number of traffic safety issues from which alcohol and speeding are the most relevant for the PEPPER project. Based on the presentations from the first Safetynet meeting in Prague the following suggestions have already been made regarding alcohol:

- To have random breath tests for all drivers and not only for 'suspected' drivers.
To raise the chance of getting caught by carrying out more random roadside breath tests (especially at times and on spots where drink driving is expected).

To have alcohol ignition interlocks installed in the cars of severe first time offenders and all recidivists in combination with a driver improvement course.

To have better public campaigns and education programmes (for all age groups) based on scientific research.

To reduce the availability of alcoholic beverages, especially for young novice drivers. This can be done by raising the age limit for buying alcohol and by banning the sales of alcoholic beverages in petrol stations and transport cafes.

The following suggestions have been made regarding speeding:

Speed limits must define a safe speed, reflecting the function of the road, traffic composition and road design characteristics. Speed limits must also be credible, reflecting the characteristics of the road and the road environment.

Drivers must be aware of the local speed limit at all times. This can be realised by good and consistent signing as well as consistent application of road markings and delineation, specifically related to particular speed limits.

Road engineering, such as speed humps and narrowings, helps to reduce speed at locations where low speed is essential. If applied in a consistent way, these measures also help drivers to recognise the traffic situation and the corresponding speed limit.

Speed management has to be accompanied by education and information to make road users aware of the speed and speeding problem and about the 'why' and 'what' of countermeasures.

Despite these measures, there always will be drivers who exceed the speed limit. For these intentional violators enforcement remains a necessary instrument.

New technologies enable in-vehicle systems that support drivers to comply with the speed limits. These systems provide information about the speed limit in force; warn the driver when exceeding the limit; or make excess speed impossible or uncomfortable. Such systems are available and likely to be introduced progressively. New technologies also enable communication between road and vehicle, allowing for full dynamic speed limits, based on the actual traffic and weather conditions.

PEPPER can greatly benefit by the data collected by SafetyNet and the safety indicators which this project is producing since all this information will give an accurate description on the road safety situation in the member countries in terms of accident statistics both in general and for specific road user groups and types of roads. The accident statistics and safety indicators developed by SafetyNet can be used by PEPPER to account for and monitor the impact of enforcement measures on target behaviour and changes in behaviour(s) and in the number of accidents in the member countries.
In addition to SafetyNet, PEPPER will produce a model to collect and monitor enforcement data across the EU countries. It should be mentioned that, unlike for accident data, there are no common databases nor common standards or procedures about which type of enforcement data should be collected. PEPPER will explore the availability of enforcement data in the Member States and how to collect them in a common database.

3.4.2 ETSC & enforcement monitoring

Summary and objectives

ETSC has launched in 2004 a programme to monitor progress made in EU Member States in terms of improving traffic law enforcement. ETSC will be assessing and comparing their efforts and report on its findings regularly to keep the item on the agenda. Through this, ETSC will promote best practice not only regarding traffic law enforcement carried out by the police, but also through "self-enforcing" cars and roads. The programme will therefore focus on all three pillars of enforcement policymaking (and transport safety policymaking in general):

- **The user:** Traditionally, enforcement is understood as police enforcement, ensuring compliance with traffic rules. Police enforcement actions should be planned, monitored and evaluated according to the Commission Recommendation.

- **The vehicle:** Enforcement technologies such as alcohol interlocks, seat belt reminders or intelligent speed adaptation devices have an important role to play in securing compliance with key traffic rules. Their implementation requires additional awareness and support from car makers.

- **The infrastructure:** Ensuring appropriate road user behaviour is also a question of efficient enforcement design, i.e. of constructing self-enforcing roads. There are good examples from Member States that should be identified and promoted amongst policymakers across Europe.

Furthermore, on June 7th, 2006 ETSC launched the so called Road Safety PIN (Performance Index) programme. The purpose is to monitor the road safety situation in the EU Member States in order to see if the policy makers are taking the steps needed to substantially improve the road safety records in the respective countries. One of the purposes of the programme is to answer to questions such as: Are effective strategies implemented to target speeding, drink driving and the use of seat belts and helmets?

With the PIN programme, ETSC together with the Swedish Road Administration and Toyota Motor Europe is introducing a monitoring mechanism to “pin” the responsible for the road safety in order to ensure that they deliver on their commitment.

Road safety performance differs both between states and between aspects of road safety within the same state. Comparable road safety indicators will be used in the PIN programme that can help decision makers across EU to recognise achievements and to identify short-
comings. The PIN programme will use extensively the databases, the methodologies and the results of SafetyNet and SUNFLOWER+6 projects.

The Road Safety PIN will be used:

- To compare countries.
- To compare aspects of road safety within the same country.
- To identify best practices.
- To put pressure on underperformers.
- To prioritize and evaluate actions on EU-level.

The Road Safety PIN is:

- A new policy instrument to translate science into policy.
- A new mechanism to separate good from bad actions.
- A “carrot” stimulating everybody to do better.
- A “yardstick” for citizens to assess the level of protection their governments are providing in the field of road safety.
- A tool to identify problems and provide solutions.

**Suggestions relevant for TLE and PEPPER**

PEPPER can benefit mostly from the ETSC programme related to the user behaviour and to a lesser extent the vehicle technology. Although the PEPPER project has a somewhat wider view on enforcement, the central theme remains the same. The Road Safety PIN would offer a valuable information source that can be used in PEPPER in order to:

- Investigate the possibility to create enforcement performance indicators (similar to the road safety PIN) so the member countries can be compared.
- Investigate the possibility to compare the speeding, drink driving and seat belt usage aspect of enforcement within the same country.
- Map the best enforcement practices in the partner countries.
- Map the underperformers.
- Suggest a tool to identify problems in the enforcement chain (both across countries and across different issues in the same country) and possible solutions.

PEPPER can use the road safety indices introduced by the PIN-programme to monitor the road safety situation in the partner countries, with focus on speeding, drink driving and seat belt usage. In addition to this, PEPPER can benefit from the methodologies used to create
comparable performance indices and from the monitoring mechanism put together by the PIN programme to separate good from bad practices, and eventually develop similar instruments for enforcement related to speeding, drink driving and seat belt usage. If such enforcement indices are created by PEPPER, the PIN-programme can eventually include them as an integral part of its monitoring mechanism.

