SWOV Fact sheet

International comparability of road safety data

Summary
Many countries compare the level of their road safety with other countries as an impulse for developing road safety policy. This, however, is by no means easy. The absolute numbers of crashes or casualties can not simply be compared, but must be related to the number of inhabitants of a country or to the number of kilometres travelled. The definitions of crashes, road deaths, injury severity, and road types differ quite a lot, as do the ways in which the data is gathered. Presently, several international projects attempt to harmonize data and make definitions comparable. These projects should result in comparisons of a higher quality.

Background and content
Many countries compare their performance in all sorts of fields, including that of road safety, with that of other countries. Countries are pleased with a favourable comparison and disappointed with an unfavourable one (see SWOV fact sheet *Dutch road safety in international perspective*). The latter prompts questions such as 'why are we doing so badly?' and 'what can we learn from other countries?' (Harris & Wegman, 1991). Although a priority list of the safest countries seems trivial, it does act as an impulse to develop a policy to set road safety targets. One of the goals of the Netherlands is to maintain its position among the top four in Europe (Mobility Policy Document, 2006).

This fact sheet will discuss the various ways in which countries can be compared and which features can be used in this. The choice for a particular feature can determine the outcome. For example, a country can score high on one feature and low on another. Countries show similarities as well as differences, in for example motorization rate or laws and regulations, geography (climate, landscape), road network, population size and density, age distribution, vehicle use or the possession of driving licenses. These aspects are grouped according to structure and culture of a country, measures that are taken, actual road user behaviour, safety outcomes in terms of the numbers of crashes and casualties and the social costs of traffic danger.

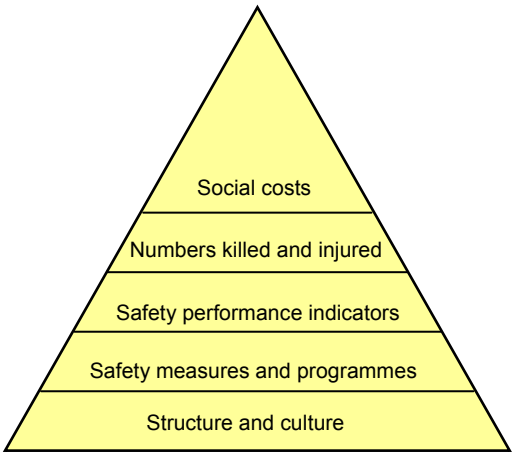

Figure 1. *A hierarchy for road safety, based on SUNflower (Koornstra et al., 2002) and the New Zealand-hierarchy (LTSA, 2000).*

In this fact sheet we limit ourselves to quantitative data on crashes and the exposure to traffic dangers. Information on behaviour (safety performance indicators, SPI) or traffic laws is excluded; for this information we refer to Hakkert & Gitelman (2007). Recently, some studies have been completed which propose a composite road safety performance index on the basis of a weighted count of several indicators. Among these are SPIs and the quality of road safety policy and measures, see Hermans

(2009) and Wegman et al. (2008).

What do we compare?
Countries can most easily be compared for the total number of casualties. A number of indicators are available for this, such as the number of road deaths, the number of severely injured, or the number of fatal crashes. This data can be found in IRTAD (*International Road Traffic and Accident Database*) of the OECD countries, CARE (*Community Database on Accidents on the Roads in Europe*), and data from EuroStat, the United Nations or the World Health Organization (WHO). However, these data sources use different definitions. Initiatives are taken to improve the data quality and completeness, so that better comparisons can be made.

Numbers of crashes are not directly comparable. After all, in countries with a large population more crashes will happen than in countries with a small population, without this being indicative of the safety level. Therefore, we need to correct for differences in population size and, related to that, the mobility. Several methods can be used to make these corrections:
1. Dividing the number of crashes by the size of the country, expressed, for example, in population, distances travelled, or road network length.
2. Comparing the number of crashes with the number in a basis year which is set at 100 (indexing).
3. Examining certain subdivisions. In the Netherlands, three quarters of all road deaths are male; more than one in five are cyclists. Are these percentages the same in other countries?
4. Relating the number of road deaths to the total number of deaths. In the Netherlands 4% die of unnatural causes; a decreasing percentage of these are road deaths (from more than 40% in the early seventies to 13% in 2008).

An example of methods 1 and 2 is given below.

Number of casualties related to the size of the country
The number of road deaths can be related to the size of a country (standardization) by calculating the mortality rate, which is the number of deaths per 100,000 inhabitants. The advantage of using population data is that nearly all countries have accurate data, including subdivisions by age, sex, and region. The comparison fails when road users participate in traffic in another country, for example holiday traffic, or foreign freight traffic.
We can also standardize by using the traffic volume or distances travelled (mobility). Unfortunately not all countries have this data. Indicators that can be used for the traffic volume are the total number of vehicles or the fuel consumption. However, for a valid comparison all countries must use the same definitions. Data on the number of vehicles is mainly available for motor vehicles.

