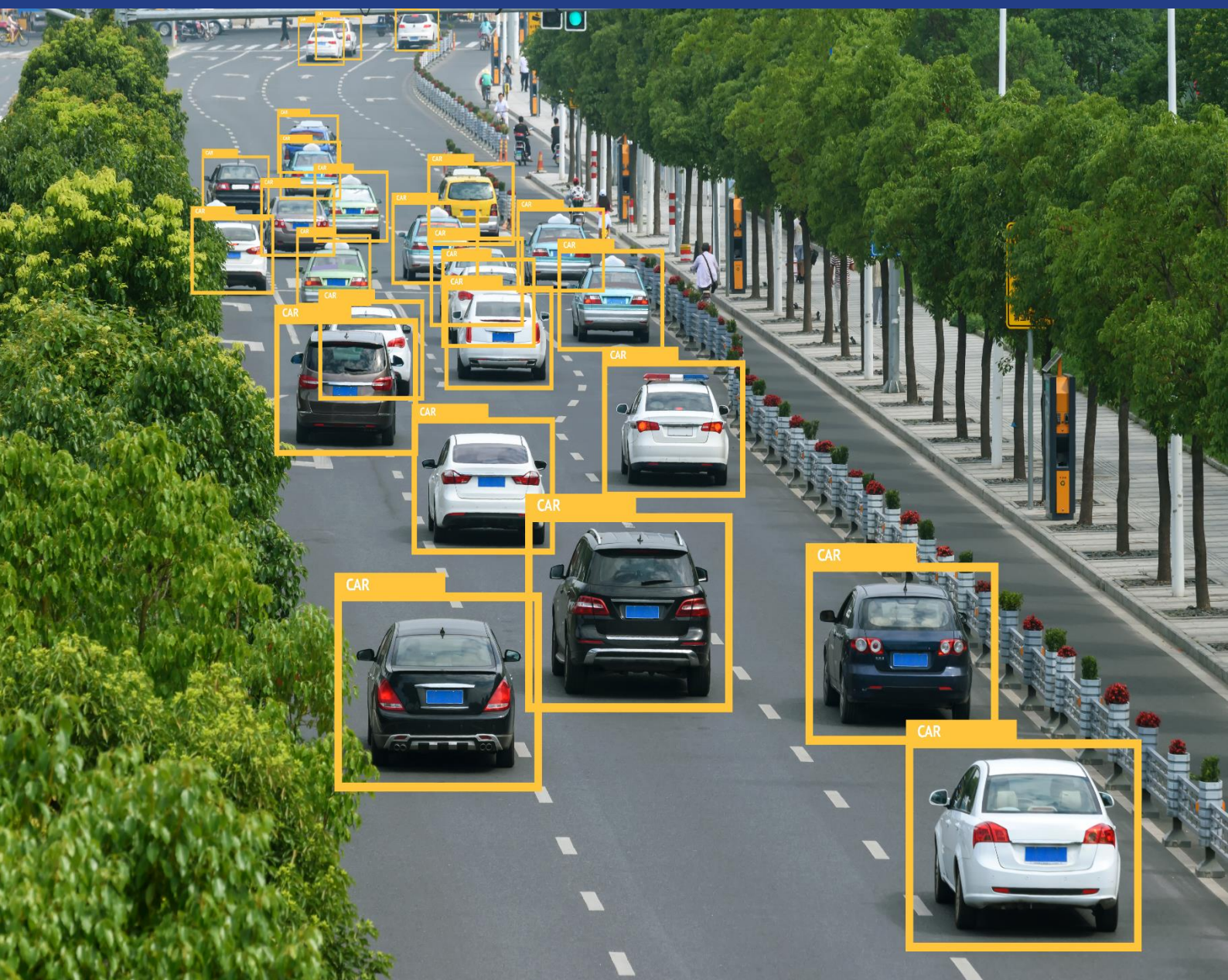




Monitoring Road Safety in the EU:

towards a comprehensive set of Safety Performance Indicators

2018



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1 Overview

Is it enough to count crashes and casualties?

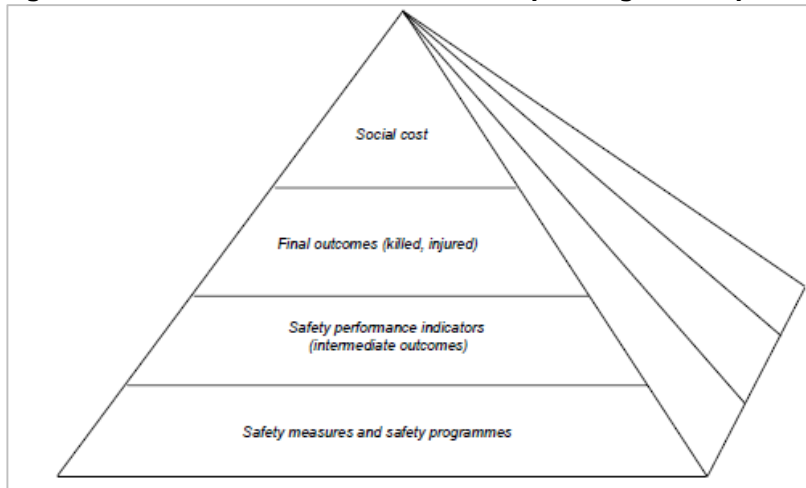
The analysis of road safety performance in the EU and its Member States is so far focused on rankings of mortality rates and counts of fatalities and (serious) injuries. Although such macroscopic view can be valuable in identifying trends – such as the ever-growing fatality share of vulnerable road users – however we have limited knowledge about the underlying unsafe operational conditions of our road transport system. Only when the available crash and casualty counts (“final outcomes”) are supplemented by a set of so called Safety Performance Indicators (SPI, e.g. on seatbelt and helmet use, drink driving, and speeding), will it be possible to better explain systematic developments in safety performance over time and evaluate the systemic impacts of countermeasures.

This report therefore aims to prepare the scope for introducing an enlarged set of SPIs to be assessed at regular intervals, preferably which comparable methods and assigned with tangible targets, to provide an improved and objectivised basis for road safety policy and management at EU and national levels for the decade 2020-30.

The concept of Safety Performance Indicators

In the early 2000s, SPIs (“Intermediate Outcome Indicators”) were defined as “any measurement that is causally related to crashes or injuries [...] to indicate safety performance or understand the process that leads to accidents” (ETSC 2001).

Figure 1: The essential elements of a safety management System (ETSC 2001)



Source: ETSC, 2011

In practice, the process of defining adequate SPIs can be complex. Only for some domains can direct indicators be identified and collected which directly measure an unsafe operational condition (e.g. seatbelt non-use). For others, such direct measurement is not feasible, e. g. for technical, economical or ethical reasons. In these cases, either indirect indicators can be identified as a proxy for the problem (e.g. number of alcohol-related fatalities, from police records), or one which is related to an intervention (e.g. number of alcohol roadside checks), see also Hakkert et al., 2007).

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What to collect, how to collect and analyse?

Currently, no two countries in the EU collect the same set of indicators, let alone with the same methodology. This report gives an overview of the state of play in the EU with respect to:

- scientific motivation to collect indicators in different problem areas,
- the size of the respective problem and reduction potential,
- data collection and analysis requirements, and
- current data availability.

For each of these areas, potential indicators for joint collection by the Member States are identified, with a view to future shared analysis, target setting and benchmarking at European level. In addition, good practices are identified in terms of uptake of SPIs (assigned with targets) in national road safety strategies, data collection and analysis, and reporting and communication.

For the following domains, SPI data collection by Member States is suggested:

| Domain | Indicator | Priority I | Priority II | Priority III |
|--|---|------------|-------------|--------------|
| Seatbelts and child restraints | Daytime wearing rate of seatbelts (passenger cars) on front seats | x | | |
| | Daytime wearing rate of seatbelts (passenger cars) on rear seats | x | | |
| | Daytime use of child restraint systems (<14y) in passenger cars | x | | |
| Helmets for PTW riders and cyclists | Daytime use rates of motorcycle helmets | x | | |
| | Daytime use rates of moped helmets | x | | |
| | Daytime use rates of cycle helmets | | x | |
| Driving speeds | Motorways with dual carriageway and median separation | | x | |
| | Single carriageway rural roads | | x | |
| | Single carriageway urban distributor roads | | x | |
| Driving under the influence: alcohol and drugs | Fatalities resulting from crashes involving (at least) one driver or rider under the influence of alcohol (above the legal limit) | x | | |
| | Fatalities resulting from crashes involving (at least) one driver or rider impaired by psychoactive substances other than alcohol (national offence impairment level) | | x | |
| | Number of alcohol roadside checks by police per population | x | | |
| Use of handheld cell phone | Proportion of passenger car drivers using a handheld cell phone (roadside survey) | x | | |
| Infrastructure | The proportion of travel on new rural roads (non-motorways) that have a star-rating (Road Protection Score) of 3 or better | | x | |
| | The proportion of travel on existing rural roads (non-motorways) that have a star-rating (Road Protection Score) of 3 or better | | | x |
| Vehicle | Average EuroNCAP occupant protection score of new passenger cars (cars sold in respective year) | | x | |
| Post-Impact Care | Composite indicator of 14 indicators in the field of a) Speed and quality of initial treatment by emergency medical services, and b) Quality of further medical treatment | | | x |

Regarding future activity of data collection, analysis, publication, benchmarking and target setting for SPIs, the following recommendations are given at EU and national levels:

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Advisable action at EU level

- Seek for a common understanding with MS on the potential and benefits of working with SPIs and which areas should be tackled with highest priority (at the level of the High-Level Group on Road Safety)
- Inform Member States about current good practices in the EU with regard to SPI data collection and target setting, e.g.
 - observational campaigns with professional staff and according to statistically sound data collection protocols;
 - national statistics and registries with harmonised (or transformable) variables and values;
 - road safety strategies with reduction targets on final outcomes (fatalities and serious injuries) and additional targets on intermediate outcomes (SPIs): Management by Objectives.
- Discuss with MS options for regular data collection and analysis, possibly in an expert level group similar to the CARE Expert Group, convening representatives of all EU and EFTA countries.
 - Current SPI practices in member countries
 - Comparison of definitions and statistical methods for sampling and analysis
 - Assessment of the current comparability of indicators between countries
 - Identification of – and agreement on – minimal standards for indicator collection and collection frequency; The spirit however should be to leave to Member States a certain degree of freedom in terms of collection methodology and assessment frequency to keep as many Member States as possible in the loop from the start
 - Options for step-wise harmonisation towards such minimal standards
 - Set up a regular reporting channel from Member States to EC (and back)
 - Develop statistical methodology to arrive at gross-EU values for selected indicators
- Agree with Member States on the setting voluntary targets for selected indicators. It may be advisable to start with widely available indicators such as use rates of seatbelts and child restraints, and gradually widen the scope once data availability improves.
- Arrange for regular communication of recent results on SPI, possibly back to back with the annual publication of the country rankings of road mortality in the EU.
- Make country results available and easily comparable on ERSO (in addition to the existing ERSO Country Profiles which are always dedicated on one specific country).
- Seek to cooperate with WHO on the further development of voluntary targets on SPI.
- Support research towards further development of good practices (collection and analysis).
- Consider further research towards the country-wise development of composite indices, i.e. statistical models that help explaining the overall road safety performance of a country.

Advisable action at national level

- Consider the regular collection of SPI as integral part of a country's road safety management strategy.
- Assess the national reduction potential (fatalities and serious injuries) in the different areas covered by the SPIs considered in this report.
- Set targets on indicators where this potential is high and indicator data collection is already existing or being developed.

Monitoring Road Safety in the EU: towards a comprehensive set of Safety Performance Indicators

- Introduce Management by Objectives regarding SPIs: Review the trend towards the target for every indicator and introduce/adjust related measures where necessary (where possible: annually).
- Cooperate with the European Commission and other Member States in the joint development of improved methodology on collection and analysis of SPIs.

2 Introduction

Current assessment of road safety performance of a country, or of the EU, is mainly based on analysis and compilation of police recordings of injury accidents. Such analysis usually produces information on the counts of (fatal and/ or injury) crashes according to various subcategories, such as per traffic mode or road classes, or on mortality rates (road fatalities per population), or on trend developments of counts or rates.

It is obvious that such information can only provide a macroscopic view on the safety level (or trends) of a country, and that it leaves largely open what the underlying operational conditions are. This report therefore aims to prepare the scope for introducing an enlarged set of safety performance indicators, to be assessed at regular intervals, preferably which comparable methods, assigned with tangible targets, to provide an improved and objectivised basis for road safety policy and management at EU and national levels for the decade 2020-30.

It is likely that a better knowledge e.g. of speed levels, seatbelt wearing rates, state of the infrastructure, and crashworthiness of the vehicle fleet can give valuable insight into the safety deficiencies of a road transport system. The best performing countries have for long been building their safety policies on evidence based decision making, utilising a set of such additional indicators in their monitoring and target setting.