3.4.3 SUPREME (Summary and publication of best practices in road safety in the EU Member States)

Summary and objectives

The goal of SUPREME is to collect, analyse, summarise and publish best practices in road safety in the Member States of the European Union as well as in Switzerland and Norway, with a view to implementation in as many partner states as possible. By making the study results available to a broad target audience across Europe – and thereby encouraging the take-up of successful strategies – the project will contribute to reaching the 50% reduction target of road fatalities, which the European Commission set in its White Paper "European transport policy for 2010: time to decide" (2001).

The work will be carried out by a comprehensive group of outstanding road safety institutions and experts, bringing along both excellence in the field and insight into specific conditions and institutional settings at the level of the 27 countries in the study area. Through their participation in numerous road safety research projects and working groups at European level, the project partners are well aware of similar work previously carried out in Europe.

The crucial task of the project lies with the sound identification of best practice from the vast amount of available measures. In order to facilitate this process, a set of tools for classification, selection and ranking of measures will be developed, along with guidelines for the assessment process at country level. On this basis, a network of Country Experts will gather information from various stakeholders. Questionnaires will be completed for each measure considered suitable to be included in the SUPREME framework. In addition, 27 country reports will be produced, describing the institutional setup of road safety work in partner states.

Analysis, synthesis and further selection of collected data will be carried out along roughly 10 categories of measures (covering all areas of road safety work), each of them led by a partner with outstanding experience in the specific field (Analysis Group). Thematic reports will give a detailed description of best available practices for each of these categories, featuring basic characteristics such as target groups, quantitative and qualitative goals, key issues, duration of implementation and effects, coverage, costs, actors involved, implementation procedures as well as key success factors and potential implementation barriers in other countries or at the European level.

The project will develop a framework and a general strategic outline for dissemination activities. Each Country Expert will provide a dissemination plan (including a list of contacts), along with a dissemination strategy, for the respective country. Two separate handbooks will be provided, one for the European level (European institutions, international organisations,
global industries) and one for the Country level (Ministries, regions, local level: stakeholders, policy makers, practitioners and the interested public). Results of the project will be published on the Internet. Further dissemination activities will be carried out by several partners as a follow-up to the project.

Suggestions relevant for TLE and PEPPER

The PEPPER project can benefit from the identification of best practice from the vast amount of available measures. Since this will be done by using a set of tools for classification, selection and a ranking of measures will be developed, along with guidelines for the assessment process at country level, this might offer a possibility for presenting the indicators created for measuring the efficiency of enforcement programmes.

3.4.4 CARE (Community database on Accidents on Roads in Europe)

Summary and objectives

Road traffic accidents in the European Union annually claim more than 40,000 lives and leave more than 1.7 million people injured, representing estimated costs, both direct and indirect, of 160 billion Euro. Since 1984 a large number of measures to reduce road accidents have been taken at the Community level. It was commonly agreed that a database at the Community level would make it possible to identify and quantify road safety problems, evaluate the efficiency of road safety measures, determine the relevance of Community actions and facilitate the exchange of experience in this field.

CARE focuses on road accidents resulting in death or injury (no statistics on damage - only accidents). The major difference between CARE and most other existing international databases is the high level of disaggregation, i.e. CARE comprises detailed data on individual accidents as collected by the Member States. This structure allows for maximum flexibility and potential with regard to analysing the information contained in the system and opens up a whole set of new possibilities in the field of accident analysis. Today, the only system comparable to CARE database is the FARS system (Fatality Analysis & Reporting System) operational since the 70s' at Federal level of the United States of America.

Instead of entering into a lengthy process of defining and adopting a new standardised structure and recognising that this would require considerable changes for the national administrations (such as the harmonisation of accident reports, definitions and collection methodologies) it has been decided that the national data sets should be integrated into the CARE database in their original national structure and definitions, with confidential data blanked out. Subsequently, the Commission provided a framework of transformation rules so that CARE provides compatible data. The process of improving "homogenisation" of accident data within CARE and the process of developing it are underway.

The statistical data contained on the CARE website provide an overview of road accident fatalities in the Member States for the period 1991 - 2004, on the basis of data available in the CARE database. A crucial remark needs to be made regarding the use of the database: the
CARE database does not contain socioeconomic data such as traffic data. This has to be taken into account and possible extensions of the database should be considered for making valid comparisons and conclusions.

The variables available through the CARE database include accident frequency, number of persons killed or injured, class, gender and age of persons killed, vehicle group involved in accident, area type, junction type, collision type, lighting conditions, weather conditions and time of day.

**Suggestions relevant for TLE and PEPPER**

The CARE database is very useful in providing data and examples of best practices on how this data can be used in a cross-comparison between enforcement methods. Obviously, the effectiveness of any enforcement programme is at least partially measured in terms of the accident number so this element should at least be incorporated in or made comparable with a PEPPER database.

### 3.4.5 Switzerland: enforcement indicators

**Summary and objectives**

According to the ETSC Report ‘Traffic law enforcement across the EU’ the best example for monitoring enforcement is Switzerland (ETSC Report 2006). Switzerland had introduced a detailed indicator system to monitor development in areas of drink driving and speeding. The goal of the presentation of this information is informing the public with regards to the current situation of traffic violations and presenting development indicators.

Each indicator represents a distinctive aspect of the violation of traffic laws in general. An overview can only be presented when all of these indicators are taken into account. The indicators are grouped in five sets:

**Level of police checks (effective and perceived):**

- Alcohol: Percentage of drivers who are encounter an alcohol-check at least once every year; Percentage of drivers who are tested on alcohol during checks; Number of measuring equipment; Percentage drivers who demand more alcohol-related checks; Percentage drivers who believe they will not be checked on drink driving.
  - Speeding: Number of vehicles checked; Number of measuring equipment; Percentage drivers who demand more speed checks; Percentage drivers who believe they will not be checked on speed.

**Level of offences:**

- Alcohol: Self-reported drink-driving; Number of drink-driving sentences; Percentage drink driving violations (BAC > 0.8 pro mille).
  - Speeding: Number of drivers’ licences revoked; Percentage speed violations in general; Self-reported speeding in build-up areas.

**Traffic safety (effective and perceived):**
Alcohol: Deadly accidents with influence of alcohol; Drivers’ fear for involvement in an alcohol-related accident caused by self or other.