An example of this can be found in SWOV fact sheet *Dutch road safety in international perspective*. Of course other variables might be used, e.g. a country's surface area, the number of driving licence holders, or the population density.

Indexing
We can compare the developments in the number of road deaths in various countries by setting the number in a particular year at 100. This is known as indexing. *Figure 2* compares the developments in four regions with 1995 as the index year.

A comparison of the total numbers of casualties provides no insight into differences on a detailed level. This concerns, for example, the modes of transport used by the casualties, the ages of casualties and drivers, and the road types on which the crashes took place. The difficulty of such detailed comparisons lies in the differences of definition.

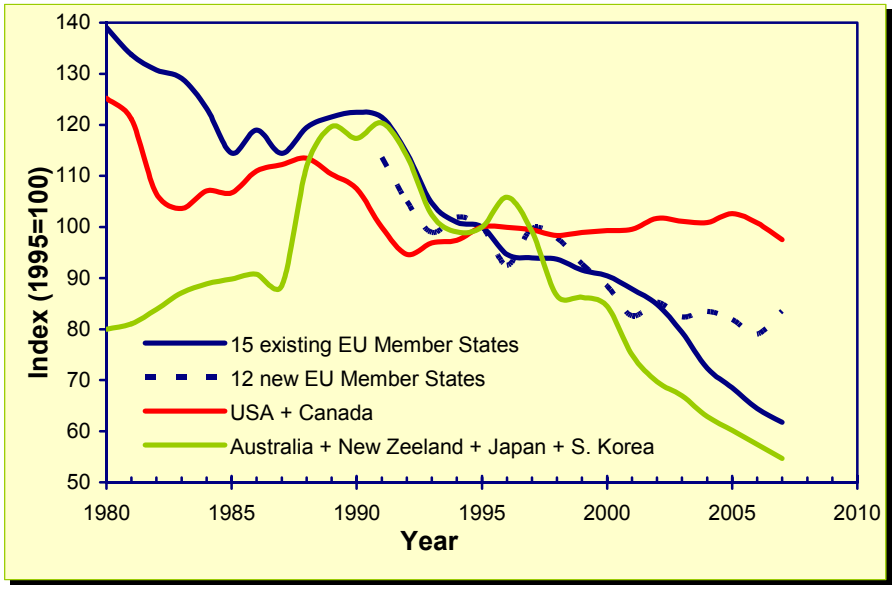

Figure 2. *Indexed development of number of road deaths; 1995=100. (Sources: IRTAD, CARE)*.

Are countries really comparable?

Countries that are in completely different phases of development are difficult to compare. Trinca et al. (1988) evaluated various countries according to their motorization rate, which is the number of motor vehicles per 1000 inhabitants. At an increasing motorization rate, the number of deaths per 10,000 vehicles decreases, but the number of deaths per 100,000 inhabitants initially increases. The latter declines only after a particular motorization rate is reached. In The Netherlands that point was reached soon after 1970 (see *Figure 3*).

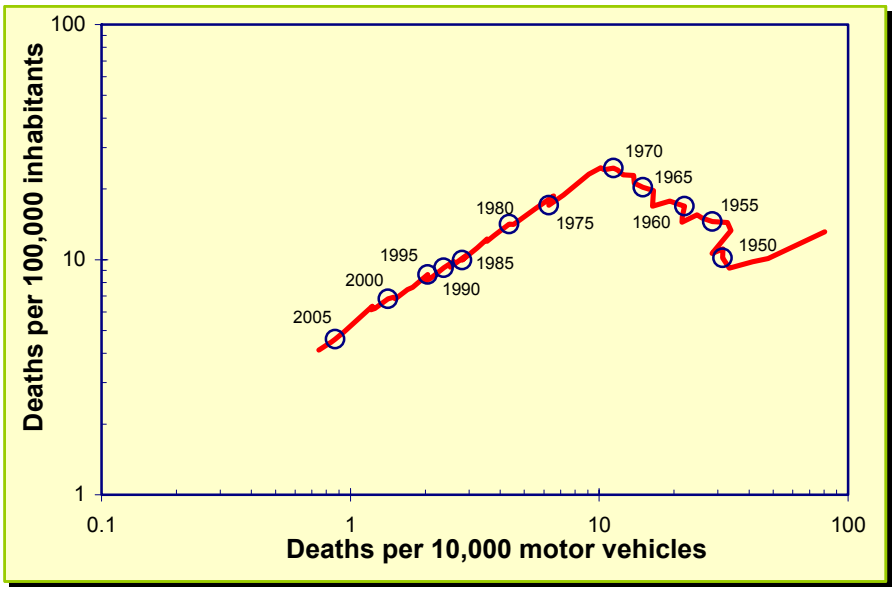

Figure 3. *Registered number of deaths per 100,000 inhabitants plotted against the registered number of deaths per 10,000 motor vehicles, for the Netherlands 1946-2008, on logarithmic axes. (Sources: AVV/DVS, CBS).*

Which data is available and accessible?