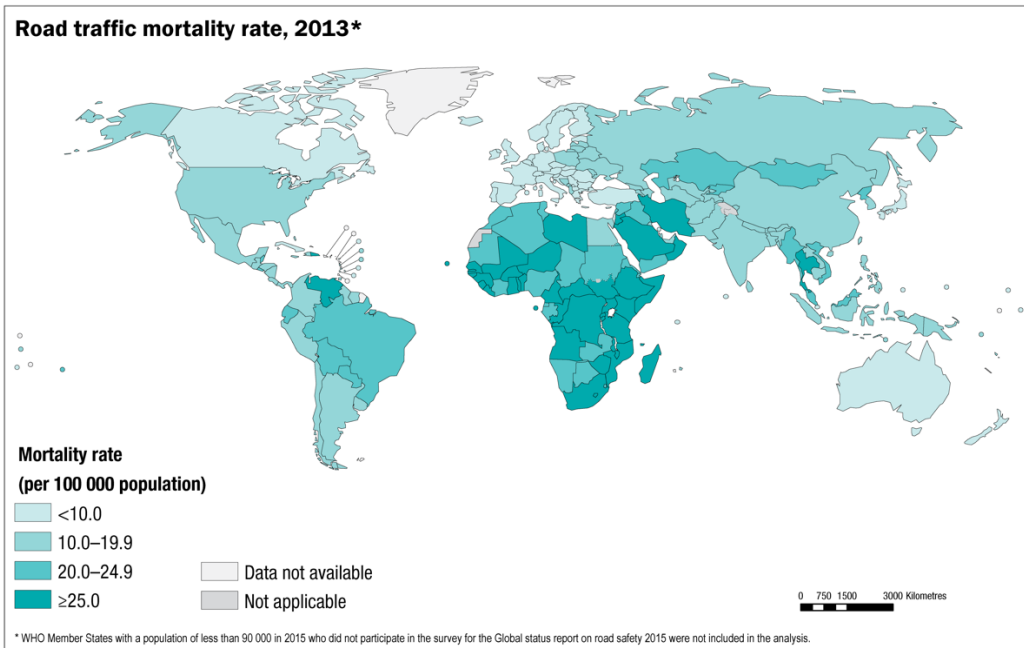
The present report is structured as follows: the current knowledge on road safety performance in the EU and an overview of road fatality developments between 2006 and 2015 are given in Chapter 3. In Chapter 4, the data availability, as well as the need and usefulness for data collection concerning some of the most important Safety Performance Indicators are identified. Additionally, an indicative set of indicators is proposed to be collected at EU level. In Chapter 5, the exploitation of the knowledge coming from the collection of performance indicators in road safety management is discussed. Finally, conclusions and recommendations are included in the Chapter 6.

3 What do we currently know about road safety performance in the EU?

The European Union has seen favourable development in terms of road fatality reductions over the last decades. Between 2006 and 2015 alone, road fatalities were reduced from about 44.000 to about 26.000 – a reduction of about 40%. As of 2016, all EU countries have road mortality rates (fatalities per 100.000 population) of well under 10, the average being at 5. Therefore, living in the EU today is equal to driving, riding and walking the safest streets of the world (see Figure 1).

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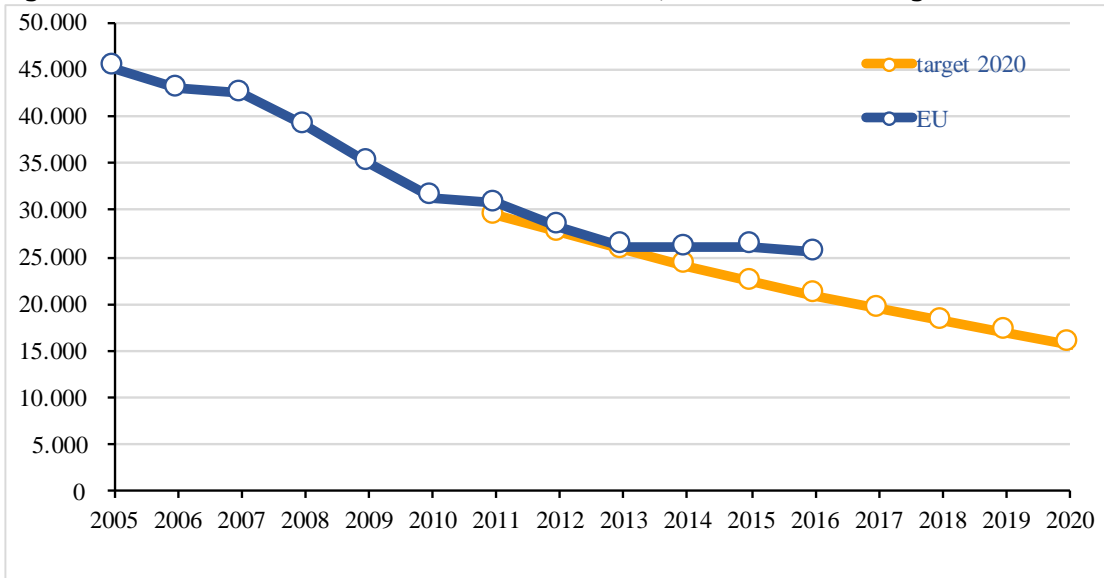
Figure 1: Road traffic mortality rate per 100.000 population in the countries of the world



Source: WHO, 2016

The last years (since 2013) have, however, shown stagnation of the downward trend – and achieving the fatality reduction target of 50% between 2011 and 2020 (European Commission, 2010) seems now a more than ambitious objective (see Figure 2). It therefore seems necessary to prepare a much better insight into the building blocks of the current state – and to analyse the available evidence in detail in order to develop strategies for saving even more lives.

Figure 2: Number of road accident fatalities in the EU, 2005-2016 and target 2020



Source: European Commission 2017b

3.1 Road fatalities in the EU

3.1.1 Basic concept and limitations

Analysis in this chapter is based on CARE¹ data. The information in CARE is based on data collected by Member States' police forces at accident sites. EU legislation requires Member States to share their disaggregated accident databases with EUROSTAT. Commission services provide technical tools to query the data, and the CARE Experts Group of Member States' has for more than 20 years been developing transformation rules between these inherently incompatible databases to allow for sound comparisons between countries. The CARE database takes the national databases as is and does not correct in any way for underreporting. Since around 2010, all Member States use the so-called 30 days' rule, i.e. a death within this period after a road accident is considered a fatality.

3.1.2 Fatalities along different categories and their development

For different user groups, road categories and accident scenarios, a snapshot of the current situation across the Member States is given as well as the EU-wide trend over the last ten years. Between 2006 and 2015 the number of road accident fatalities in the EU fell by 40% from about 44.000 to 26.000.

1. Pedestrian fatalities

During the decade 2006-2015, pedestrian fatalities were reduced from about 8.500 to 5.400 in the European Union – a reduction of 36%. However, the EU-wide share of pedestrian fatalities (of all road fatalities) rose from 20% in 2006 to 21% in 2015. The share is lowest in the Netherlands (11%) and Finland (12%), whereas in Estonia, Romania, Latvia Lithuania and Poland, it is above 30%.

2. Cyclist fatalities

The number of cyclist fatalities in the EU decreased from about 2.800 in 2006 to 2.000 in 2015 – a reduction of 27%. The EU-wide share of cyclist fatalities rose slightly from 7% in 2006 to 8% in 2015. The Netherlands, Denmark and Hungary had the highest share of cyclist fatalities.

3. Powered two-wheeler fatalities

Motorcycle and moped fatalities, together referred to as Powered Two Wheelers (PTW) fatalities, decreased from about 7.000 fatalities (motorcycle: 5.458; moped: 1.618) in 2006 to 4.640 fatalities (motorcycle: 3.939; moped: 701) in 2015 – a reduction of 34%. The EU-wide share of PTW fatalities (of all road fatalities) rose from 17% in 2006 to 18% in 2015. Greece had the highest share of PTW fatalities.

4. Car occupant fatalities

During the decade 2006-2015, car occupant fatalities in the European Union decreased from about 21.300 to 12.100 – a reduction of 43%. The EU-wide share of car occupant fatalities (of all road fatalities) also decreased from 50% in 2006 to 46% in 2015. Finland, France and Estonia had the highest shares of car occupant fatalities, whereas this share is lowest in Slovenia, Portugal and the Netherlands.

¹ CARE: The European Union's road accidents database; https://ec.europa.eu/transport/road_safety/specialist/statistics_en#

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5. Fatalities involving heavy goods vehicles (HGVs)

The number of fatalities in accidents involving Heavy Goods Vehicles (goods vehicles of over 3,5t maximum permissible gross weight) in the European Union decreased from about 7.200 in 2006 to 3.800 in 2015 – a reduction of nearly 50%. Also, the EU-wide share of fatalities in accidents involving HGVs fell slightly from 17% in 2006 to 14% in 2015. The share is highest in Finland and Poland, whereas it is lowest in Estonia and Italy.

6. Fatalities involving buses or coaches

The number of fatalities in accidents involving buses or coaches in the European Union decreased from 1.250 in 2006 to about 720 in 2015 – a reduction of almost 50%. The EU-wide share of fatalities in accidents involving buses or coaches also fell slightly from 2,9% in 2006 to 2,8% in 2015. The share is highest in Estonia and Hungary and lowest in France and Italy.

7. Children (below 15 years old)

In the decade 2006-2015, in the European Union, the number of child fatalities (those who are aged below 15 years) decreased from about 1.300 in 2006 to 650 in 2015 – a reduction of 50%. The EU-wide share of child fatalities (of all road fatalities) also fell slightly from 3,0% in 2006 to 2,5% in 2015. The share of child fatalities was highest in Estonia and Latvia, whereas it was lowest in Greece, Italy and Spain.

8. Youngsters (15-17 years old)

The number of youngster fatalities decreased from about 1.400 in 2006 to 600 in 2015 – a reduction of 57%. The EU-wide share of youngster fatalities also slightly decreased from 3,3% in 2006 to 2,3% in 2015. The share of youngster fatalities is highest in Estonia and lowest in the Czech Republic, Hungary and Portugal.

9. Young road users (18-24 years old)

The number of young people fatalities decreased from about 7.500 in 2006 to 3.600 in 2015 – a reduction of more than 50%. The EU-wide share of young people fatalities (of all road fatalities) also decreased from 17% in 2006 to 14% in 2015. The share of young people fatalities was highest in Denmark, Finland and France, while this share was lowest in Estonia, Portugal and Spain.

10. Elderly (>64 years old)

In the decade 2006-2015, the number of elderly people killed in road accidents (aged >64) decreased from about 8.300 in 2006 to 6.800 in 2015 – a reduction of 18%. The EU-wide share of elderly fatalities increased from 19% in 2006 to 26% in 2015. The share of elderly fatalities was highest in the Netherlands, whereas it was lowest in Croatia and Latvia.

11. Gender

In the decade 2006-2015 the number of female fatalities decreased from about 10.200 in 2006 to 6.200 in 2015 – a reduction of 39%. In the same period, the number of male fatalities also decreased in the same range (39%) from about 32.800 in 2006 to 20.000 in 2015. The EU-wide share of male fatalities remained stable (76,3%) between 2006 and 2015. The share of male fatalities is highest in Greece and Italy, whereas it is lowest in Cyprus and Estonia.

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12. Motorways

The number of fatalities on motorways in the European Union decreased from about 3.500 in 2006 to 2.000 in 2015 – a reduction of 41%. The EU-wide share of fatalities on motorways (of all road fatalities) remained almost stable (8%) between 2006 and 2015. The share is highest in Spain, whereas it is lowest in Romania, Poland and Finland.

13. Roads outside urban areas

In the decade 2006-2015 the number of fatalities on roads outside urban areas fell from about 23.600 in 2006 to 14.400 in 2015 – a reduction of 39%. The EU-wide share of fatalities on roads outside urban areas (of all road fatalities) remained stable (55%) between 2006 and 2015. The share is highest in Latvia and Finland, whereas it is lowest in Cyprus and Croatia.

14. Urban areas

The number of urban road fatalities decreased from about 16.000 in 2006 to 9.700 in 2015 – a reduction of 39%. The EU-wide share of urban road fatalities fell slightly from 38% in 2006 to 37% in 2015. The share is highest in Croatia, Cyprus and Portugal, whereas it is lowest in Ireland.

15. Single vehicle accidents

In the decade 2006-2015 the number of single vehicle accident fatalities (type of road accident in which only one vehicle and no other road user is involved) decreased from about 13.200 to 8.000 – a reduction of 39%. The EU-wide share of single vehicle accident fatalities (of all road fatalities) remained stable (31%) between 2006 and 2015. The share is highest in Greece and France, whereas it is lowest in the UK.

































16. Junctions

The number of junction fatalities in the European Union decreased from about 8.500 in 2006 to 5.100 in 2015 – a reduction of 40%. The EU-wide share of junction fatalities however remained stable (20%) between 2006 and 2015. The share is highest in the UK, the Netherlands and Denmark, whereas it is lowest in Slovenia and Greece.

Table 1 gives an overview of the development of road fatalities in the EU along the different described categories and their share of all road fatalities between 2006 and 2015. Whereas the absolute number of fatalities decreased in all categories, considerable reductions in the shares of all road fatalities are only observable for car occupant fatalities and young road user's fatalities. The share of elderly fatalities of all road fatalities increased substantially. In addition, the proportion of VRU fatalities (pedestrians, cyclists, powered two-wheeler riders) is on a constant increase in the EU. Remarkably, this finding is true also for other high-income regions across the world.