Speeding: Deadly accidents with speeding influence; Drivers’ fear for involvement in a speed-related accident caused by self or other.

Severity of sanctions:
- Alcohol: Number of heavy sanctions; Median height of fine; Median duration of imprisonment; Recidivism.
- Speeding: Number of heavy sanctions; Median height of fine; Median Duration of imprisonment; Recidivism.

Feeling of the drivers about the relevant road safety rules and their enforcement:
- Alcohol: Percentage of drivers who demand lower BAC limits; Percentage of drivers who demand alcohol checks without implication; Percentage of drivers who believe drink-driving violations are criminal acts.
- Speeding: Percentage of drivers who believe speeding violations are criminal acts.

The data stem from various registers and surveys (interviews) and are updated on a regular basis.

PEPPER will investigate which variables used in monitoring enforcement performance are available in the member countries, how and/or is it possible to collect them as well as mapping eventual gaps (which data are missing and/or in which countries it is not possible to collect the data). The indicators used in Switzerland can form a good reference point for the PEPPER project. In addition, a prediction model is expected to be produced by the PEPPER project; this model will give an estimate on the changes in road safety indicators (e.g. targeted road user behaviour, number of accidents etc.) which are due to enforcement measures.

3.4.6 TISPOL (European Road Police Network)

Summary and objectives

Although TISPOL isn’t a research project but an Operation project in cooperation with the European Commission, it does deserve to be included in this document.

The TISPOL Organisation has been established by the traffic police forces of Europe in order to improve road safety and law enforcement on the roads of Europe and contains members from 25 EU countries. The main priority is to reduce the number of people being killed and seriously injured on Europe’s roads by enforcing traffic law and advocating traffic-education. It is expected that TISPOL can make a significant contribution to reducing the number of accidents on European roads.

The main goals of TISPOL are:

- To reduce road deaths and casualties on European Roads.
To bring together the Roads and Traffic Police Forces in Europe to work together and exchange information and experiences regarding good practices.

Organising and co-ordinating pan-European operations and campaigns.

To encourage enforcement and education based on research, intelligence and information so as to establish an effective and targeted education and enforcement programme.

Initiating and supporting research on road safety.

Providing an informed and co-ordinated police opinion on road safety issues.

Suggestions relevant for TLE and PEPPER

TISPOL unites a significant amount of stakeholders on road police-level from most EU countries. As such, TISPOL can prove very valuable in contacting the different stakeholders. Furthermore, several TISPOL-members have already worked in different European Projects.

TISPOL can provide PEPPER with a good medium to collect information (statistics, legislations, etc) from different EU Member States and might already possess such information itself.

TISPOL is a partner in the PEPPER consortium.

3.5 Enforcement efficiency: literature from other domains

3.5.1 EuReporting: European system of social indicators

Summary and objectives

The European system of social indicators is a research project funded by the European Commission for the duration of 3 years as a subproject of the "EuReporting-Project" ("Towards a European System of Social Reporting and Welfare Measurement") within the 4th Framework TSER-Programme. Its goal is to monitor the quality of life and societies across Europe. The EuReporting-Project included scholars from 13 European countries. As part of this project, the theoretical framework as well as the basic architecture of the European System of Social Indicators has been developed.

It has since then evolved into the Social Indicators Information Service whose goal it is to contribute to regular social reporting. It is edited and published by Social Indicators Department of ZUMA, the Centre for Survey Research and Methodology in Mannheim. It is used to publish the department’s own research results as well as contributions of other social scientists that work on different aspects of social reporting. The Social Indicators Information Service tries to reach both an academic as well as an interested non-academic public with or without a background in the social sciences. It is published twice a year and provides information on
problems and tendencies of welfare development as well as on selected trends of social change. At the same time empirical data on current topics of the socio-political discourse are published.

The research of constructing and implementing the European System of Social Indicators aims to develop a theoretically as well as methodologically well-grounded set of measurement dimensions and indicators to be used for a continuous monitoring of the quality of life and societies across Europe. This indicator system strives to meet the following requirements:

- The explicit coverage of the ‘European dimension', for example by means of measures of European identity or the inequalities, cohesion and conflict between member countries of the European Union.
- The coverage of new dimensions of welfare and social change as they are presently discussed for example by concepts like social exclusion and sustainable development.
- The search for new and - in terms of validity and reliability - better indicators.
- The exploitation of the best data sources available and guaranty of the best possible international and intercultural comparability of indicators.

Research on a European System of Social Indicators committed to these objectives and demands includes:

- Development of a conceptual framework:
  Science-based indicator systems need to be concept driven rather than data or policy-driven. They should in other words be based on an explicit, clearly defined and comprehensive conceptual framework which allows guiding and justifying the choice and selection of measurement dimensions and indicators.

- Design and definition of the architecture and structure:
  In a second step, the basic structural parameters of the indicator system have to be fixed. This includes the selection of life domains to be covered, as well as the identification of goal and measurement dimensions within these domains (for example: length of life in good health as a dimension of health) in accordance with the conceptual framework developed previously.

- Indicator development:
  In a further step of work adequate indicators are being selected or constructed in order to operationalize measurement dimensions in the various life domains. At this stage, indicators should be selected or constructed irrespective of the availability of adequate data as far as possible (Berger-Schmitt, 2001).

- Provision of indicator time series:
  For the selected indicators time series, data are being collected using the best available and, if possible, internationally harmonized data sources. If there are no adequate data available, ‘second best' indicators have to be chosen.
Construction of comprehensive indices:

It is also within the scope of developing a European System of Social Indicators to review and consider the possibilities of constructing comprehensive indices or to find other solutions (e.g. the selection of key indicators) of condensing and synthesizing the variety of information provided by the multitude of single indicators supplied as part of the indicator system.

One of the dimensions where indicators were created for is ‘public safety and crime’. The indicators collected for this dimension are interesting for the PEPPER project because of the similarity of the enforcement-related aspects traffic law violations and other law violations and the similar goals of ‘traffic safety’ and ‘public safety’. The structure that is used in the EuReport project can offer a guideline for a structure suitable for organising variables or indicators in the PEPPER project. Apart from that, various indicators that are collected for the dimension ‘public safety and crime’ can offer insight in the future selection of indicators in the PEPPER project when they are analysed over the course of years.