Various organizations gather data at the international level. IRTAD, CARE, and EuroStat are examples of such databases. The *Data sources* paragraph at the end of this fact sheet gives links to these databases.

Using national databases in international comparisons more complicated. Not only is the data often provided in the national language, but differences in definitions and variables can also present an obstacle. Few countries make their crash database available via Internet.

What is the quality of the data?
Databases are rarely gathered with road safety in mind. For example, the police register crashes in order to determine the guilty party, for a summons, or for insurance purposes. Above all, mobility data is needed to determine traffic flows and to optimize traffic distribution. This data is therefore seldom optimal for road safety research purposes. Nevertheless, many databases are useful, particularly if the features important for road safety have been taken into account sufficiently.
Before such a database can be used, one should first examine: a) the quality features of the data collection method used, b) the relevance of the data, c) the availability of the data, the d) continuity of data gathering, e) the flexibility with regard to new features or other classifications, f) the possibility to link it to other data sources, g) the accuracy of the registered features, and h) the documentation on them. Furthermore, it is important to know if there are alternative sources with better quality features, or sources that can validate the data. Most databases offer documentation in which these subjects are dealt with.

How comparable is the quality of the crash data?
In practically all countries the crash registration is carried out by the police, for the reasons mentioned in the previous paragraph (determination of the guilty party, a summons, or insurance purposes). Therefore, no large differences are to be expected on this point. However, crash registration is always incomplete. In the Netherlands, the registration rate since 1996 is quite well known, thanks to an analysis of alternative data sources. About 90% of all road deaths in the Netherlands are currently registered in the road crash database. The current registration rate of in-patients is about 55%, whereas that of less severely injured is about 15%. There are only few countries that acknowledge that their data is incomplete. A recent survey on the registration rate of road deaths resulted in the following findings for the 21 responding OECD/IRTAD countries (Derriks, 2007): nine countries reported that there was no underregistration of road deaths, eight countries didn't know, and four countries said their registration rates for this varied between 93% and 98%. Registration rates of 65-80% are used for countries in Africa and Asia (Aeron-Thomas et al., 2000).

The registration rate also depends on the vehicle types involved in a crash. In general, crashes involving motor vehicles are registered more completely than other crashes.

What is the quality of the mobility data?
Every country has its own method of determining the mobility. Possible methods are a) multiplying the total number of vehicles by the average annual number of kilometres driven (with possibly a correction for foreign traffic), b) estimates based on fuel sales, c) roadside traffic counts, d) odometer readings at periodical vehicle inspections, vehicle repairs or sales, or e) mobility surveys among road users or inhabitants.
Of course, the method used to estimate the exposure has consequences for the possibilities to subdivide the data by relevant characteristics. Fuel sales figures do not show which road types were used, nor do they say anything about the age of the road user. Moreover, driving behaviour also has an influence on the fuel consumption. The method of calculating mobility thus determines the margin of uncertainty of the result.
Knowledge of the quality of the data is often limited, and the margins of the known data are usually unknown. This makes comparison very difficult. The EU SafetyNet project examined which methods are used and examined the validity, utility, and comparability of the data, and how these can be harmonized (Duchamp et al., 2007).

Which definition differences are relevant for the crash data?
Much research has been done into the definitions that are used in Europe for crash data (Lejeune, 2000; EU, 2006a, 2006b). Here we will discuss the definitions of road crash, road death, injury severity, transport mode, and road type.

Definition of road crash
The definition of a road crash in the Netherlands is as follows:

> *Event on a PUBLIC ROAD in the NETHERLANDS that occurred in TRAFFIC and resulted in DAMAGE to OBJECTS and/or INJURY to PEOPLE and involved at least one MOVING vehicle.*

The consequence of this definition is that collisions between pedestrians, but also between pedestrians, skaters, and horse riders, are not road crashes. Only a collision with a moving vehicle (bicycle, moped, light-moped, or motor vehicle) qualifies as a road crash.

Comparable definitions are used in other countries. Some countries only register a crash in their official statistics if a motor vehicle was involved (USA/FARS, Canada). There are minor differences in the registration of crashes on private roads, of suicide and of a death by natural causes, like a heart attack, just prior to the road crash.