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Table 1: Development of road fatalities in the EU along various categories and their share of all road fatalities 2006-2015

| Categories | Fatalities 2006 | Fatalities 2015 | Development of share of all road fatalities |
|---|-----------------|-----------------|---|
|  Pedestrian fatalities | 8.508 | 5.435 | 20,0%  21,0% |
|  Cyclist fatalities | 2.820 | 2.043 | 7,0%  8,0% |
|  Powered Two-wheeler fatalities | 7.076 | 4.640 | 17,0%  18,0% |
|  Car occupant fatalities | 21.334 | 12.090 | 50,0%  46,0% |
|  Fatalities involving HGVs | 7.233 | 3.803 | 17,0%  14,0% |
|  Fatalities involving buses or coaches | 1.250 | 722 | 2,9%  2,8% |
|  Children (below 15 years old) | 1.300 | 654 | 3,0%  2,5% |
|  Youngsters (15-17 years old) | 1.437 | 611 | 3,3%  2,3% |
|  Young road users (18-24 years old) | 7.460 | 3.607 | 17,0%  14,0% |
|  Elderly | 8.275 | 6.813 | 19,0%  26,0% |
|  Gender (male) | 32.752 | 19.947 | 76,3%  76,3% |
|  Motorways | 3.485 | 2.048 | 8,0%  8,0% |
|  Roads outside urban areas | 23.635 | 14.391 | 55,0%  55,0% |
|  Urban areas | 15.964 | 9.735 | 38,0%  37% |
|  Single vehicle accidents | 13.216 | 8.007 | 31,0%  31,0% |
|  Junctions | 8.463 | 5.142 | 20,0%  20,0% |

4 In which areas should we build better knowledge across the EU?

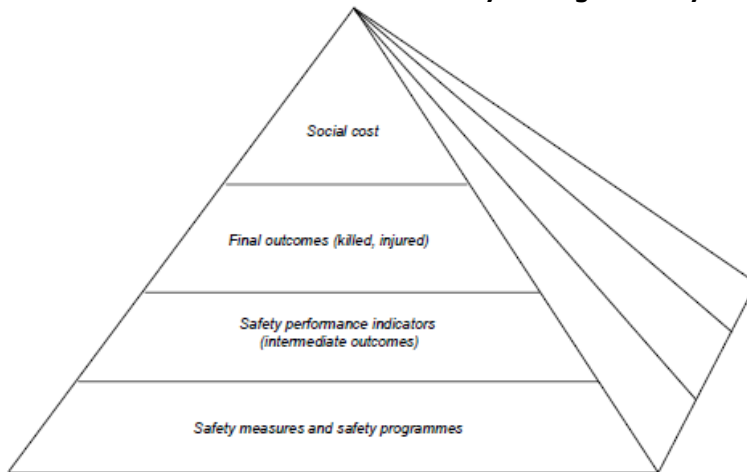
From the previous chapters, it becomes obvious that a detailed picture of the numbers and main characteristics of road fatalities is already available in the EU. However, there is as yet entirely incomplete knowledge on the underlying unsafe operational conditions of the road transport domain – be they related to behaviour, infrastructure, vehicles or trauma management – and the processes which cause crashes and injuries. It is therefore advisable to supplement the available crash and injury counts (“final outcomes”) by a set of so called Safety Performance Indicators (SPI) to better explain systematic developments in safety performance over time and evaluate the impacts of countermeasures.

4.1 Basic concepts of Safety Performance Indicators

The history of SPIs goes back to the early 2000s, when SPIs (“Intermediate Outcome Indicators”) were defined as “any measurement that is causally related to crashes or injuries [...] to indicate safety performance or understand the process that leads to accidents” (ETSC 2001), see Figure 3.

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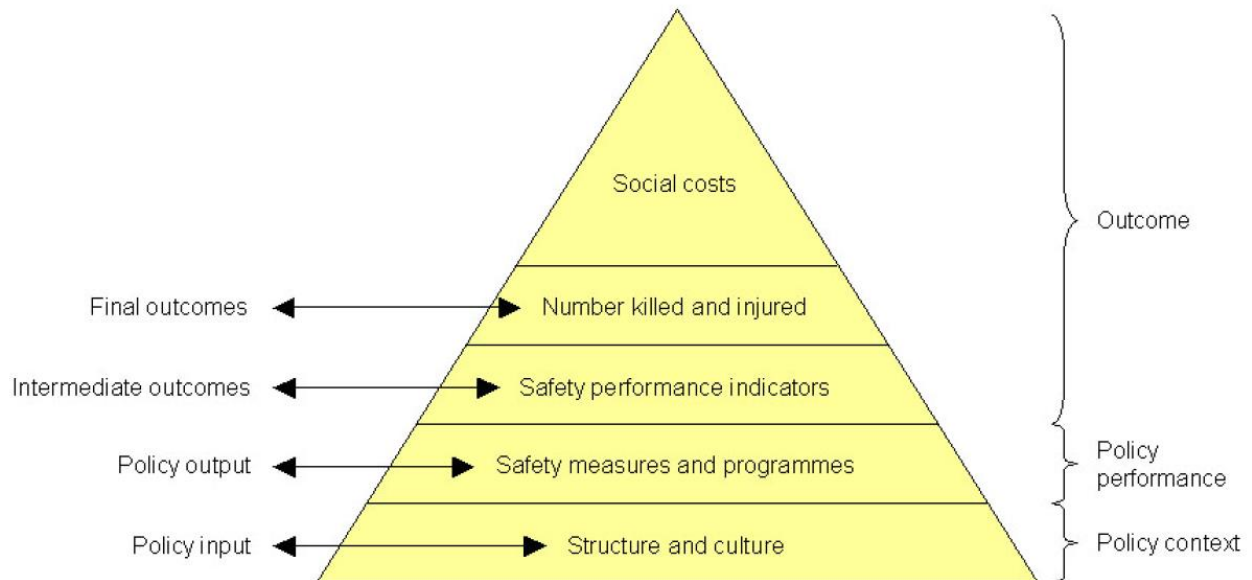
Figure 3: The essential elements of a safety management System



Source: ETSC, 2001

In the projects SUNflower and SUNflower6+, an approach concerning the methodological framework for benchmarking road safety performances has been given, which uses a target hierarchy for road safety, including five layers, as shown in Figure 4. The safety performance indicators are defined as intermediate outcomes, which could be used in benchmarking of road safety performances as well as in road safety implementation through their relationships with the other layers and mainly with the final outcomes.

Figure 4: A target hierarchy for road safety based on SUNflower approach



Sources: Koornstra et al., 2002; LTSA, 2000

The EU research project SafetyNet² designed a comprehensive theory for the development of SPI (Hakkert et al., 2007) and distinguished between

- outcomes (i.e. operational conditions of road traffic which can be reflected by SPIs, like e.g. speed level on specific types of roads, see yellow fields in Figure 4), and

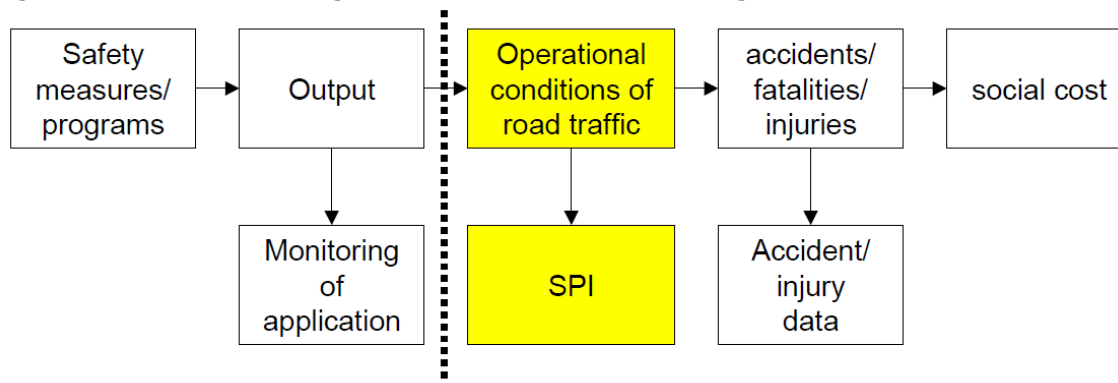
² <http://erso.swov.nl/safetynet/content/safetynet.htm>

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- outputs of programmes and measures (e.g. the number of speed cameras in use)

A specific SPI should ideally be outcomes - and not depend on individual measures but react to every change in the system. Otherwise, the indicator may possibly react to one intervention (e.g. speed cameras), but not to another (e.g. Intelligent Speed Assistance) (Hakkert & Gitelman, 2007).

Figure 5: Road safety management system and its monitoring



Source: Hakkert et al., 2007

Thus, the purpose of SPIs can be summarised as follows:

- 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).

In practice, the process of defining adequate SPIs can be complex and not always can SPI be identified that are adequately confined to the yellow part of Figure 4. Only for some domains can direct indicators be identified and collected which directly measure an unsafe operational condition (e.g. seatbelt non-use). For others, such direct measurement is not feasible, e. g. for technical, economical or ethical reasons. In these cases, either indirect indicators can be identified as a proxy for the problem (e.g. number of alcohol-related fatalities, from police records), or one which is related to an intervention (e.g. number of alcohol roadside checks), see also Hakkert et al., 2007).

Currently, no two countries in the EU collect the same set of indicators, let alone with the same methodology. The following chapters give an overview of the state of play in the EU with respect to

- scientific motivation to collect indicators in different problem areas,
- the size of the respective problem and reduction potential,
- data collection and analysis requirements, and
- current data availability.

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For each of these areas, potential indicators for joint collection by the Member States are identified, with a view to future shared analysis, target setting and benchmarking at European level.

4.2 Seatbelts and child restraints

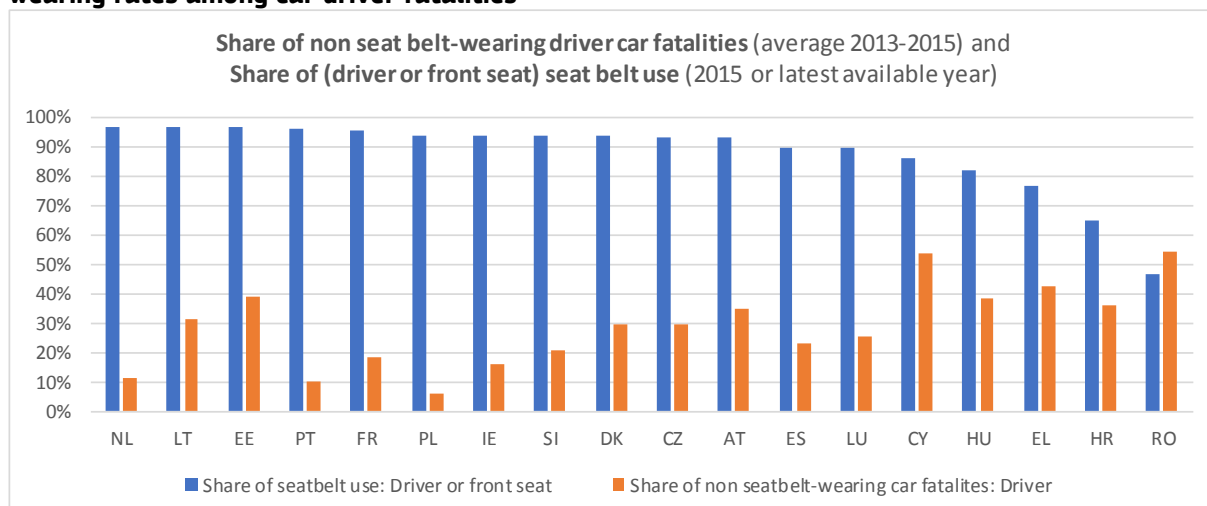
4.2.1 Background and motivation

Seatbelts were among the first passive safety measures that were developed for car passengers; the year 2009 marked the fiftieth anniversary of the three-point seat belt (ETSC 2010). Today, the use of seatbelts on all seats (when equipped) and the use of adequate child restraints is mandatory in all EU Member States and EFTA countries. However, seat-belt use rates still vary substantially, especially on rear seats, where recent observational studies revealed a range from 99% in Germany to only 11% in Italy (ITF 2017). Several EU countries have arrived at front seat wearing rates between 90 and 100%, but even in these countries, surprisingly high shares of vehicle occupant fatalities are not belted. This is mainly since a) the risk of sustaining fatal injuries is higher for unbelted occupants, and b) the use rates at night-time are usually lower than at day-time (when use rates are usually measured).

Figure 5 outlines the stunning gap between driver or front seat wearing rates and non-wearing rates among car driver fatalities. In several countries, at least every third killed car driver is still unbelted. It is obvious that this implies a substantial fatality reduction potential.

The use rates of child restraints are currently above 90% in almost all countries which collect data, however there is reason to believe that a substantial share of children is either not properly fastened or they didn't have an appropriate restraint for their length and/or weight (see e.g. ITF 2017, p.88).

Figure 6: EU seatbelt wearing rates in normal traffic (driver or front seat, average 2013-15) and non-wearing rates among car driver fatalities



Source: IRTAD Annual Report 2016 for observational seatbelt wearing rates; CARE analysis by KfV for wearing rates among car driver fatalities

4.2.2 Relevance and effectiveness

There is little doubt that seatbelts and child restraints effectively save lives; estimates for fatality reductions due to seatbelts are reported to range between 40 and 60% (Hakkert et al.,

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2007, p58). The reported fatality reduction rates for child restraints are even higher; ETSC names 90% for rearward and 60% for forward facing systems (ETSC 2001). However, high rates of misuse are regularly reported for child restraints, i.e. failures in mounting and strapping, (Hakkert et al., 2007, p58) which can substantially deteriorate their effectiveness.

4.2.3 Size of the problem and reduction potential

It is possible to estimate the number of lives saved by seatbelts and CRS in current traffic as well as the number of potentially additionally saved lives in case of a higher use rate by applying the method described by Glassbrenner (2003). The method sets in relation a) the number of killed persons who used the device (known from accident databases) and b) the effectiveness of the device in reducing fatalities (known e.g. from in-depth studies) to calculate the number of people who were saved by the device – and the potentially additionally saved lives in case of higher (or 100%) use rates.

An estimation based on recent CARE data (2013-2015) revealed that approximately 5.700 lives are already saved by seatbelts and child restraints in the EU annually, and that about 2.800 lives could additionally be saved if all car occupants wore their seatbelts (Table 2).