Berger-Schmitt and Noll (2000) argued that six major dimensions of welfare development and two dimensions of general social change can be identified where relevant indicators for measuring ‘public safety and crime’ can be collected:

Dimensions of welfare development:

- Objective living conditions: the ascertainable living circumstances of individuals.
- Subjective well-being: perceptions, evaluations and appreciation of life and living conditions.
- Disparities, inequalities and social exclusion: distribution of welfare within a society.
- Social relations and ties: social capital; the existence of informal networks, associations, organisations and the performance of social institutions.
- Human capital: people’s skills, education and health.
- Natural capital: current state and processes and measures that improve or deteriorate the base of natural resources.

Dimensions of general social change:

- Demographic and socio-economic structures
- Values and attitudes

Different groups of indicators and individual indicators were identified for each of these dimensions. The exact indicators will be presented in the next chapter but what is worth noting now is that apart from objective indicators concerning the current crime load (comparable with the traffic safety indicators used for measuring traffic safety), a number of indicators were used that can be located in the European Commission’s recommendation and the conditions identified by Adriaensen et al. (2004). These indicators include:

- Resources and efficiency in fight against crime.
- Subjective perception and evaluation of public safety.
- Trust and expectations regarding police.
Because of this overlap, the selection of indicators on these domains in order to assess the performance of enforcement is further strengthened and it can be argued that these levels also deserve our attention.

**Suggestions relevant for TLE and PEPPER**

- EuReporting identified a number of indicators regarding the efficiency of crime-related enforcement. Special attention was given to the theoretical framework while developing these variables and their capacity for capturing changes. Because of this, the use of these indicators for the PEPPER project should be considered.

- Variables and indicators that might be selected for the PEPPER project should be capable of giving an overview over time so that the particular influence of changes in enforcement measures can be captured.

- Eight dimensions of welfare development and general social change were identified and used by Berger-Schmitt and Noll (2000) to capture changes in the quality of life. It can be interesting to look into these dimensions in order to gain insight on specific aspects of enforcement that weren’t captured in the specialised traffic-related projects.

### 3.5.2 The Policing Performance Assessment Framework (United Kingdom)

**Summary and objectives**

The creation of the Policing Performance Assessment Framework (PPAF) is an initiative taken in the United Kingdom in order to achieve a consistent, high standard policing service across the UK. In order to achieve this, a set of national measures of performance was created in 2001 as was proposed earlier by a National Police Plan (Home Office, 2003a).

Policing in a community is a complex task to assess but nevertheless both the Government and the public need to be able to judge whether forces are delivering the quality of service that everyone expects. The construction of the performance assessment framework is an ambitious project in which the Home Office is working with police forces, police authorities, the Association of Chief Police Officers (ACPO), the Association of Police Authorities (APA), and others.

An information set was created in 2001 with concrete data for assessing police performance in all of the UK communities. This information set or database was used as a baseline condition to measure changes over the years and contains indicators that are used to monitor performance on six domains of policing:

- Citizen focus: whether the public are satisfied of the service they get from the police.

- Reducing crime: does police activity help prevent and reduce crime.

- Investigating crime: does police activity help solve crimes and bring offenders to justice.
W Promoting public safety: does police activity decrease the fear of crime and is public safety promoted.

W Providing assistance: how the police deals with the public when asking for police assistance.

W Resource usage: what is the level of resources available and the deployment of those resources.

Given the overlap between police enforcement in general and police enforcement related to traffic safety, it is useful to compare the indicators created for each of these domains with the recommendations made by the European Commission (2004) and where necessary add them to the preliminary list of variables and indicators that is presented in chapter 4.

Suggestions relevant for TLE and PEPPER

W Performance monitors represent a powerful method for displaying, in a single diagram, the relative performance levels of a police force across a range of key policing activities. The publication introduces the public to both the concept of performance monitors and the notion of comparative assessments of policing performance. However, these monitors cannot be used to construct league tables.

W Variations in policing performance that are highlighted by the monitors should prompt questions as to why there is such variation. Variation in policing practice should not be seen as the only possible reason behind variation on a monitor.

W Obtaining consistent and reliable information regarding crime is vital to the work of the police service and related partners. However, because of the particular subject, it can be necessary to develop a new methodology to capture that data. This should be taken into account for the creation of any type of variable, indicator or database.

3.5.3 VERA Institute of Justice

Summary and objectives

The Vera Institute of Justice works closely with leaders in government and civil society to improve the services people rely on for safety and justice. Vera develops innovative, affordable programs that often grow into self-sustaining organizations, studies social problems and current responses, and provides practical advice and assistance to government officials in New York and around the world.

VERA published a guide in 2003 titled “Measuring progress toward safety and justice: a global guide to the design of performance indicators across the justice sector”. This guide, funded by the British Department for International Development, describes how to develop practical and effective indicators in both data-poor and data-rich environments, starting with the desired outcome. Although numerous variables and indicators for the measurement of the
efficiency of traffic law enforcement were already available from other projects, the guide nevertheless presents us with some valuable guidelines.

**Suggestions relevant for TLE and PEPPER**

- A distinction has to be made between three levels of indicators:
  - Strategic purpose indicators: used to track performance against the most ambitious objective upon which separate institutions, policies, and programmes are expected to have a material effect.
  - Institutional objective indicators: used to measure the specific objectives of separate institutions, policies, or programmes, shedding light on how these may be advancing over all strategic objectives.
  - Activity indicators: used to track progress in the implementation of a programme or policy.

- As such, each variable or indicator can be situated on one of these levels. The relationship between the strategic goal (i.e. 50% decrease in traffic deaths over a period of 10 years, partly achieved by improving TLE), the different institutions involved (i.e. higher number of traffic law violations caught by police and an improvement in the prosecution before court) and the individual activities (i.e. increase in time spent checking on violations by police officers; automating administrative procedures, etc.) can also be clarified.

- As far as the justice departments are concerned, turn-around time and the number of cases effectively dealt with remain the most important indicators of efficiency.

### 3.5.4 CEPEJ (European Commission for the Efficiency of Justice)

**Summary and objectives**

The European Commission for the Efficiency of Justice (CEPEJ) has been established by the Council of Europe in September 2002 and is composed of experts from all the Member States of the Council of Europe. Its aim is the improvement of the efficiency and functioning of justice in the member States, and the development of the implementation of the instruments adopted by the Council of Europe.

