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Executive Summary

Safety performance indicators (SPIs) can be used to improve our understanding of the causes of accidents, and they can be used to monitor policy interventions. In that sense, they are one of the elements of a safety management system.

SafetyNet Work Package 3 deals with these indicators. On the basis of the ETSC report 'Transport Safety Performance Indicators' (2001) [1], seven domains for SPIs have been defined:

1. Alcohol and drug-use
2. Speeds
3. Protection systems
4. Daytime running lights
5. Vehicles (passive safety)
6. Roads
7. Trauma management

In Work Package 3, seven tasks are defined that work on each of the respective SPI domains. Their findings are communicated through reports, presentations, conferences and a website.

This deliverable deals with the communication of findings through the European Road Safety Observatory website (<http://www.erso.eu>). The report contains those web texts, published on the website, that are adapted from the contents of Deliverable 3.1 from SafetyNet WP3, the State-of-the-art report [2]. The web text focuses on the explanation of the concept of SPIs, and gives background details of two SPI areas: alcohol & drugs, and speeds.

In the future new web texts related to the subject of Road Safety Performance Indicators will be added to the ERSO website.

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1 Introduction

1.1 Purpose of this report

In Work Package 3, seven tasks are defined that work on each of the respective SPI domains. Their findings are communicated through reports, presentations, conferences and a website.

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The second chapter of this report is about safety performance indicators in general. The third chapter gives examples of two SPI areas: alcohol & drugs, and speeds.

2 Safety Performance Indicators

2.1 Safety Performance Indicators

Accidents are final outcomes of a road traffic system. Monitoring the operational conditions of traffic, which means monitoring how road users behave in traffic, can help to explain why road safety risk changes. What do we know about appropriate safety performance indicators? The knowledge about this is communicated in this section on Safety Performance Indicators (SPIs).

It should be kept in mind that SPIs represent more or less ideal measurements of relevant behaviour or characteristics whereas actual practice of data monitoring or data availability does not always live up to this ideal. For two SPIs concerning alcohol and drugs, and speed, the reasons for developing these SPIs are presented and appropriate SPIs are proposed (chapter three).

2.2 What is a Safety Performance Indicator (SPI)?

“A Safety Performance Indicator is any variable, which is used in addition to the figures of crashes or injuries to measure changes in the operational conditions of road traffic. SPIs can give a more complete picture of the level of road safety and can detect the emergence of problems at an early stage, before these problems result in crashes. They use qualitative and quantitative information to help determine a road safety programmes' success in achieving its objectives.”

Work Package 3 of the SafetyNet project investigates SPIs in seven different road safety areas.

1. Alcohol & Drug use
2. Speeds
3. Protective systems
4. Daytime Running Lights
5. Vehicles
6. Roads
7. Trauma management

You can read more about each of these SPIs in report D3.1 of the SafetyNet project at the SafetyNet website (SafetyNet - Building a European Road Safety Observatory) [2].

2.3 What purpose serve Safety Performance Indicators?

The purpose of SPI is:

- to reflect the current safety conditions of a road traffic system (i.e. they are considered not necessarily in the context of a specific safety measure, but in the context of specific safety problems or safety gaps)
- to measure the influence of various safety interventions, but not the stage or level of application of particular measures
- to compare between different road traffic systems (e.g. countries, regions)



3 Examples of safety performance indicators

3.1 Why monitor use of alcohol and drugs in traffic?

Driving under the influence (DUI) of alcohol and drugs is one of the most important factors increasing the risk of severe road accidents because impaired road users are likely to be reckless and to behave inadequately when a dangerous situation appears. Moreover, impaired road users may also be more vulnerable to physical impacts caused by collision. Consequently, a large share of more severe road accidents is normally associated with drivers using alcohol and/or drugs. A Dutch case-control study finds that “35% of serious injuries among drivers in the Tilburg police district were associated with self-administered alcohol and/or illegal drugs”.

For alcohol there is a long research tradition from Borkenstein and before showing that accident risk increases with the drivers' blood alcohol concentration (BAC). As the Blood Alcohol Concentration (BAC) in the driver increases, also the accident risk increases. The increase in accident risk with increasing BAC is progressive. Compared to a sober driver the accident risk of a driver with a BAC of 0.8 g/L (still the legal limit in 3 of 25 EU-member states) is 2.7 times that of sober drivers. When a driver has a BAC of 1.5 g/L his accident risk is 22 times that of a sober driver. Not only the accident risk increases rapidly with increasing BAC, also the severity of the accident increases. With a BAC of 1.5 g/L the accident risk for fatal accidents is about 200 times that of sober drivers.