Table 2: Estimation of fatality reduction potential due to seatbelt and child restraint use in the EU

| | | | |
|---|--|--------------|---|
| A | Killed car occupants annually, Ø 2013-15 | 11.334 | Data from CARE |
| B | Average effectiveness of seatbelt and child restraints in reducing fatalities | 0,5 | estimated average; based on findings in (Hakkert et al., 2007) |
| C | Occupants who died using the device | 5.682 | Estimation based on CARE data for 18 countries that provide information |
| D | Occupants who used the device in a setting in which they would otherwise have died | 11.364 | = C/D |
| E | Occupants already saved by the device | 5.682 | = D-C |
| F | Occupants potentially saved if 100% use | 2.736 | = (A-C)*B |

Source: CARE analysis by KfV

4.2.4 Data collection and analysis

There are several potential ways to obtain wearing rates of seatbelts and child restraints as a direct indicator: Police reported rates (roadside checks), self-reported rates (from interviews or online-surveys), wearing rates of victims at accident scenes (reported by police) and observational roadside surveys. All collection methods – apart from the latter – come with systematic biases, e.g. wearing rates from police roadside checks are generally higher than those obtained from observational surveys, and interviews also generally overestimate the real values (Hakkert et al., 2007).

Visual observations performed by trained observers is the most common method used; Observers can be either placed along the roadside (or another convenient place), or in a moving car (Hakkert & Gitelman, 2007). The latter makes possible observation on high-speed roads, were full assessment of all car occupant's use rates can otherwise be a challenge. Recently, cameras with feature recognition functionality have become available that may gradually replace human observers and automatically detect infringements like belt non-use or handheld mobile phone use, at least for front seat occupants. First comparisons between results from the ESRA³ initiative (using on-line surveys) and results from national survey in Hungary revealed

³ E-Survey of Road User's Attitudes, <http://www.esranet.eu/>

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“relatively good conformity between self-reported and observed data” with respect to both seatbelt and child restraint wearing rates (Hollo & Berta 2017).

Estimating representative use rates for a country is a complex task which involves careful choice of number and spatial distribution of census points along different road categories in different regions, and the determination of proper sample sizes. Therefore, a sampling procedure needs to be developed and properly trained personnel is required for data collection and analysis. A manual for the establishment of national SPI for protective systems has been developed by Hakkert & Gitelman (2007).

4.2.5 Availability in Member States

The collection of wearing rates of seatbelts has been widespread practice in most EU Member States for several years, hence this indicator is among the ones with the highest availability across the EU.

The collection of child restraints’ usage, however, is far less common; Only 14 Member States provided data for a recent ETSC survey (ETSC 2017). The European Commission’s European Safety Observatory (ERSO) regularly collects information on use rates of protective systems from EU Member States and EFTA countries in its Road Safety Country Overviews⁴.

4.2.6 Discussion

Many countries collect indicators on seatbelt and child restraint use, but indicator scope varies (driver, front seats, front seat passengers etc.), and little is known about comparability of the collection methodologies, sample sizes, and the statistical methods to stratify the samples, e.g. to road categories, and to regions. Given the reduction potential of these protective systems, and as the potential to influence use rates by campaigns, incentives or enforcement is assumed to be substantial, these indicators should however be ranked as prime candidates for joint collection by Member States, preferably by making use of good practices in terms of collection methodology and datasets to be produced. Given the statistical capacity required to produce overall indicators for a country, it may be beneficial to start the procedure stratified by road type (urban, rural, motorway). This way, those countries which are not yet in the position to collect data for all three road categories could also contribute.

4.2.7 Proposed Indicator(s) for seatbelts and child restraints

| | Urban | Rural | Motorway |
|---|-------|-------|----------|
| 1 Daytime wearing rate of seatbelts (passenger cars) on front seats | % | % | % |
| 2 Daytime wearing rate of seatbelts (passenger cars) on rear seats | % | % | % |
| 3 Daytime use of child restraint systems (<14y) in passenger cars | % | % | % |

Considerations for future indicators:

- Seatbelt wearing rates front seats (whole country)
- Seatbelt wearing rates rear seats (whole country)
- Daytime use of child restraint systems (<14y) in passenger cars (whole country)

⁴ https://ec.europa.eu/transport/road_safety/specialist/erso/country-overviews_en

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- Seatbelt wearing rates for HGV and coaches (front seats, whole country)
- Seatbelt wearing rates for coaches (passengers, whole country)

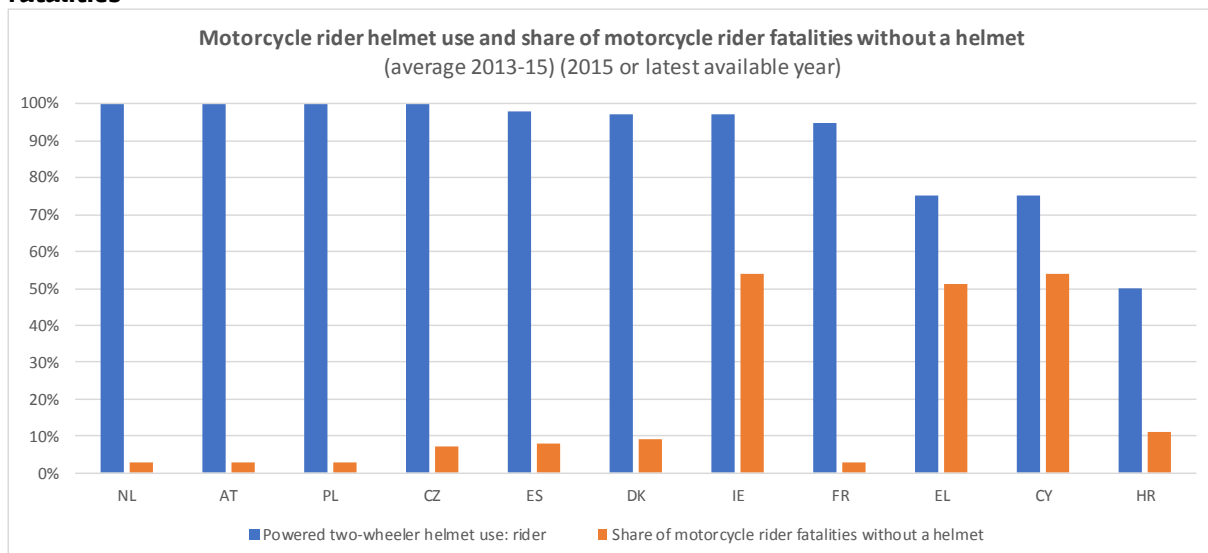
4.3 Helmets

4.3.1 Background and motivation

This chapter deals with crash helmets which are designed for motorised or non-motorized two-wheelers. Helmets for powered two-wheelers have evolved alongside with helmets designed to increase work safety, as well as those for use by the military, police or fire brigades. As for seatbelts, early models (at least) date back to the 1950's. Before that, PTW rider helmets were designed to protect from wind and weather rather than from injury. The wearing of crash helmets is today mandatory in all EU countries for motorcycles and mopeds, with some notable exceptions for small mopeds ("mofas" with engines <50cm³) in some countries. Cycle helmets are nowhere mandatory for adults, with the notable exception of Finland (recommended), Spain (rural roads, but not uphill) and Malta. Several other countries have introduced cycle helmet obligations exclusively for children or young riders, with age limits varying between 12 and 18 years.⁵

The helmet wearing rates for PTWs vary widely; Whereas in northern Europe the rates are reported to be close to 100%, those for some southern countries can be substantially lower, and they systematically tend to be lower for moped than for motorcycle riders. In addition, indications are that PTW passengers have lower wearing rates than riders (ITF 2017). Figure 6 illustrates the gap between motorcycle helmet wearing rates observed in normal traffic and the proportion of non-wearing among rider fatalities.

Figure 7: Motorcycle helmet use in normal traffic and non-wearing rates among motorcycle rider fatalities



Source: OECD 2016, ERSO Road Safety Country Overviews 2016; CARE analysis by KfV for helmet wearing rates among motorcycle rider fatalities

⁵https://www.dvr.de/site.aspx?url=/html/betriebe_bg/daten/radhelmpflicht_europa.htm,
http://ec.europa.eu/transport/road_safety/going_abroad/index_en.htm

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For cycling helmets, wearing rates are mostly below 50% - but can be as low as 12%, see Table 3.

Table 3: Cycle helmet wearing rates in EU and EFTA countries and year of observation

| Country | Cycle helmet wearing rate | Year of observation |
|---------|---------------------------|---------------------|
| BE | 34% | 2006 |
| DK | 28% | 2014 |
| DE | 17% | 2015 |
| EE | 31% | 2014 |
| IE | 52% | 2015 |
| LV | 12% | 2014 |
| AT | 30% | 2014 |
| PL | 12% | 2014 |
| FI | 41% | 2014 |
| SE* | 30% | 2015 |
| UK | 34% | 2008 |
| NO** | 56% | 2015 |
| CH | 43% | 2014 |

Sources: ERSO Road Safety Country Overviews 2016; ETSC 2015; WHO 2015

* for adults

** for cyclists above 12 years

4.3.2 Relevance and effectiveness

Helmets are designed to mitigate kinetic forces and injuries to the human body's most fragile region. Wearing a helmet reduces the risk of head injury in a crash considerably. An international review of 61 studies on motorcycle crashes shows that the risk of severe head injury decreases by about 69% when wearing a helmet. The risk of being killed decreases by about 42% (SWOV 2010). With respect to cycling helmets, Olivier & Creighton (2016) estimate that the risk of severe head injury decreased by 69% and that of fatal head injury by 65%. The estimates in this meta-analysis are based on 40 case-control studies. In these studies, the injuries of a total of 64.000 cycling casualties with and without helmet were compared (SWOV 2016). See also [ERSO Traffic Safety Synthesis on Power Two Wheelers](#).

4.3.3 Size of the problem and reduction potential

The method described by Glassbrenner (2003, see Table 2 on seatbelts and child restraints above for explanation) can also be applied in the domain of helmets, to calculate the number of people who were saved by the device – and to estimate the potentially additionally saved lives in case of higher (or 100%) use rates. The effectiveness rates in Table 4 have been adopted from Hakkert & Gitelman (2007). It is estimated that increasing helmet use to 100% could save the lives of 600 motorcyclists, 136 moped riders and 680 bicyclists in the EU annually.

Table 4: Estimation of fatality reduction potential due to helmet use in the EU

| | | Motorcycle | Moped | Bicycle |
|---|---|--------------|------------|------------|
| A | Killed riders annually, Ø 2013-15 | 3.791 | 721 | 2.005 |
| B | Average effectiveness of helmets in reducing fatalities | 0,4 | 0,5 | 0,5 |
| C | Riders who died using the device (Estimation based on CARE*) | 2.291 | 450 | 645 |
| D | Riders who used the device in a setting in which they would otherwise have died | 5.728 | 900 | 1.290 |
| E | Riders already saved by helmets per year | 3.437 | 450 | 645 |
| F | Riders potentially saved if 100% use per year | 600 | 136 | 680 |

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Source: CARE analysis by KFV

* 17 EU Member States provide data on motorcycle rider helmet wearing in crashes, 16 countries do so for moped and bicycle riders

4.3.4 Data collection and analysis

For the collection of helmet wearing rates, similar considerations apply as for seat belts and child restraints: the most reliable results will be obtained by visual observations performed by trained observers, either at the roadside or in moving vehicles. Care should be exercised to arrive at a representative number and spatial distribution of census points in different regions (both urban and rural roads), and at proper sample sizes.

There are indications that part of the injuries of motorised and non-motorised 2wheeler riders could be due to incorrectly strapped or entirely unstrapped helmets (SWOV, 2010). It is therefore advisable to consider assessing the rates of incorrectly strapped helmets in the mid-term.

4.3.5 Availability in Member States

The collection of helmet wearing rates is still less of a widespread practice than it is for seatbelts and child restraints. Several EU countries assume their PTW helmet wearing rates to be “Nearly 100%” but do not (anymore) collect the indicator per se. Even several countries with lower rates do not carry out collections on a regular basis, e.g. the most recent data for Greece are from 2009. Only a minority of countries provide separate moped and motorcycle helmet wearing rates (ITF, 2017).

The available evidence on cycling helmet wearing rates is also scarce; only around 10 EU countries gather data in a regular way (ETSC 2015). Even if the ERSO Road Safety Country Overviews⁶ list rates for several additional countries, the sources are often single studies which sometimes date back up to ten years.

4.3.6 Discussion

The wearing of helmets among powered two-wheeler riders and cyclists have been found to substantially contribute to reducing road fatalities and injuries. It is therefore advisable that Member States consider collecting these rates on a regular basis. It is noted that several countries have reached very high motorcycle helmet wearing rates and will therefore not be in favour of investing the resources for observations. For those countries it may be advisable to investigate their national crash databases for residual fatalities among PTW riders who had not used a helmet, to identify potential blind spots in their assessment. In some countries, strong lobbying has taken ground to combat any initiatives towards cycling helmets, therefore the assessment of helmet use might also be faced with opposition.