Its tasks are:

- To analyse the results of the judicial systems.
- To identify the difficulties they meet.
- To define concrete ways to improve the evaluation of their results and the functioning of these systems.
To provide assistance to Member States.

In order to carry out these different tasks, the CEPEJ prepares benchmarks, collects and analyses data, defines instruments of measure and means of evaluation, adopts documents (reports, advices, guidelines, action plans, etc), develops contacts with qualified personalities, non-governmental organisations, research institutes and information centres, organises hearings, promotes networks of legal professionals.

As such, CEPEJ has identified four individual elements that need to be distinguished for the assessment of judicial systems (CEPEJ, 2004):

- The quantity of cases to be processed.
- The resources available to the system to process these cases: staff, equipment, courts, etc.
- The case processing times.
- The quality of case processing.

CEPEJ has initiated an international study in order to evaluate the judicial mechanism in the different Member States. In order to collect this information, a questionnaire was proposed (CEPEJ, 2005) where very specific elements of the judicial system are being questioned. Some of these are relevant for the PEPPER project and have been incorporated in the preliminary list of variables and indicators in chapter 4.

As such, a number of indicators can already be mentioned:

- The ability to assess the overall length of proceedings.
- The presence of established standards for duration of proceedings.
- A sufficiently elaborated typology of cases.
- The ability to monitor the course of proceedings.
- The means to promptly diagnose delays and mitigate their consequences.
- The use of modern technology as a tool for time management.

No results have yet been published at the moment of writing. However, future documents can be interesting for the PEPPER project.

**Suggestions relevant for TLE and PEPPER**

For each of the four elements that were identified as being relevant for the assessment of judicial systems, 18 different lines of actions have been recommended in order to achieve a judicial system that works more efficiently. Not all of these recommendations are directly relevant for the PEPPER project and only those directly relevant for the PEPPER project are presented:
Justice cannot function without resources. As such, the number of judges, other judicial and non-judicial staff has to be sufficient and equipment enabling the automated recording, forwarding and publishing must be available. Furthermore, the available resources must be managed according to action and management programmes designed upon precise objectives.

The quality of law-making has a significant influence on the judicial timeframes and court activities. This has to be taken into account before new laws are announced.

For justice to have an influence on court users, clear information needs to be provided on the foreseeable timeframe. Transparency should be provided through the publication of data related to the length of proceedings for each type of cases. A standard timeframe could be defined and it must be monitored whether this timeframe is upheld or not.

The use of statistical tools should be improved and new information and communication strategies need to be developed.

The number of cases that are effectively processed is influenced by the number of appeals that are posted. This number must, without prejudice of the right of an effective remedy, be limited and filtering mechanisms can be introduced.
4 VARIABLES AND INDICATORS

This chapter presents an overview of the various variables and indicators regarding traffic safety and traffic law enforcement that were found during the literature study. These variables and indicators could be used to gain insight in the efficiency of traffic law enforcement.

The variables and indicators are divided into separate lists according to the level in the traffic law enforcement chain where they apply to and the project or study where they were mentioned. A further distinction between the variables or indicators can be made within each level: different aspects can be identified depending on the actors involved and the type of information that is collected. Where possible, a definition and measurement unit for each variable and indicator is provided.

The variables and the indicators suggested here are largely based on the “Recommendations of the European Commission on enforcement in the field of road safety (2004/345/EC).” This is done so because of two of the goals that are proposed in the PEPPER project: checking whether the indicators proposed by the European Commission are available and creating a database with indicators that are usable for the measuring of the efficiency of traffic law enforcement. Of course, the recommendations of the Commission are themselves a product of an exhaustive literature review and the results and findings of different projects in the topic of road safety, many of which are also part of our literature review.

A special remark should be made regarding the SARTRE studies. Because of their inherent set-up, virtually every question could be taken on board for the PEPPER study since they are completely focussed on the individual road users’ attitudes and driver behaviour. This link is very prominently active in the models that explain the effect of enforcement programs and cannot be underestimated. However, in order to keep the list presented here within some boundaries, it is best not to go into too much detail but instead present the most important topics that were questioned.

In addition to the Recommendations of the Commission, we added some variables and indicators, found in projects and literature not related to road safety. It should be mentioned however, that some variables or indicators that were mentioned in those sources aren’t taken on board in our lists because they cannot possibly be linked to traffic safety, traffic safety performance, traffic law enforcement or traffic law enforcement performance.

It should be noted that, the lists of variables and indicators suggested here shouldn’t be considered extensive or comprehensive, but rather a first step towards the creation of a questionnaire that will be used to test for availability of information in the different Member States of the European Union. In the course of the PEPPER project, some of these variables will possibly be selected to create traffic law enforcement indicators, while others might well be discarded as unavailable or irrelevant.
4.1 Indicators from “Commission recommendation of 21 October 2004 on enforcement in the field of road safety (2004/345/EC).”

The Member States should communicate to the Commission the following information, which can be used to derive “enforcement indicators” (EC, 2004/345/EC):

4.1.1 Speed enforcement

4.1.1.1. Automated speed control (ASC)
   a) Number, kind and type of the ASC equipment used on highways, secondary roads and urban road respectively and whether it is visible for the drivers or not.
   b) Number of hours and periods when the control checks were carried out using this equipment on the different types of road given above.
   c) Stretches of roads (in km) where the ASC equipment is applied.

4.1.1.2 Violations
   a) Number of speeding violations registered by the ASC equipment.
   b) Number of speeding violations committed by drivers of foreign-registered vehicles and registered by ASC equipment.
   c) Total number of speed violations registered by ASC equipment and by other enforcement methods.
   d) Total number of violations committed by drivers of foreign-registered vehicles.

4.1.1.3 Sanctions
   a) Number of sanctions imposed for speeding violations registered by the ASC equipment.
   b) Number of different types of such sanctions (e.g. fines, penalty points, suspension/withdrawal of driving license, etc.) and additional details such as the amount of fines (for example in euros), number of points, period of suspension and for which violations.
   c) The information mentioned in (a) and (b) for drivers of a foreign-registered vehicles.
   d) The information mentioned in (b) and (c) with respect to sanctions imposed for speed violations registered by other enforcement methods.
   e) The information mentioned in (a) to (d) on sanctions effectively executed.