Drugs are more varied than alcohol, they can be legal or illegal. Drugs can be used alone, or in combination with alcohol, or with other drugs, and they can be used in medical or abuse doses. A meta-analysis of accident risks related to impairment shows that the use of prescribed medicinal drugs has a relative risk of 1.49 (i.e. a risk one and a half times as high as sober drivers), and that the use of non-prescribed drugs has a relative risk of 1.96. Based on a Dutch case-control study it was concluded that “extremely high relative risks were associated with the use of morphine/heroin-only and with the combination of drugs and BAC-levels above 0.8 g/l.” Moreover, this study found that “strongly increased injury risks were also associated with the combined use of several drugs, and with the combination of drugs and a BAC between 0.2 and 0.8 g/l” and “A moderately increased risk of serious road injury was associated with a BAC-level between 0.5 and 0.8 g/l. At higher BAC-levels, the relative injury risk increased more or less exponentially”. Other research has found higher accident responsibility rates for drivers with high BAC or high cannabis concentrations or combinations of alcohol and cannabis.

3.2 What are appropriate indicators for alcohol and drugs?

It is possible to find several direct indicators for alcohol and drug use. The most relevant indicators would be:

- the percentage of the general road user population impaired by alcohol and/or drugs
- the proportion of injuries and fatalities resulting from accidents involving at least one impaired active road user.

Defining SPIs for alcohol and drugs is not difficult, but the lack of data is the problem. The lack of data cannot be solved by indirect indicators or dividing the problem.

Collecting data on alcohol and drug use in the general road user population is costly and difficult. Moreover, demanding breath or blood specimens for drugs from the general road user population without suspicion is not allowed in most countries. In some countries random breath testing for alcohol of motor vehicle drivers is carried out, but in other countries, like Germany and the UK, random breath testing of motor vehicle drivers is not allowed. Voluntary testing is possible, but may be invalid, because the prevalence of drugs and alcohol may be lower than the non response rate. Consequently, the prevalence of alcohol and drugs among the active road users involved in on-the-spot fatal accidents was chosen as the most valid and practical indicator. Only on-the-spot fatal accidents were chosen, because the definition of fatal accidents varies between countries, from victims dead on the spot to victims dead within 30 days after the accident. Moreover, collecting blood specimens for drug analyses if the victims die several days after the accident, does not make sense, and the only possible way would be to demand specimens from all severe personal-injury accidents.

3.3 Why monitor speeds?

Driving speed is an important factor in road safety. Firstly, driving speed (actually: impact speed) is directly related to crash severity. This relation is based on the kinetic energy that is released during a collision. The amount of kinetic energy depends on the masses of the colliding objects and the square of their (relative) velocity. Secondly, driving speed is related to the risk of getting involved in a traffic crash. Theoretically, the relation between speed and crash rate is much more complex than the relation between speed and crash severity, because there are many potentially interacting physical and psychological factors. First of all, higher speeds leave drivers less time to react to changes in their environment than lower speeds. Second, stopping distances are larger at high driving speeds than at low driving speeds and manoeuvrability is reduced.

The speed-crash rate relation is further complicated by the fact that crash rate is not only related to absolute speed, but also to speed dispersion. If vehicles in the same lane travel at different speeds, the probability of an encounter is larger than if they drive at similar speeds.

Speed measurement is often part of a wider traffic survey that also collects data about traffic volumes and vehicle following distances. Decision makers in the field of traffic safety can make use of traffic/speed data in several ways:

- monitor the extent of speeding on several roads in order to identify roads with high proportion of offenders and roads with extreme offenders
- monitor the relation between traffic intensity and traffic speeds
- monitor the development of speeding over time in order to identify hours per day, months in a year, or seasons in a year, that shows disproportionably high numbers of offenders
- monitor the proportion of heavy goods vehicles over time in order to study the possible connection to speeding and to road safety
- monitor the development of speeding over time in relation to the actual speeds enforced by the police (enforcement margins) and activities on or near the measured road type

- monitor the development of speed distribution over time and identify hours per day, months per year, and seasons in a year that shows a deviant distribution with possible negative effects on road safety

It is clear that before traffic/speed data can be used to support policy decisions, they should be representative, reliable, valid, and precise enough.

3.4 What are appropriate safety performance indicators for speed?

A Safety Performance Indicator for speed should ideally reflect non-congested vehicle speeds, that are measured under normal traffic conditions and that are based on a representative sample of straight road sections of a particular road type (e.g. 1-lane rural roads, or 2-lane motorways). Preferably, separate indicators should be reported for weekdays and weekend days, day and night periods.

In respect to the statistical properties of the indicator, a 2006 literature review in Accident Analysis and Prevention shows that two aspects of a speed distribution have an influence on the general road safety and on speeding related risk :

- the average speed on a road, and
- the variability in speeds

The decrease in reaction times that accompanies high speeds implies higher risk on the one hand, and difference in speed or conflicting speeds will on the other hand be more likely to induce collisions. As these aspects have separate effects and fulfil different roles in the crash generating process, it is necessary to develop at least two types of speeding SPIs: a measure of location, i.e. a typical value that can describe the speed data, and a measure related to the speed data dispersion.

References

- [1] European Transport Safety Council ETSC (2001), *Transport safety performance indicators*. Brussels: ETSC.
- [2] SafetyNet WP3 (2005), *State of the art report on road safety performance indicators*. EU Integrated Project SafetyNet.