4.3.7 Proposed Indicator(s) for helmets

| | Urban | Rural |
|---|-------|-------|
| 1 Daytime use rates of motorcycle helmets | % | % |
| 2 Daytime use rates of moped helmets | % | % |
| 3 Daytime use rates of cycle helmets | % | % |

⁶ https://ec.europa.eu/transport/road_safety/specialist/erso/country-overviews_en

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4.3.8 Considerations for future indicators:

- Add differentiation between rider / passenger wearing rates (motorcycle, moped)
- Add share of correctly strapped helmets (motorcycle, moped)
- Add assumed gender age (bicycle)

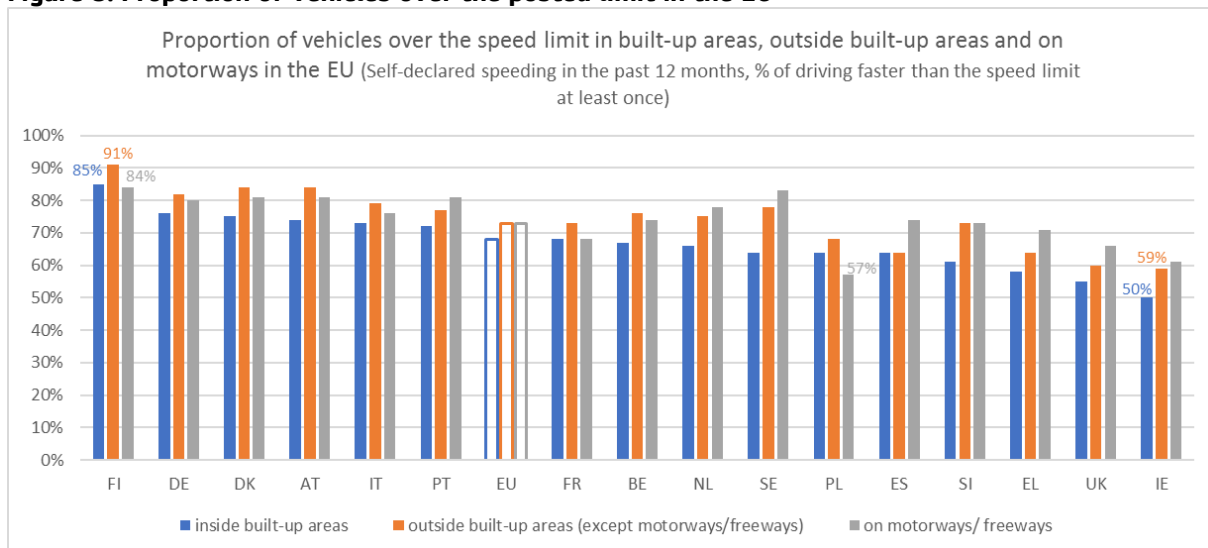
4.4 Speed

4.4.1 Background and motivation

Speed has been identified as one of the major causal factors for road crashes. Higher driving speeds lead to more kinetic energy released in a crash – which increases their severity. The relationship between changes in absolute speed and changes in road safety can be described by the Power Model, i.e. a series of power functions depending on crash severity levels – developed by Nilsson (1982) the results of which have been confirmed by several studies (e.g. Elvik et al, 2004). It is also argued that not only the absolute speed but also the differences in speeds, i.e. speed dispersion or speed variance along a stretch of road play a safety role; the larger the differences, the more crashes (Aarts & Van Schagen, 2006).

Different speed limits apply in the EU, on urban roads they range from 48 km/h (i.e. 30mph) to 50 km/h, on rural roads from 70 km/h to 100 km/h and on motorways from 100 km/h to 130 km/h. This is applicable unless otherwise stated by traffic signs (European Commission, 2017c). A substantial proportion of drivers exceed the posted speed limit in all EU countries – between 50% and 85% on urban roads, between 59% and 91% on rural roads and between 57% and 84% on motorways (see Figure 7; Yannis et al., 2016).

Figure 8: Proportion of vehicles over the posted limit in the EU



Source: Yannis et al., 2016

Concrete information on speed levels preceding crashes are usually not available from national accident records. Such data can only be made available through in-depth studies and accident reconstructions by expert witnesses during court cases.

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4.4.2 Size of the problem and reduction potential

Results of naturalistic driving studies show that driving well above the speed limit or driving too fast for the conditions has a baseline prevalence of 2,77% in normal traffic; The risk to be involved in a crash when speeding is 12,8 times higher than for non-speeders (Dingus et al., 2016). It is generally assumed that about one third of fatal crashes are (partly) caused by excessive or inappropriate speed (OECD/ECMT, 2006). The Power Model allows for swift estimations of fatality and injury reductions. It was estimated that if average driving speeds dropped by only 1 km/h on all roads across the EU, more than 2.200 road deaths could be prevented each year, 1.100 of them on urban roads, 1.000 on rural roads and 100 on motorways (ETSC, 2010). There is multitude of measures available to reduce speed levels, along the fields of regulations (posted speed limits), enforcement, road infrastructure design, education and campaigns, and in-vehicle driver assistance systems. See also [ERSO Traffic Safety Synthesis on Speed and Speed Management](#).

4.4.3 Data collection and analysis

In addition to manual observation by measuring staff (handheld radar and laser devices), a wealth of automatized collection machinery is available on the market, from inductive loop detectors to – mobile or stationary – radar sensors and video-based software tools. Recently there have been first initiatives to extract driving speeds from telecom providers' databases, making use of information on place and time of GSM cell handovers, and matching those to road corridors. Similar information can in principle also be gathered by providers of on-line navigation systems (real-time travel times on specific roads), or via shared geo-location information of users of mobile phones. It must be noted, however, that these recent virtual measuring methods come with limitations, e.g. the vehicle category usually cannot be specified and it is also difficult to determine whether a vehicle is in congestion or not.

Only the speeds of vehicles in reasonably free flowing conditions should be considered, which implies that – especially for automatic recordings – headways should be recorded as well, and free-flowing vehicles filtered out thereafter (i.e. those with headways >5-10 seconds to the vehicle in front). The measurements should represent driving under normal conditions and should not be influenced e.g. by adverse weather. Temporal variations such as during holidays or weekends should be considered, as well as the difference in speed levels between day and night. It is therefore advisable to concentrate measurements on late spring and early autumn, on typical working days (Tue-Thu) during off-peak times, in daylight, between 9:30 and 15:30 (Hakkert & Gitelman, 2007).

Any speed-related indicator only makes sense if collected for specific types (or in fact rather: lengths) of vehicles. It is advisable to distinguish between cars (light vehicles), PTWs, small trucks and HGVs. Several requirements have been identified for the selection of census points for them to produce representative data; Among other things, they should be based on a random sample of roads (representative for a countries' road network), be on straight sections of road with only small gradients and far away from junctions, speed calming devices, pedestrian crossings, work zones, and speed limit changes. Measurements should cover at least 200 vehicles per census point (Hakkert & Gitelman, 2007; Hakkert et al, 2007). Measurements should be invisible to drivers and sampling locations should remain the same over the years.

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4.4.4 Availability in Member States

Many countries have a practice of collecting speed data on a regular basis also for other purposes than road safety. However, this practice often applies mainly to roads with high traffic loads – and does not constitute a representative sample of the road network. In addition, the principle of collecting only speeds of free-flowing vehicles is pursued in different ways by countries. (Hakkert et al., 2007). Hence, the derived data may be used for longitudinal analysis within a country but are to a lesser extent apt for international comparison.

ERSO compiles available evidence for mean speeds and proportion of vehicles exceeding the speed limit from EU and EFTA countries in its Road Safety Country Overviews⁷.

4.4.5 Discussion

The substantial speed infringement rates across the EU imply that indicators on speed levels are an indispensable prerequisite for road safety management of any country. Most EU countries already collect data on speed, but the data collection methods may not yet all be entirely up to meet methodological demands in terms of representativeness and comparability. It is therefore advisable to collect meta data on current methodologies at EU level and thereupon identify and communicate good practices.

4.4.6 Proposed Indicator(s) on speed

| | mean speed | speed deviation | v ₈₅ speed | proportion of vehicles over the limit |
|--|------------|-----------------|-----------------------|---------------------------------------|
| 1 motorways with dual carriageway and median separation* | km/h | ±km/h | km/h | % |
| 2 single carriageway rural roads | km/h | ±km/h | km/h | % |
| 3 single carriageway urban distributor roads | km/h | ±km/h | km/h | % |

*at census points with default speed limit for this road category, daytime, normal working day, free-flowing passenger cars

Considerations for future indicators:

- Additional category for analysis: vehicles 10 km/h over the limit
- Additional road categories: e.g. 30km/h zones
- Other vehicle types: small trucks (<3,5t), HGVs
- Additional times of day and week: e.g. darkness, weekend

4.5 Driving under the influence: alcohol and drugs

4.5.1 Background and motivation

Driving under the influence (DUI) of alcohol has been identified as one of the major causal factor for crashes and injuries. An exponential correlation between blood alcohol concentration (BAC) and crash risk has been established in numerous studies; the relative crash risk adjusted for age

⁷ https://ec.europa.eu/transport/road_safety/specialist/erso/country-overviews_en

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and gender for drivers with a BAC of 0,5 g/l is approximately two times higher than for drivers at zero BAC. At 0,8 g/l BAC it is four times higher (see e.g. Compton and Berning, 2015).

With regards to DUI of drugs, the relation between doses of illicit and medicinal drugs versus crash risk highly depends on the substance in question, the physical and mental condition of the individual user, whether there was poly drug use, and the time passed after taking the drug. Contrary to alcohol, the impairment due to drugs can last long (depending on substance) and even increase over time during metabolism and drug interaction.

On a European level, alcohol was estimated to be found in 3,48% of the drivers in daily traffic, illicit drugs in 1,90% of the drivers, medicinal drugs in 1,36%, drug-drug combinations in 0,39% and alcohol-drug combinations in 0,37% of the drivers. However, there were big differences between the means in the four European regions (North, South, West, East). There were high prevalence rates of alcohol, cocaine, cannabis and combined use in Southern Europe, partly also in Western Europe, whereas z-drugs and medicinal opioids were more common, although still low prevalent, in the northern countries (Schulze et al., 2006).

Regarding alcohol, all EU Member States (except UK and Malta) apply legal BAC limits of 0,5 g/l or lower; four countries apply a 0,2 limit (EE, FIN, PL, SE) and four of the new Member States run a zero-tolerance policy (CZ, HU, RO, SK).

Regarding drugs, hardly any EU country (notable exceptions: DK, DE, LU) has set substance-specific blood concentrations as offence impairment levels; most countries either treat driver impairment or any detection of a drug in a driver's blood as an offence (EMDCCA 2017).

4.5.2 Size of the problem and reduction potential

It is a complex task to objectively quantify the size of the alcohol problem from accident statistics, as collection by the police methods vary widely between Member States. In experimental studies in 13 countries during the DRUID project, alcohol alone was found in 15-30% of seriously injured and killed car drivers, with an exceptional rate of 40% for Portugal (Schulze et al., 2006). An IRTAD study identified an average of 21,8% alcohol-related road deaths, based on a survey among 45 countries, but argues that this figure may underestimate the problem as the shares of fatalities in official national police statistics range between below 5% and over 35% (Vissers et al., 2017). There are several reasons for this big spread, e.g. several countries do usually not foresee blood tests of deceased – or unconscious – crash victims unless the prosecutor requires it. Even if the proportion of 21,8% was correct, for the EU more than 5.500 fatalities would have been connected to DUI of alcohol in 2016. For DUI of drugs - and the combination of alcohol with drugs – such assessment is even more difficult as no harmonised test methods exist.

A range of countermeasures is available to combat DUI, ranging from law and enforcement to education, campaigns and in-vehicle devices. See also ERSO Traffic Safety Synthesis on Alcohol.

4.5.3 Data collection and analysis

The ideal indicator for the DUI issue would be the prevalence and impairment levels of intoxicated active road users (drivers, riders and pedestrians) in traffic, collected from roadside surveys among randomly selected individuals. There are several impediments to such collection, e.g. random testing – without suspicion – is prevented by law in some jurisdictions, others do not allow the testing of pedestrians. Therefore, it is proposed to derive an indirect indicator from

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national accident statistics. Regarding the methodological shortcomings of data collection on alcohol-related crashes in many countries, Vissers et al. (2017) recommend to:

- Aim for a systematic alcohol testing of every road user actively involved in a serious crash.
- Use statistical analysis methods to better estimate the number of alcohol-related road fatalities, i.e. to combat underreporting.
- Harmonise definitions of alcohol-related road casualties (across countries).
- Conduct future research on how to measure alcohol-related road crashes involving pedestrians and cyclists.

In addition to deriving an indicator from accident statistics it may be advisable to consider collecting an additional one from the number of roadside checks by police. Such an indicator would not follow the classical definition of SPI (to measure a specific unsafe operational condition) but directly assess the intensity of a countermeasure, i.e. measuring a country's determination in combatting one of the most dangerous misbehaviours in the EU.

4.5.4 Availability in Member States

The CARE database currently has information on alcohol tests after fatal road crashes for 23 EU countries, however the resulting proportion of alcohol-related crashes (of all crashes) vary widely. In addition, not all road user types currently undergo the same testing procedure; only 11 countries provide data on alcohol tests of crash-involved pedestrians. Only for seven countries information on drug impairment is available (FR, FI, HU, LU, PL, PT, SI) in CARE. In terms of indicators, hence it will be recommendable to seek for a step-wise approach to produce information which is not only comparable within countries but also across Europe.

In a survey on enforcement activities in the Member States, 17 countries provided information on a) the total number of alcohol road side breath tests per year, and b) the number of those above the legal limit. Another four countries only provided the latter (ETSC, 2016). It should be noted that the quotient of the two figures (i.e. the proportion of drunk drivers of all tested) cannot be compared between countries, as practices and legal prerequisites differ, e.g. whether the police randomly test all drivers, even without suspicion. In addition, the police's check points and "sample" sizes are usually not selected with the objective to arrive at a statistically representative indicator for a country.

4.5.5 Discussion

The relevance of the issue of DUI is as substantial as is the range of different methodologies and deficiencies in assessment methodologies across the Member States. A major effort will be needed to produce comparable figures, but given the size of the problem having comparable indicators is indispensable. One major objective in this quest will be to strive for testing all involved active users involved in a crash (including pedestrians), be they alive, unconscious or deceased.