4.1.1.4 Follow-up procedures
   a) To what extent are the prosecution and sanction of the registered violations carried out through automated procedures; how long does it takes for offenders to receive notification for the sanction; how much time it takes for the sanction to be implemented
(i.e. what is the deadline for paying the fine, is it possible to appeal, time schedule and procedure for appeal)?

b) Does a fixed set of sanctions apply in such procedures? If so, which?

c) Who is liable to receive the sanction: the owner of the vehicle, the driver, or both and in which order?

d) Is there still a role for the court in the follow-up procedure? If yes, which?

e) Duration of the procedure, including execution of the sanction (average, minimum and maximum).

f) Information concerning special challenges Member States should meet with respect to the implementation of the follow-up procedures.

g) Other relevant information concerning the follow-up procedures.

4.1.1.5 Court decisions
The same kind of information as in 4.1.1.3 (Sanctions).

4.1.1.6 Changes in the rules and/or legislation
a) Report any relevant changes in the rules and/or legislation (for example changes in the speed limits) that occurred in the last 2 years.

4.1.1.7 Other
a) Any other information that the Member State considers relevant for the implementation of the provisions of enforcement, including special challenges that may exist with respect to the provisions.

4.1.2 Drink driving enforcement

4.1.2.1 Random breath testing and evidential breath testing
a) Information about places and times where the random breath testing took place.

b) Number, kind and type of alcohol screening devices used.

c) Number of checks and periods during which random breath tests took place.

d) Number of checks with an evidential breath testing device. Number, kind and type of evidential breath testing devices available for enforcement actions.

e) (a)-(d) with respect to drivers who were not resident in the Member State.

f) Other ways to control the blood alcohol concentration (BAC), i.e. blood test etc.

g) Other than random checks enforcement actions for drink-driving; if possible give details similar to those given in (a)-(f).
4.1.2.2 Violations

a) Number of drink-driving violations registered during the random checks; number according to the equipment used to detect the violation (i.e. alcohol screening device, evidential breath test, blood test etc.).

b) Number of violations committed by non-resident drivers.

c) Total number of drink driving violations, including those registered in the course of other enforcement methods (for example, during speed control actions).

d) Total number of violations committed by non-resident drivers.

4.1.2.3 Sanctions

a) Number of sanctions imposed for drink-driving violations registered in the course of random control actions.

b) Number of different types of such sanctions (e.g. fines, penalty points, suspension/withdrawal of driving license, etc.) and additional details such as the amount of fines (for example in euros), number of points, period of suspension and for which violations.

c) The information mentioned in (a) and (b) for sanctions imposed to non-resident drivers.

d) The information mentioned in (b) and (c) with respect to sanctions imposed for drink driving violations registered in the course of other enforcement methods (for example, during speed control actions).

e) Information about sanctions imposed in cases where the driver refused to submit to test; all drivers, non-resident drivers.

f) The information mentioned in (a) to (e) on sanctions effectively executed.

4.1.2.4 Court decisions:

The same kind of information as in 4.1.2.3 (Sanctions).

4.1.2.5 Changes in the rules and/or legislation

a) Report any relevant changes in the rules and/or legislation (for example changes in the BAC limits) that occurred in the last 2 years.

4.1.2.6 Other

a) Any other information that the Member State considers relevant for the implementation of the provisions of enforcement, including special challenges that may exist with respect to the provisions.
4.1.3 Restraint (i.e. seat belt) use

4.1.3.1 Intensive enforcement actions
   a) Number of checks carried out in the intensive enforcement actions on different types of roads; also for different types of checks (e.g. visual, camera).
   b) Duration of the actions; number of times per year and periods during which they occurred.
   c) Where these actions combined with enforcement of other traffic laws/rules (e.g. speed controls, drink-driving, etc.).

4.1.3.2 Violations
   a) Number of restraint use (seat belts, child restraints) violations registered during intensive enforcement actions.
   b) Number of violations committed by occupants of foreign-registered vehicles.
   c) Total number of seat belts & child restrain violations, including those registered in the course of other enforcement methods (for example, during speed control actions).
   d) Total number of violations committed by occupants of foreign-registered vehicles.

4.1.3.3 Sanctions
   a) Number of sanctions imposed for seat belts & child restrain violations registered in the course of intensive enforcement actions.
   b) Number of different types of such sanctions (e.g. fines, penalty points, etc.) and additional details such as the amount of fines (for example in euros), number of points etc., and for which violations.
   c) The information mentioned in (a) and (b) for sanctions imposed to occupants of foreign-registered vehicles.
   d) The information mentioned in (b) and (c) with respect to sanctions imposed for seat belts & child restrain violations registered in the course of other enforcement methods (for example, during speed control actions).
   e) The information mentioned in (d) about sanctions imposed to occupants of foreign-registered vehicles.
   f) The information mentioned in (a) to (e) on sanctions effectively executed.

4.1.3.4 Court decisions:
The same kind of information as for 4.1.3.3 (Sanctions).

4.1.3.5 Changes in the rules and/or legislation
   a) Report any relevant changes in the rules and/or legislation (for example changes in the rules for rear seat belt) that occurred in the last 2 years.
4.1.3.6 Other

a) Any other information that the Member State considers relevant for the implementation of the provisions of enforcement, including special challenges that may exist with respect to the provisions.

4.2 Preliminary list of indicators and variables

This is a preliminary list of variables and indicators which will be eventually used to develop a conceptual model of a TLE data collection system or database. The focus is on speeding, drink driving and seat belt use.

The data are divided into three main groups related to:

- Road Safety: general data, accident statistics, road user attitudes etc.
- Planning of enforcement for: speeding, drink driving and seat belt use.
- Actual enforcement: enforcement action, violations, sanctions, follow-up procedures, court decisions, changes in rules, etc.

This preliminary list of variables and indicators is built upon the EC Recommendations and the literature review given in Chapter 3.

The list will be circulated among all PEPPER partners, and in particular WP4 partners in order to complete it.