4.5.6 Proposed Indicator(s) for alcohol and drugs

| | number | Proportion of all fatalities |
|--|--------|------------------------------|
| 1 Fatalities resulting from crashes involving (at least) one driver or rider under the influence of <u>alcohol</u> (above the legal limit) | n | % |
| 2 Fatalities resulting from crashes involving (at least) one driver or rider impaired by <u>psychoactive substances other than alcohol</u> (national offence impairment level) | n | % |
| 3 Number of alcohol roadside checks by police per population | n | |

Considerations for future indicators: (once testing procedures and data availability have converged at Union level)

- The number and proportion of fatalities resulting from crashes involving (at least) one active road user (driver or rider or pedestrian) under the influence of alcohol (above the legal limit)
- The number and proportion of fatalities resulting from crashes involving (at least) one active road user (driver or rider or pedestrian) impaired by psychoactive substances other than alcohol (national offence impairment level)
- Number of drug roadside checks by police per population
- Share of drunk drivers among those tested (above the legal limit)
- Share of drugged drivers among those tested (national offence impairment level)

4.6 Use of handheld cell phones

4.6.1 Background and motivation

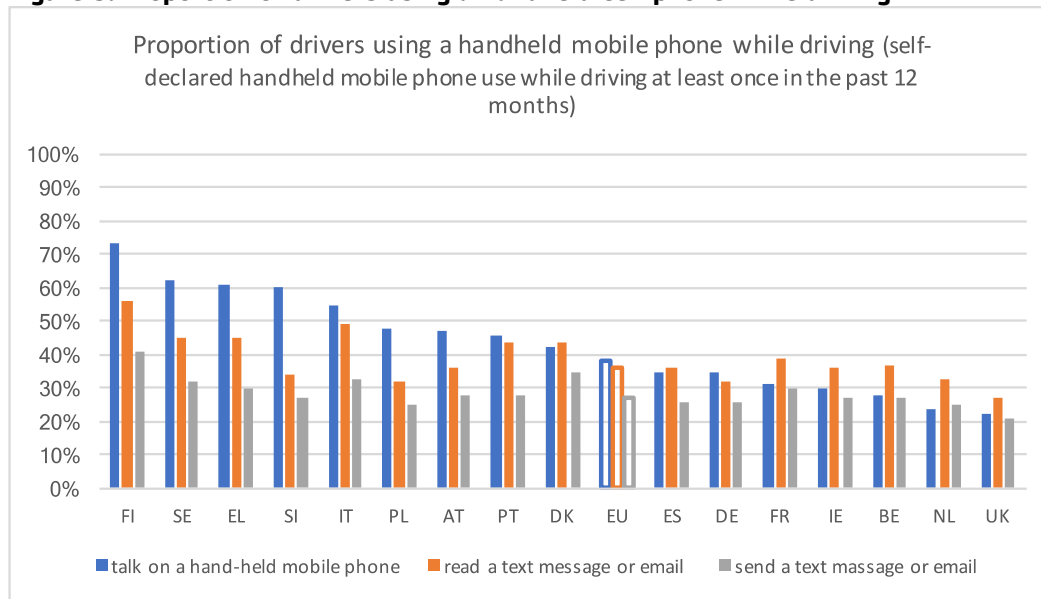
The use of cell phones that are handheld (i.e. not using a hands-free or Bluetooth device to free the hands of the user) induces a level of distraction to the person driving, which is a major risk factor in road safety (Ziakopoulos et al., 2016). It is suggested that cell phone use may be the most important in-vehicle distraction source for drivers (Yannis, 2013). This is not only the case for making calls (dialing or talking). Also several texting and reading activities on the smartphone (email, messenger, social network apps etc.) impose risks to the person driving (Basacik et al., 2011). The reason behind that are the several possible ways cell phone use can distract persons while driving: (1) physical distraction (e.g. using the hands for dialling), (2) visual distraction (e.g. looking on the cell phone and off the road), (3) auditory distraction (e.g. when driver is startled by the initial ringing of the mobile phone) and (4) cognitive distraction (e.g. lapses in attention and judgement due to performing two mental tasks at the same time). See also [ERSO Traffic Safety Synthesis on Cell phone use while driving](#). The extra amount of mental workload and cognitive functions to drivers reduces their reflexes and slows their reaction times to events (both the time to mentally register the effect and the time to physically react to it (see e.g. Strayer et al., 2013).

Handheld cell phone use (phoning, texting etc.) while driving is especially widespread amongst young novice drivers and decreases with the increase of age (Trigoso et al. 2016). A substantial percentage of drivers use handheld cell phones (talking, reading, texting/sending) while driving

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in all EU countries (between 22% and 73% for talking, between 27% and 56% for reading and between 21% and 41% for texting/sending) (Trigoso et al. 2016, see Figure 8).

Figure 9: Proportion of drivers using a handheld cell phone while driving



Source: ESRA project, Trigoso et al., 2016

4.6.2 Size of the problem and reduction potential

Results of naturalistic driving studies show that using a handheld cell phone (overall) while driving has a baseline prevalence of 6,40%; the risk to be involved in a crash when using a handheld cell phone is 0,5 times higher (overall) than when not using a handheld phone (Dingus et al., 2016). A meta-analysis mainly including studies using case-crossover designs estimated the likelihood of crash involvement even higher, at a factor of three (Elvik, 2011). The risk of being involved in a crash is substantially increased, especially when dialling (12.2 times higher) and when texting (6.1 times higher) (Dingus et al., 2016). For Australia, it is reported that cell devices may be a factor in 7% of crashes (Bureau of Infrastructure, Transport and Regional Economic, 2014).

The use of handheld cell phones when driving is banned in all EU countries. However, the effect of legislation on driving behaviour turns out to be limited, especially in the case of young people, as amongst them handheld cell phone use is especially widespread (see e.g. Foss et al., 2009). Compliance with legislation only seems to increase when combined with publicity and education campaigns, enforcement and appropriate penalties in the event of non-compliance. Moreover, technological developments in voice control or text-to-speech as well as technical provisions that make it impossible to use a phone while driving can also be useful in reducing handheld cell phone use (SWOV, 2017a). See also [ERSO Traffic Safety Synthesis on Cell phone use while driving](#).

4.6.3 Data collection and analysis

Handheld cell phone use by drivers or riders while driving can be obtained as a direct indicator by roadside observations or from moving vehicles by trained observers. However, challenges may arise at night time (DEKRA, 2013). Recent studies propose technical applications within the car such as cameras (Wang et al., 2014) or radar modules (Leem et al., 2017) to detect the use of cell phones while driving. As for the collection of use rates of protective systems, the data

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collection protocol should feature a representative set of census points and proper sample sizes. It may be beneficial to merge the observation campaigns of protective systems and handheld cell phones.

It should be noted that roadside observations provide a snapshot of the situation, i.e. how many drivers use the cell phone while driving at census points, in the period of observation (Holló & Berta, 2017). Their results contrast with (online) survey methods like the ESRA survey (Trigoso et al., 2016), where participants were asked whether they had used their cell phone while driving in the last 12 months at least once (Trigoso et al., 2016). For Hungary, Holló & Berta (2017) report a large difference in results of the two methods: 5-6% (roadside observation) compared to 39,2% (survey in the ESRA project).

4.6.4 Availability in Member States

The collection of data about cell phone use while driving as well as cell phone involvement in road crashes is neither widespread nor systematic among European countries. Moreover, in most European countries, the presence or use of a cell phone in a vehicle is generally not recorded in a crash unless the crash has severe consequences (European Commission, 2015b). In a IRTAD survey, out of the participating European countries only Great Britain reported to collect data on distraction in general (among that, also on the use of handheld cell phones) for all crashes. France, Spain and Hungary collect data on distraction for fatal and injury crashes. In Finland and Sweden, data on distraction is only collected for fatal crashes, while Germany and Belgium do not collect data on distraction at all. Moreover, countries use different terms to define distraction (e.g. inclusion of emotional distress), making comparing this issue – especially regarding cell phone use – between European countries a challenge (WHO 2011, NHTSA 2010).

4.6.5 Discussion

Handheld cell phone use has been found to substantially contribute to road crashes. It is therefore advisable that Member States consider collecting data on handheld cell phone use on a regular basis. Currently such collection is neither widespread nor systematic. A major effort will be needed to produce comparable figures, but given the size of the problem having a comparable indicator is indispensable.

4.6.6 Proposed Indicator(s) for use of handheld cell phones (phoning, texting, etc.)

| | Proportion |
|---|------------|
| 1 Proportion of passenger car drivers using a handheld cell phone (roadside survey) | % |

Considerations for future indicators:

- Proportion of drivers or riders of other vehicle types than passenger cars using a handheld cell phone: cyclists, PTW riders, lorry/HGV drivers.

4.7 Infrastructure-related indicators

4.7.1 Background and motivation

In addition to the behaviour of road users, also the design and operational conditions of the road network play a significant role in the causation of crashes. Recent safety philosophies – like the Safe System Approach – have thus extended the formerly user centred approach to explaining crashes (“user blame”) and advocate a shared responsibility in road safety: Those who design, build and maintain infrastructure shall share an (ethical) responsibility to avoid fatalities and serious injuries (see e.g. ITF 2016b).

A multitude of infrastructural factors contribute in several ways to causing, avoiding, or mitigating crashes. One of the many potential ways to structure the safety principles for road infrastructure are the ones defined in the Dutch “Sustainable Safety” Philosophy: Functionality of roads (i.e. to generate a hierarchically structured road network), assuring homogeneity of masses and/or speed and direction along a stretch of road, forgivingness of the road environment, and predictability of road course and road user behaviour by a recognizable road design (Wegman et al., 2008). See also ERSO Traffic Safety Synthesis on Roads.

The EU’s Infrastructure Safety Directive⁸ covers some of the above aspects implicitly but is restricted to the Trans-European Road Network. The safety management of the secondary and other parts of the road networks falls under the jurisdiction of the Member States, where tools, procedures and data availability may vary substantially.

4.7.2 Size of the problem and reduction potential

Evidently, a majority of road fatalities and serious injuries occur on the EU’s rural road networks. According to the CARE database, 55% of all fatalities – about 14.400 – happened on roads outside urban areas (excluding motorways) in 2015, and 8% on motorways (European Commission, 2017b). It is therefore advisable to concentrate initial efforts at EU scale on identifying performance indicators for the rural setting. Hakkert et al. (2007) identified four accident scenarios which claim more than 80% of rural road fatalities: Single vehicle (run-off road, 32%), head-on collision (24%), side impact e.g. at intersections (19%), and collisions with pedestrians or cyclists (11%).

4.7.3 Data collection and analysis

Hakkert & Gitelman (2007) developed two “ideal” SPIs for road elements:

- a road network SPI, indicating whether urban centres in a country or region are linked by appropriate road classes. Yannis et al (2012) proposed an indicator for the interurban road network which compares the actual road network to a theoretically required one (meeting some minimum safety requirements) and applied the method in four pilot countries (Netherlands, Portugal, Greece, and Israel); An earlier pilot calculation utilising Dutch data and software tools concluded that – even if the necessary data were available in a geographical database, the process of calculating a road network SPI was however quite complex and a large amount of data was needed (Hakkert & Gitelman, 2007).
- a road design SPI, indicating at a more detailed level the availability of safety-related design elements of roads. The European Road Assessment Programme (EuroRAP) provides –

⁸ Directive 2008/96/EC of the European Parliament and of the Council of 19 November 2008 on road infrastructure safety management

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amongst other tools – a method to score the passive (“protection”) features of a road section, the “Road Protection Score” (RPS or “Star Rating”). The RPS includes treatment of roadsides, median separation of traffic flows, design and frequency of junctions (Lynam 2012). Data are gathered using specially equipped vehicles, software and trained coders. EuroRAP inspections⁹ focus on more than 50 different road features that are known to influence the likelihood of a crash and its severity, and also embrace facilities for vulnerable road users. See also [ERSO Traffic Safety Synthesis on Safety Ratings](#). It has been shown that a decrease in RPS goes hand in hand with increased crash risk on various types of roads (Harwood et al., 2010). In a similar attempt at national scale, Wijnhuizen & Schermers (2014) were only partly able to establish a relationship between two Dutch indicators’ scores (the Sustainable Safety Indicator and the “Safe Speeds, Credible Limits” indicator) and crash rates.

4.7.4 Availability in Member States

Currently, no infrastructure-related SPIs are available across the EU. Especially with regards to a road network SPI, further development will be necessary before any of the proposed methods can be deployed. As for road design SPIs, several Member States have already run first pilots establishing a EuroRAP Road Protection Score – however often limited to certain corridors.

4.7.5 Discussion

So far, at a European scale, road-related SPIs have mostly been discussed at a theoretical level and did not yet become part e.g. of the initiative of the EU FP7 research project DaCoTA towards creating Composite Road Safety Indices for countries (Bax et al., 2012). It is however suggested to further elaborate on the options to deploy the EuroRAP’s road design star rating methodology across the Member States, preferably starting with high-level (non-motorway) rural roads.

4.7.6 Proposed infrastructure-related indicator

| | Proportion |
|---|------------|
| 1. The proportion of travel on new rural roads (non-motorways) that have a star-rating (Road Protection Score) of 3 or better | % |
| 2. The proportion of travel on existing rural roads (non-motorways) that have a star-rating (Road Protection Score) of 3 or better | % |

Considerations for future indicators (once data availability allows):

- The proportion of travel on all existing roads that have a star-rating (Road Protection Score) of 3 or better

⁹ <http://www.eurorap.org/protocols/star-ratings/>

4.8 Vehicle-related indicators

4.8.1 Background and motivation

Vehicle technology can help both reduce the likelihood of crashes and to mitigate the severity of crashes. Generally, two dimensions of vehicle safety are distinguished:

- passive (also referred to as secondary) safety features such as seat belts, airbags, and general crashworthiness of vehicles, and
- active (primary) safety features, such as ABS or ESC.

It is generally acknowledged that a substantial part of the fatality reductions in the EU over the past decades can be accounted to improvements in increased active and passive vehicle safety. Méndez et al (2010) show for the Spanish case that drivers of cars registered before 1985 have a significantly higher probability of being killed or seriously injured than drivers of cars registered in 2000–2005. In single-car crashes, however, the improvement in crashworthiness was very slight, and they also found a significant worsening in aggressiveness in two-car crashes: the driver of the average car had a significantly lower probability of being killed or seriously injured when crashing into a car registered before 1985, than when crashing into a car registered in 2000–2005. This shows the necessity to follow the developments of both the crashworthiness and the crash compatibility of a car fleet.

4.8.2 Size of the problem and reduction potential

The crucial question in assessing current deficiencies and future safety potential in the vehicle sphere is the crashworthiness, age and composition of a country's car fleet. Page et al. (2011) show that – taking the French case “... the combination of recent passive and active safety technologies is highly effective in reducing road fatalities and hospitalized victims. The intrinsic effect of the whole package (passive safety, as grouped in the EuroNCAP¹⁰ rating, ESC, and brake assist) could be close to 70% of relevant vehicle crashes if all cars of a nation's fleet were fully equipped with the above technologies.”

A study by Pastor (2013) showed that for each additional point in the Euro NCAP pedestrian protection score, the probability of pedestrian death in the event of a car-to-pedestrian accident is reduced by 2,5% and the probability of serious injury by 1%. It was also found that a vehicle scoring 22 points is related to a reduction in pedestrian death risk by 35% and in serious injury risk by 16% compared to a vehicle scoring five points. See also [ERSO Traffic Safety Synthesis on Safety Ratings](#).

4.8.3 Data collection and analysis

It was suggested by Hakkert et al. (2007) to establish two sets of indicators:

- the crashworthiness and age of the vehicles of a country's car fleet, and
- the composition of the car fleet (with the aim to arrive at a measure for crash compatibility)

EuroNCAP has evolved as the most widely used measure for the crashworthiness of passenger cars, although criticism was uttered about its limitations: it does not allow for mutual mass differences in frontal car-car collisions (incompatibility), whereas this in particular is a very determining factor in the further outcome of a crash. Originally tailored to assess prevalence

¹⁰ <https://www.euroncap.com/de>

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and function of passive safety features, since 2009 credits in the rating (1-5 stars) are also given for active safety features, i.e. devices that are intended to reduce the probability of a crash. The EuroNCAP safety rating today is composed of tests in four domains: Adult Occupant Protection, Child Occupant Protection, Pedestrian Protection, and Safety Assist. The latter is dedicated to advance driver assistance systems (ADAS) and includes e.g. speed assistance, automatic emergency braking, and lane support. The crash tests carried out by Euro NCAP are stricter than those required by regulation – and have also become stricter over time. Therefore, it has been suggested to build a composite indicator for crashworthiness of vehicles from the average EuroNCAP score and average (median) age of the car fleet (Hakkert et al., 2007). As initial approach at EU level, it may nevertheless be advisable to start with collection of crashworthiness scores of new vehicles alone. Evidently, as not all model variants can be tested by EuroNCAP for practicality reasons, it will be necessary to arrive at a common understanding on how to assign specific ratings to whole model series.

As for fleet composition and compatibility, a composite indicator has been suggested as well, consisting of the two factors a) crash severity per vehicle type (for three main types: passenger cars, HGVs and motorcycles) and b) the crash risk of each vehicle type normalised so that the size of the fleet itself is not a factor (Bax et al., 2012).

Both indicators can be built based on national accident and car registration databases combined with data from EuroNCAP. The following prerequisites for registration databases should be considered (Hakkert & Gitelman, 2007):

- scrapped vehicles should be removed from the database;
- detailed and accurate descriptions of vehicle make and model should be provided;
- vehicles according to vehicle-types should be classified in a way that is compatible with CARE definitions;
- smaller (less than 3,5 tonnes) and larger goods vehicles should be distinguished, since these are significantly different when assessing their compatibility in collisions with passenger cars or vulnerable road users;
- all motorised vehicles should be registered, including public service vehicles and mopeds.

4.8.4 Availability in Member States

There are currently no vehicle-related SPIs in use across Europe with the notable exception of Sweden. However, all Member States run vehicle registration and accident databases, and therefore in principle no major obstacles exist.

4.8.5 Discussion

Vehicle-related SPIs may play a key role in future safety management schemes across Europe, even if their calculation may require developing a joint methodology across Europe. Their importance will further grow once the deployment of crash-avoiding assistance systems reaches critical mass. To allow for a smooth start, it is suggested to build an initial crashworthiness indicator for new cars sold in countries across the EU. It is noted that, according to recent EuroNCAP protocols, such an indicator would also embrace pedestrian protection scores and points for the fitting of active safety systems which have shown to prevent or mitigate crashes and injuries.

4.8.6 Proposed Indicator(s) for vehicles

| | Average value |
|--|---------------|
| 1. Average EuroNCAP occupant protection score of new passenger cars (cars sold in respective year) | n |

Considerations for future indicators (once data availability allows):

- Combined Indicator for crashworthiness: Average EuroNCAP occupant protection score of passenger cars (whole fleet), weighted (multiplied) by the percentage of cars younger than ten years
- Overall crash severity between and within vehicle types (cars, HGVs and motorcycles), normalised by fleet size (Hakkert et al., 2007)

4.9 Indicators for Post-Impact Care

4.9.1 Background and motivation

The field of post-crash (trauma) care, or trauma management, embraces several parts of a complex system which is responsible for the treatment of injuries resulting from road crashes. It is often also referred to as the area of life-sustaining or tertiary safety, whereas crash-prevention is referred to as primary and injury prevention during the crash as secondary safety. Its activities cover

- response management to emergency calls
- treatment of victims at the scene
- transport of victims to medical facilities such as hospitals and trauma centres
- further treatment of victims at medical facilities

Trauma management is organised in many ways across the EU and substantial variation exists, e.g. whether helicopter transport is available in severe cases, whether psychiatric support is available for victims, or whether general practitioners or voluntary “first responders” can be called in in addition or to replace ambulances (SUPREME 2007). Likewise, even if Member States typically have norms for emergency services, they differ over countries and over areas in a country (ETSC 2001). See also [ERSO Traffic Safety Synthesis on Post-Impact Care](#).

Various aspects of trauma management – and their improvement – can contribute to mitigating the consequences of crashes, such as shorter response time by Emergency Medical Services (EMS), well-trained EMS staff and well-equipped EMS vehicles, and adequate hospital care (Bax et al., 2012). Trauma triage, i.e. the methods to rapidly [diagnose and] direct victims to appropriate health care facilities, has been identified to improve patient survival (Haddak et al., 2017). The better the post-accident care by EMS, the greater the chance of survival and, on survival, the better the quality of life (ETSC 2001).

4.9.2 Size of the problem and reduction potential

Studies show that improvements of the various components of trauma management can indeed help to save lives. Systemized training of rescue and ambulance teams in cooperation at a crash site may reduce the extrication time of entrapped car/truck crash victims by 40-50 % (SUPREME

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2007). Dutch experience shows that mortality of victims who had suffered from polytrauma would be 17% higher if the group of victims transported by the trauma helicopter would have been transported by ambulance (SUPREME 2007). It is estimated that if trauma care systems for seriously injured patients in low and middle-income countries could be brought up to the levels of high performing countries, an estimated half a million lives could be saved each year globally (WHO, 2015).

4.9.3 Data collection and analysis

With a view to currently limited data availability in the Member States, a set of seven data items for trauma management systems has been proposed (Gitelman et al., 2008):

- Total number of EMS stations,
- Number of EMS staff in service (according to distinct categories such as physicians, paramedics, nurses, medical technicians),
- Number of EMS transportation units in service (according to distinct categories such as Basic Life Support Units (BLSU), Mobile intensive care units (MICU), helicopters/ planes),
- The demand for a response time, [“target value”] (minutes),
- Percentage of EMS responses which meet the demands for response time,
- Average response time of EMS (minutes),
- Total number of trauma beds in permanent medical facilities (according to distinct categories, such as certified trauma centres, and trauma department of hospitals).

A set of 14 indicators is derived from these data items, mostly describing the availability of trauma care services of a country. The suggestion there was to rank all countries for each of the 14 individual indicators – and thereafter calculate an average rank for each country to allow both for longitudinal analysis over time and for international comparison (Hakkert et al., 2007).

4.9.4 Availability in Member States

No trauma management related indicators are currently used in the EU, especially not on the quality of medical treatment. However, most of the required information on availability of trauma care services (see hereunder) are usually available from public health related annual publications of national statistics offices.

4.9.5 Discussion

Performance indicators in the post-crash domain are a relative recent component in the sphere of road safety management, as classical road safety activities were so far mainly focused on primary and secondary prevention. Norms and practices differ between Member States, sometimes even between regions, and the number of factors which make up a successful trauma care system is vast. However, it seems well justified to establish performance indicators in this area as the potential to save harm that relates to the well-working trauma care is substantial.

4.9.6 Proposed Indicator(s) for trauma management

| | | | Unit |
|---|--------------------------------|---|------|
| Speed and quality of initial treatment by EMS | Staff and Equipment in service | EMS (Emergency Medical Services) stations per 10.000 population | n |
| | | EMS stations per 100 km length of rural public roads | n |
| | | Percentage of physicians out of the total EMS medical staff | % |
| | | Percentage of physicians and paramedics out of the total EMS medical staff | % |
| | | EMS medical staff per 10.000 citizens | n |
| | | Percentage of MICU out of the total EMS units | % |
| | | Percentage of BLSU, MICU and helicopters/ planes out of the total EMS units | % |
| | | EMS transportation units per 10.000 citizens | n |
| | | EMS vehicles per 100 km road length of total public roads | % |
| | Time values | The demand for a response time, min. | n |
| Percentage of EMS responses which meet the demand for response time | | n | |
| Average response time of EMS, min | | n | |
| Quality of further medical treatment | Facilities in service | Percentage of beds in certified trauma centres and trauma departments of hospitals out of the total | % |
| | | Number of the total trauma care beds per 10.000 citizens | n |

5 How to integrate performance indicators into European Road Safety Management?

5.1 Target setting

All intermediate outcome indicators considered in this report have a proven causal – or preventive – link to crash and injury occurrence, and thus provide improved insight into safety-related operational conditions of a country's road transport system. Several EU Member States have a long tradition of collecting some of these indicators on a regular basis. As yet, however, it is much less of a common tradition to exploit the potential of this knowledge by proactively integrating it in target setting in national road safety management strategies; Although targets for fatality reduction are commonplace, only a small group of countries has set numerical targets with respect to SPIs, see Table 5.

Table 5: Road safety strategies and targets in countries where targets for SPIs were set.

| | |
|--|---|
| Ireland Government Road Safety Strategy 2013-20 | Reduction of fatalities to 25 per million population (i.e. 124 or fewer fatalities) or less by 2020. Provisional target for the reduction of serious injuries by 30% from 472 (2011) to 330 or fewer, by 2020, or 61 per million population. Specific targets for reducing speed increasing seat belt use |
| Serbia National Strategy for Road Traffic Safety for the period 2015-20 (adopted in June 2015) | No child killed in traffic by 2020 -50% fatalities and serious injuries by 2020 compared to 2011 Halving by 2020 the total annual social-economic costs of traffic crashes compared to 2011 level Several sub-targets on seatbelt wearing rates, child restraint usage, helmet wearing rates, speed and drink-driving |

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| | |
|--|---|
| <p>Spain Road Safety Strategy 2011-20</p> | <p>Less than 3,7 killed per 100.000 population aligned with the European 2020 target -35% seriously injured compared to 2009 Several targets for various performance indicators (restraint systems, speed, drink-driving, etc.)</p> |
| <p>Sweden No safety plan/strategy in a traditional sense Management by Objectives</p> | <p>-50% fatalities between 2007 and 2020 (the average for 2006-08 is used as the base figure), i.e. max. 220 deaths by 2020.-25% severely injured between 2007 and 2020. Management by Objectives with targets for 2 final outcome indicators and 10 safety performance indicators</p> |

Source: ITF, 2017

5.1.1 Good practice: Management by Objectives in Sweden

Sweden has a long tradition as a forerunner in European road safety work and gained international publicity when adopting the Vision Zero philosophy at parliamentary level in 1997. For the first ten years, the new philosophy however did not materialise in terms of reduced road fatalities as expected. This was the reason to propose a re-cast of the interim targets in 2008 and "... include objectives that are closer to measures, i.e. targets for key road safety-related condition states on the road transport system" (Vägverket, 2008) in the following domains:

- Speed compliance, state roads
- Speed compliance, municipal streets
- Sober drivers
- Fatigue drivers
- Seat belt use
- Bicycle helmet use
- Safe passenger cars
- Safe heavy vehicles
- Safe state roads
- Safe municipal streets
- Rescue, care and rehabilitation
- Valuation of road safety

Over the years, the above list was operationalised and targets for 2020 were adopted. The list of two final outcome indicators (fatalities, seriously injured) and 10 Safety Performance Indicators has since then become a core topic of the annual Swedish Results Conferences on Road Safety where a large group of stakeholders and experts regularly attend. For each of the indicators, annual updates are determined. The colour of the "Target for 2020" column shows whether or not the respective indicator is converging towards the target as intended (see Table 6).

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Table 6: Management by Objectives in Sweden using targets for 12 safety-related indicators

| | Indicator | Initial | 2016 | Target 2020 |
|---------------------|---------------------------------|---------|---------|-------------|
| Outcome indicators | Fatalities | 440 | 270 | 220 |
| | Severe injuries | 5400 | 4600 | 4000 |
| System indicators | Safe state roads | 50 % | 75 % | 75 % - 90 % |
| | Safe VRU crossings (urban) | 19 % | 26% | 35 % |
| | Maintenance Bicycle network | 18 % | 40 % | 70 % |
| | Vehicle safety | 20% | 67 % | 80 % |
| Safe use indicators | Speed compliance, rural roads | 43 % | 44 % | 80 % |
| | Speed compliance, urban streets | 64 % | 67 % | 80 % |
| | Sober traffic | 99,71 % | 99,76 % | 99,90 % |
| | Belt use | 96 % | 98 % | 99 % |
| | Helmet use | | | |
| | - Bicycles | 27 % | 33 % | 70 % |
| - Mopeds (50cc) | 96 % | 95 % | 99 % | |

Sources: Matts-Åke Belin (Swedish Transport Administration), Presentation at Conference “European approach towards better road safety. Safe infrastructure, safe vehicles and safe road users”, organised by the Slovene Road Safety Council, 23 June 2017, Ljubljana.