4.2.1 Variables and indicators regarding road safety (data available from national statistics, EU projects and databases, etc)

4.2.1.1 General information

a) Motorization: number of vehicles, total stretch (km) of road network, stretch (km) or % of highways, secondary, urban roads.

b) Number of accidents: total, for different road users and types of roads (highway, secondary, urban roads).

c) Number of fatalities & injuries: total, for different road users and types of roads (highway, secondary, urban roads).

d) Applicability (ease of use, clearness, contradictions, speed of introduction and/or revision and adaptation) of traffic laws.

e) Public awareness and acceptance of traffic laws and their importance for road safety.

f) Public need for stricter or/and more transparent traffic laws.

g) Other.
4.2.1.2 Speeding

a) Speed limits on different types of roads: highway, secondary, urban roads.
b) Average speed on different types of roads: highway, secondary, urban roads.
c) Number of accidents & fatalities due to excessive speed: in total and for types of roads (highway, secondary, urban roads).
d) Road user attitude towards speeding; awareness and acceptance of speed limits; needs for changing the limits, etc.
e) Other.

4.2.1.3 Drink Driving

a) Legal Blood Alcohol Concentration (BAC) limit for the country, when it was introduced, when (if) it was changed, to what it was changed.
b) Number of accidents due to alcohol: total, for different road users and types of roads (highway, secondary, urban roads).
c) Number of fatalities & injuries due to alcohol: total, for different road users and types of roads (highway, secondary, urban roads).
d) Road user attitude towards drink driving, awareness and acceptance of BAC limits, etc.
e) Other.

4.2.1.4 Seat Belt usage

a) Dates when it became obligatory for: drivers; front passenger, back passengers, children below XX years.
b) Compliance: % of drivers, front passenger, back passengers, children below XX years using seat belt.
c) Number of fatalities & injuries due to non-use of seat belt: total, for different road users and types of roads (highway, secondary, urban roads).
d) Road user attitude towards seat belt use; awareness and acceptance of obligation of use; etc.
e) Other.

4.2.2 Variables and indicators regarding the planning of enforcement

4.2.2.1 National Enforcement Plan

a) Does it exist: YES (year of introduction) / NO - will it be introduced and when (year)?
b) Duration of the Plan (start year – end year).
c) Planned evaluation (yes, no). If yes, when (time) and how?
4.2.2.2 Data regarding the planning of speed enforcement

a) Road stretches were speed enforcement is most appropriate:
   - Number of stretches in total.
   - Number of stretches on highways, secondary roads, urban roads.
   - Length of the stretches (km) in total.
   - Length of the stretches on highways, secondary roads, urban roads.
   - Other.

b) Automated speed enforcement equipment in the above mentioned road stretches:
   - Date when the speed enforcement equipment is (or will be) installed.
   - Type (camera, other) and number of devices in total (existent and/or planned) and on highways, secondary roads, urban roads.
   - Type (camera, other) and number of devices (existent and/or planned) on highways, secondary roads, urban roads.
   - How long the automated speed enforcement equipment is (or will be) operational on the different stretches of road.
   - Other.

c) Other speed enforcement equipment (non automated) in the above mentioned road stretches:
   - Time when the speed enforcement equipment is (or will be) used.
   - Type and number of devices in total (existent and/or planned) and on highways, secondary roads, urban roads.
   - Type and number of devices (existent and/or planned) on highways, secondary roads, urban roads.
   - Other.

d) Other.

4.2.2.3 Data regarding the planning of random breath testing

a) Planned number of places (highways, secondary roads, urban roads), number in total, number of specific road type (highways, secondary roads, urban roads) for random testing.

b) Times for which random breath testing is most appropriate: time of the day (morning, evening), time of the week (working day, weekend), time of the year (month, season) and for which road type.

c) Planned frequency of the application of random breath testing: in total, on specific road types, at specific times.

d) Type and number of alcohol screening devices used in the random testing.

e) Other.

4.2.2.4 Data regarding the planning of enforcement of restraint use

a) Places (highways, secondary roads, urban roads), number in total, number of specific road type.
b) Times for which enforcement on restraint use is most appropriate: time of the day (morning, evening), time of the week (working day, weekend), time of the year (month, season).

c) Planned application of intensive restraint use enforcement actions in the selected places listed above, their timing and duration and the number of times per year that they will be held.

d) Other.

It should be investigated if it is possible to link violations against traffic laws to casualties in road accidents.

4.2.3 Variables and indicators regarding actual enforcement

The European Commission recommends, where possible, that the data gathered for the following variables should be separated into two groups:

- Private vehicles.
- Commercial vehicles.

4.2.3.1 Speed enforcement

4.2.3.1.1 Automated speed control (ASC)

a) Number, kind and type of the ASC equipment (i.e. cameras, stationary, mobile, visible etc.) used on highways, secondary roads and urban road respectively and whether it is visible for the drivers or not.

b) Number of hours and periods when the control checks were carried out using this equipment on the different types of road given above.

c) Stretches of roads (in km) where the ASC equipment is applied: in total and for highways, secondary roads and urban road respectively.

d) Out of service time for the ASC equipment; false alarm frequency: in total and on the different types of roads.

e) Number of vehicles checked: in total and on the different types of roads.

f) Other.

4.2.3.1.2 Violations

a) Number of speeding violations registered by the ASC equipment, in total and on the different types of roads; violation detection rate (%).

b) Number of speeding violations committed by drivers of foreign-registered vehicles and registered by ASC equipment, in total and on the different types of roads; violation detection rate (%).
c) Total number of speed violations registered by ASC equipment and by other enforcement methods and number on the different types of roads; violation detection rate (%).

d) Total number of violations committed by drivers of a foreign-registered vehicles and number on the different types of roads; violation detection rate (%).

e) Number of incorrectly recorded violations (%).

f) Other.

4.2.3.1.3 Sanctions

a) Number of sanctions imposed for speeding violations registered by the ASC equipment.

b) Number of different types of such sanctions (e.g. fines, penalty points, suspension/withdrawal of driving license, etc.) and additional details such as the amount of fines (for example in euros, minimum, maximum, average), number of points, period of suspension and for which violations.

c) The information mentioned in (a) and (b) for drivers of a foreign-registered vehicles.

d) The information mentioned in (b) and (c) with respect to sanctions imposed for speed violations registered by other enforcement methods.

e) The information mentioned in (a) to (d) on sanctions effectively executed.

f) Other.