5.1.2 Good practice: WHO discussion paper on developing voluntary global performance targets for road safety risk factors and service delivery mechanisms

In the framework of the UN Decade of Action for Road Safety the World Health Organisation (WHO) was requested to “assist interested countries to develop voluntary global performance targets on key risk factors and service delivery mechanisms to reduce road traffic fatalities and injuries” (WHO 2017). The following indicators and targets were brought forward to discussion with member countries (excerpt, see Table 7):

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Table 7: Voluntary Safety Performance Indicators and targets proposed by WHO (excerpt)

| Domain | Indicator(s) | Target |
|---|---|---|
| Safer roads and mobility | % of new roads that are 3 star or better for all road users (or national equivalent) % of travel on existing roads that are 3 star or better for all road users (or national equivalent) | 100 % of new roads are 3 star or better for all road users And >75% of travel on existing roads are 3 star or better for all road users (or national equivalent) |
| Safer vehicles | Implementation of various UN Regulations; | 100% of new cars meeting priority UN Regulations; Establishment of national new car assessment programmes |
| Safer road users (speed) | % of vehicles driving over the speed limit in urban and rural areas % of deaths attributable to speed | Reduce the proportion of vehicles travelling over the posted speed limit by at least 10% per year |
| Safer road users (motorcycles) | Legislation on motorcycle helmet use meets best practice; % of motorcycle riders (drivers and passengers) wearing helmets | Reduce the proportion of unhelmeted motorcycle riders by at least 10% per year |
| Safer road users (seatbelts) | % of all occupants wearing seat-belts (disaggregated by driver, front seat passenger and rear seat passenger rates) | Reduce the proportion of unrestrained occupants by at least 10% per year |
| Safer road users (drinking and driving) | % of driver deaths attributable to alcohol % of drivers over the legal BAC limit | Reduce the proportion of driver deaths attributable to alcohol by 10% per annum |
| Post-crash response | Average time from serious injury to first contact with emergency care provider (includes providers at all trauma facility levels. -In urban areas -in rural areas | - Reduce the time from serious injury to first emergency care provider by 10% per year |

Source: WHO, 2017

The need to introduce SPIs into RSM was recently uttered also by IRTAD, in its Marrakech Declaration on Road Safety (Ref xx).

5.2 Data collection and analysis

An extensive attempt to collect and compare many of the aforementioned performance indicators among 29 European countries revealed that "... in many cases essential data were missing or that the quality of the data was too poor to use for country comparisons" (Vis & Eksler, 2008). Even in best performing countries like Sweden, room for methodological improvement seems to exist, as e.g. in the assessment of speed levels "... these [speed census] places are not exactly statistically representative and therefore assumptions cannot be made about the general mean speed" (Berg et al., 2009). Much of the indicator data available today are thus mostly applicable for longitudinal comparison over several years within a country, but additional efforts will be necessary to arrive at sound comparison and benchmarking between Member States.

A comprehensive textbook to assist countries in establishing the necessary systems for data collection and analysis of SPI has been provided by Hakkert & Gitelmann (2007), and an equally comprehensive overview of (good) practices was compiled by Vis and Van Gent (2007).

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For a European approach, it will be necessary to reach a collective understanding on the necessary methodological requirements, to arrive at statistically representative – and comparable – indicators for a country. These requirements will have to be tailored to each specific indicator and data protocols with minimal standards developed. Some of the proposed indicators require observational campaigns, following carefully reasoned sampling procedures (such as seatbelts and driving speeds) and employing well-trained staff. Others (such as vehicle crashworthiness and trauma management) will rely on the availability of national statistics and registries, and upon harmonised – or transferable – variables and values therein.

5.3 Reporting and communication

There is a long-standing tradition in the EU of publishing statistics on road safety, usually as part of annual activities of national statistics bureaus. A core set of respective data is also available from EUROSTAT¹¹. The availability of information on any of the safety performance indicators considered in the previous chapters is much less widespread, however with some notable exception: some Member States have set up National Road Safety Observatories to regularly inform all stakeholders on recent developments.

The French Road Safety Observatory ONISR¹² (Observatoire National Interministériel de la Sécurité Routière) publishes – in addition to analysis on crash and injury data – indicators on speed (trends of mean speeds of passenger cars on roads with different speed limits), and the proportions of fatal crashes where impairment due to alcohol in drivers/riders or pedestrians was detected.

The British Road Safety Observatory¹³ constitutes a common-language knowledge centre for road safety and features e.g. use rates of seatbelts and child restraints, mobile phone use whilst driving, and the number of persons killed in drink drive accidents.

The Greek Road Safety Observatory¹⁴, operated by the National Technical University of Athens (NTUA), provides information on seatbelt and helmet use, and on the use of handheld mobile phones.

The by far most extensive repository of all is the European Commission's European Road Safety Observatory (ERSO) which was originally developed during the EU FP6 project SafetyNet¹⁵. The data and various reports in ERSO are continuously updated. The ERSO Country Profiles¹⁶ provide detailed overviews of the current state of road safety in all Member States. Regarding SPIs, the following data items are included for each EU country (where data available) and compared with the EU average:

- Driving speeds: Mean speed per road type, proportion of speed offenders and number of speed tickets per population

¹¹ See e.g. http://ec.europa.eu/eurostat/statistics-explained/index.php/Road_safety_statistics_at_regional_level

¹² <http://www.securite-routiere.gouv.fr/la-securite-routiere/l-observatoire-national-interministeriel-de-la-securite-routiere/english-version>

¹³ <http://www.roadsafetyobservatory.com/>

¹⁴ <https://www.nrso.ntua.gr/>

¹⁵ https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects/safetynet.pdf

¹⁶ https://ec.europa.eu/transport/road_safety/specialist/erso/country-overviews_en

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- Alcohol: test per population, and proportion over the national BAC limit
- Vehicles: cars per age group and EuroNCAP occupant protection score of new cars
- Protective systems: Daytime seat-belt wearing and use of child restraints in cars and vans, and helmet use among powered 2wheelers and cyclists

The European Transport Safety Council (ETSC)¹⁷ was among the first to advocate the collection of SPI at a European level (ETSC, 2001). In 2006, ETSC launched the PIN (“Performance Indicators”) Programme to collect data via 32 EU PIN experts¹⁸, compare Member States’ performances, set up country rankings in dedicated ETSC publications (“PIN Flashes”, “PIN Reports”) and award a prize to a year’s best performer. The programme still operates today and is not confined to intermediate indicators as considered in this report but embraces general rankings in all fields of road safety.

The IRTAD (International Traffic Safety Data and Analysis Group) publishes an annual report about road safety data and up-to-date information on road safety measures and strategies for 40 countries (see e.g. IRTAD 2017). For countries with available data it features seatbelt wearing rates (front and rear seats), use of child restraints, and helmet wearing rates for PTW riders and cyclists.

6 Conclusions and Recommendations

The continuous improvement of road safety – especially with respect to reducing the road death toll – has been a European success story: today the EU is one of the safest regions in the world. However, after decades of favourable development, the trend has recently levelled out. With still more than 25.000 killed and 135.000 seriously injured annually, the EU has every reason to reinforce its efforts. Proper assessment of unsafe operational conditions of the European road transport system will be essential to identify areas where priority action is needed – and to tailor targeted measures. Safety Performance Indicators (SPI) as considered in this report are causally related to crashes and injuries (or their prevention) but give a much more detailed picture of a country’s or region’s performance than fatality and injury counts alone.

A long-standing tradition across the EU exists to collect certain SPI. However, data collection and analysis methodologies differ, which makes the results – at best – comparable within a specific country over the years, but only to a very limited extent between countries.

This report has gathered evidence on current knowledge regarding the collection, analysis and application of SPIs. For the following domains, SPI for collection by Member States are suggested:

¹⁷ <http://etsc.eu/>

¹⁸ the 28 Member States of the European Union, together with Israel, Norway, the Republic of Serbia and Switzerland.

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| Domain | Indicator | Priority I | Priority II | Priority III |
|--|---|------------|-------------|--------------|
| Seatbelts and child restraints | Daytime wearing rate of seatbelts (passenger cars) on front seats | x | | |
| | Daytime wearing rate of seatbelts (passenger cars) on rear seats | x | | |
| | Daytime use of child restraint systems (<14y) in passenger cars | x | | |
| Helmets for PTW riders and cyclists | Daytime use rates of motorcycle helmets | x | | |
| | Daytime use rates of moped helmets | x | | |
| | Daytime use rates of cycle helmets | | x | |
| Driving speeds | Motorways with dual carriageway and median separation | | x | |
| | Single carriageway rural roads | | x | |
| | Single carriageway urban distributor roads | | x | |
| Driving under the influence: alcohol and drugs | Fatalities resulting from crashes involving (at least) one driver or rider under the influence of alcohol (above the legal limit) | x | | |
| | Fatalities resulting from crashes involving (at least) one driver or rider impaired by psychoactive substances other than alcohol (national offence impairment level) | | x | |
| | Number of alcohol roadside checks by police per population | x | | |
| Use of handheld cell phone | Proportion of passenger car drivers using a handheld cell phone (roadside survey) | x | | |
| Infrastructure | The proportion of travel on new rural roads (non-motorways) that have a star-rating (Road Protection Score) of 3 or better | | x | |
| | The proportion of travel on existing rural roads (non-motorways) that have a star-rating (Road Protection Score) of 3 or better | | | x |
| Vehicle | Average EuroNCAP occupant protection score of new passenger cars (cars sold in respective year) | | x | |
| Post-Impact Care | Composite indicator of 14 indicators in the field of a) Speed and quality of initial treatment by emergency medical services, and b) Quality of further medical treatment | | | x |

It is advisable to join forces and arrive at a collective understanding in relation to agreed methodologies on collection, analysis, publication, benchmarking and target setting regarding SPIs.

6.1 Advisable action at EU level

- Seek for a **common understanding** with MS on the potential and benefits of working with SPIs and which areas should be tackled with highest priority (at the level of the High-Level Group on Road Safety)
- Inform Member States about current **good practices** in the EU with regard to SPI data collection and target setting, e.g.:
 - observational campaigns with professional staff and according to statistically sound data collection protocols
 - national statistics and registries with harmonised (or transformable) variables and values
 - road safety strategies with reduction targets on final outcomes (fatalities and serious injuries) and additional targets on intermediate outcomes (SPIs): Management by Objectives

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- Discuss with MS options for **regular data collection and analysis**, possibly in an expert level group similar to the CARE Expert Group, convening representatives of all EU and EFTA countries.
 - Current SPI practices in member countries
 - Comparison of definitions and statistical methods for sampling and analysis
 - Assessment of the current comparability of indicators between countries
 - Identification of – and agreement on – minimal standards for indicator collection and collection frequency; The spirit however should be to leave to Member States a certain degree of freedom in terms of collection methodology and assessment frequency to keep as many Member States as possible in the loop from the start
 - Options for step-wise harmonisation towards such minimal standards
 - Set up a regular reporting channel from Member States to EC (and back)
 - Develop statistical methodology to arrive at gross-EU values for selected indicators
- Agree with Member States on the setting **voluntary targets** for selected indicators. It may be advisable to start with widely available indicators such as use rates of seatbelts and child restraints, and gradually widen the scope once data availability improves.
- Arrange for **regular communication** of recent results on SPI, possibly back to back with the annual publication of the country rankings of road mortality in the EU.
- Make country results available and easily **comparable** on ERSO (in addition to the existing ERSO Country Profiles which are always dedicated on one specific country).
- Seek to **cooperate with WHO** on the further development of voluntary targets on SPI.
- **Support research** towards further development of good practices (collection and analysis).
- Consider further research towards the country-wise development of **composite indices**, i.e. statistical models that help explaining the overall road safety performance of a country.

6.2 Advisable action at national level

- Consider the **regular collection** of SPI as integral part of a country's road safety management strategy.
- Assess the national **reduction potential** (fatalities and serious injuries) in the different areas covered by the SPIs considered in this report.
- Set **targets on indicators** where this potential is high and indicator data collection is already existing or being developed.
- Introduce **Management by Objectives** regarding SPIs: Review the trend towards the target for every indicator and introduce/adjust related measures where necessary (where possible: annually).
- **Cooperate** with the **European Commission** and other **Member States** in the joint development of improved methodology on collection and analysis of SPIs.

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Notes

1. Country abbreviations

| | | | | | | | | |
|---|----------------|----|---|-------------|----|--|----------------|----|
|  | Belgium | BE |  | Italy | IT |  | Romania | RO |
|  | Bulgaria | BG |  | Cyprus | CY |  | Slovenia | SI |
|  | Czech Republic | CZ |  | Latvia | LV |  | Slovakia | SK |
|  | Denmark | DK |  | Lithuania | LT |  | Finland | FI |
|  | Germany | DE |  | Luxembourg | LU |  | Sweden | SE |
|  | Estonia | EE |  | Hungary | HU |  | United Kingdom | UK |
|  | Ireland | IE |  | Malta | MT | | | |
|  | Greece | EL |  | Netherlands | NL |  | Iceland | IS |
|  | Spain | ES |  | Austria | AT |  | Liechtenstein | LI |
|  | France | FR |  | Poland | PL |  | Norway | NO |
|  | Croatia | HR |  | Portugal | PT |  | Switzerland | CH |

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