4.2.3.1.4 Follow-up procedures

a) Capacity of the follow-up procedure: how many of the violations can be processed (number or %)?

b) Number of plate recognition (%) – for automated speed control.

c) How long time does it takes for offenders to receive notification for the sanction; how long time it takes for the sanction to be implemented (i.e. what is the deadline for paying the fine, is it possible to appeal, time schedule and procedure for appeal)?

d) How many offenders received notification for the sanction: number in total, number of car owners, number of drivers?

e) Duration of the procedure, including execution of the sanction (average, minimum and maximum).

f) How many offenders were actually sanctioned: number in total, number of car owners, number of drivers?

g) How many offenders avoided sanctions (number in total, number of car owners, number of drivers), due to special challenges Member States had met with respect to the implementation of the follow-up procedures?

h) Other.
4.2.3.1.5 Court decisions

The same kind of information as in 4.2.3.1.3 (Sanctions). In addition:

a) Number of violations disputed and rejected in court.

b) Number of prosecutions; number of appeals; success rate.

4.2.3.1.6 Other

a) % of the public (or drivers) who demand more speed checks.

b) % of the public (or drivers) who believe that speeding violations are a criminal act.

c) % of the public (or drivers) who believe their speeding is not posing a treat.

d) % of the public (or drivers) who believe they will not be caught when speeding and/or there will not be consequences.

e) Self-reported data on speeding.

f) Other.

4.2.3.2 Drink driving enforcement

4.2.3.2.1 Random breath testing and evidential breath testing

a) How many places (in total and for specific roads) and times (in total and for specific roads) where the random breath testing took place.

b) Number, kind and type of alcohol screening devices used.

c) Number of checks and periods during which random breath tests took place: in total and for specific roads.

d) Number of checks with an evidential breath testing device; number, kind and type of evidential breath testing devices available for enforcement actions (in total and for specific roads).

e) (a)-(d) with respect to drivers who were not resident in the Member State.

f) Number and type of other ways to control the blood alcohol concentration (BAC), i.e. blood test, etc.

g) Number and type of other than random checks enforcement actions for drink-driving; if possible give details similar to those given in (a)-(f).

4.2.3.2.2 Violations

a) Number of drink-driving violations registered during the random checks, in total and according to the road type (highway, secondary, urban road).

b) Number according to the equipment used to detect the violation (i.e. alcohol screening device, evidential breath test, blood test etc.), in total and according to the road type (highway, secondary, urban road).

c) Number of violations committed by non-resident drivers during random checks.
d) Total number of drink driving violations, including those registered in the course of other enforcement methods (for example, during speed control actions); number according to the road type (highway, secondary, urban road).

e) Total number of violations committed by non-resident driver.

4.2.3.2.3 Sanctions

a) Number of sanctions imposed for drink-driving violations registered in the course of random control actions.

b) Number of different types of such sanctions (e.g. fines, penalty points, suspension/withdrawal of driving license, etc.) and additional details such as the amount of fines (for example in euros, minimum, maximum, average), number of points, period of suspension and for which violations.

c) The information mentioned in (a) and (b) for sanctions imposed to non-resident drivers.

d) The information mentioned in (b) and (c) with respect to sanctions imposed for drink driving violations registered in the course of other enforcement methods (for example, during speed control actions).

e) Information about sanctions imposed in cases where the driver refused to submit to test; all drivers, non-resident drivers.

f) The information mentioned in (a) to (e) on sanctions effectively executed.

4.2.3.2.4 Court decisions

The same kind of information as in 4.2.3.2.3 (Sanctions). In addition:

a) Number of violations disputed and rejected in court.

b) Number of prosecutions; number of appeals; success rate.

4.2.3.2.5 Other

a) % of the public (or drivers) who demand more drink driving checks.

b) % of the public (or drivers) who believe that drink driving violations are a criminal act.

c) % of the public (or drivers) who believe their drink driving is not posing a threat.

d) % of the public (or drivers) who believe they will not be caught when drink driving and/or there will not be consequences.

e) Self-reported data on drink driving.

f) Other.
4.2.3.3 Restraint (i.e. Seat belt) use:

4.2.3.3.1 Intensive enforcement actions
   a) Number of checks carried out in the intensive enforcement actions on different types of roads; also for different types of checks (e.g. visual, camera).
   b) Duration of the actions; places and number of times per year and periods during which they occurred.
   c) How many of these actions were combined with enforcement of other traffic laws/rules (e.g. speed controls, drink-driving etc.).

4.2.3.3.2 Violations
   a) Number of restraint use (seat belts, child restraints) violations registered during intensive enforcement actions.
   b) Number of violations committed by occupants of foreign-registered vehicles.
   c) Total number of seat belts & child restrain violations, including those registered in the course of other enforcement methods (for example, during speed control actions).
   d) Total number of violations committed by occupants of foreign-registered vehicles.

4.2.3.3.3 Sanctions
   a) Number of sanctions imposed for seat belts & child restrain violations registered in the course of intensive enforcement actions.
   b) Number of different types of such sanctions (e.g. fines, penalty points, etc.) and additional details such as the amount of fines (for example in euros), number of points etc., and for which violations.
   c) The information mentioned in (a) and (b) for sanctions imposed to occupants of foreign-registered vehicles.
   d) The information mentioned in (b) and (c) with respect to sanctions imposed for seat belts & child restrain violations registered in the course of other enforcement methods (for example, during speed control actions).
   e) The information mentioned in (d) about sanctions imposed to occupants of foreign-registered vehicles.
   f) The information mentioned in (a) to (e) on sanctions effectively executed.

4.2.3.3.4 Court decisions
The same kind of information as for 4.2.3.3.3 (Sanctions). In addition:
   a) Number of violations disputed and rejected in court.
   b) Number of prosecutions; number of appeals; success rate.
4.2.3.3.5 Other

a) % of the public (or drivers) who demand more seat belt checks.

b) % of the public (or drivers) who believe not wearing a seat belt is not linked to road safety.

c) % of the public (or drivers) who believe they will not be caught when not wearing the belt and/or there will not be consequences.

d) Self-reported data on use of seat belt.

e) Other.
5 REFERENCES


48. Law and Human Behaviour (1977-…). Publisher: Springer Netherlands. ISSN: 0147-7307