The definition of road death
The international definition of a road death is someone who dies within thirty days as a result of a road crash - the 30th day is included (UN-ECE, 1968; UN-ECE, 1995).
A large number of countries use this definition; however, other countries only count those caualties who die on the day of the crash. It is common practice to correct for this using a factor (see Table 1). The data as presented by IRTAD or the EU (CARE) has been corrected by multiplying the registered number of road deaths by the factors in *Table 1*.
Since 1993, Spain has employed a different method. Approximately 3% of the severely injured are assumed to die within 30 days. The exact percentage depends on the mode of transport (driver, passenger, or pedestrian) and on whether it was an urban or rural crash. This calculation gives a variable number of extra road deaths. Dividing the corrected number of deaths by the number calculated by the Spanish (24-hour definition) method, gives an average factor of 1.15 which fluctuates slightly each year.
Since 2005, France has also used the 30-day definition and, based on the 2005 data, it has determined a new factor of 1.069 which they will apply for 2004 (ONISR, 2006).
It is difficult to determine a good correction factor for developing countries. Because their public health care is poor, relatively many road crash casualties die at the scene of the crash, and only few die in the period of 1-30 days after the crash. A factor of 1.15 is therefore used for these countries (Aeron-Thomas et al., 2000).

The definition of injury severity
When someone involved in a road crash is injured this person is called 'an injured'. The injuries incurred can be severe or less severe, depending on whether after any treatment at the scene the injured was able to go home independently, or needed hospital treatment. The injury is classified as increasingly severe if the injured had to be admitted to hospital, had to take sick leave or miss education (interference of one's daily activities), had to rehabilitate, suffered permanent injury, remained in coma, or died from the consequences more than 30 days afterwards.

In the Netherlands, we use the categories 'admitted to hospital', 'treated at the Accident & Emergency department of a hospital', and 'other slight injuries'. The injured are classified using the estimation made by the police who, in the case of admission, obtain information from the hospital.
Various countries use their own definitions of who is slightly or severely injured. For example, in France a limit of at least six days in hospital is used to classify somebody as severely injured; other countries leave this entirely to the police. Therefore, data on numbers of injured are difficult to compare. Meanwhile, several international hospital studies have been done or are in progress, in which the injury severity of a large number of hospital patients is determined objectively. Examples are the Pendant and SafetyNet projects (Martin et al., 2006; Broughton et al., 2007). Based on injuries determined by doctors (ICD9, ICD 10), these studies specify the severity by using what is known as the *Abbreviated Injury Scale* (AIS). These studies show that many of the patients were only admitted for observation. Ultimately no injuries were found in these patients. The Maximum AIS score appears to be a good indicator, enabling a distinction between severely injured and slightly injured. Little is known about permanent injury and long-term physical or mental consequences of a road crash.

Country	Definition of road death within…	CARE		IRTAD	
		Factor	Period	Factor	Period
Germany (East))	3 days	-	-	1.15	up till 1977
France	3 days	-	-	1.15	1965
	6 days	1.09	1991 - 1993	1.09	1970 - 1992
		1.057	1994 - 2004	1.057	1993 - 2004
Greece	24 hours	1.18	1991 - 1995	1.18	up till 1995
Hungary	48 hours	-	-	1.20	up till 1975
Italy	7 days	1.078	1991 - 1998	1.08	up till 1998
Japan	24 hours	-	-	1.30	up till 1994
South Korea	3 days	-	-	1.15	up till 1999
Austria	3 days	-	-	1.15	1970 - 1982
		1.12	1991	1.12	1983 - 1991
Portugal	24 hours	1.3	1991 - 1997		
		1.14	1998 - now	1.14	All
Spain	24 hours	1.3	1991 - 1992	1.3	up till 1992
		1.14-1.19	1993 - now		
Czech Republic	24 hours	-	-	1.30	up till 1979
Switzerland	More than 30 days	-	-	0.97	up till 1991

Table 1. *Correction factors for numbers of road deaths for national definitions that do not use the 30-day period, for a number of OECD and EU counties, as applied in the IRTAD and CARE databases. No correction is needed for other EU/IRTAD countries.*

The definition of transport mode
The definitions of vehicle types correspond quite well in most countries. Distinctions between light and heavy lorries can differ; the limit is usually 3,500 kg. kerb weight. Some features are only registered in a few countries, like the involvement of taxis or emergency vehicles (with or without lights or sirens) in injury crashes.

The definition of road types and intersection types
Much infrastructural data is not internationally comparable. Distinction of roads by function, layout, and use, as is obligatory in the Netherlands due to the Sustainable Safety vision, has not yet worked its way through to databases, not even in the Netherlands. Each country uses its own definitions and characteristics. In the SUNflower and SafetyNet projects, the goal was to reach an unambiguous definition. Among other things, SafetyNet (Hakkert & Gitelman, 2007) recommends a division into nine road types, six of which are rural, and three urban.

Where do we go from here?
The differences between countries become more meaningful if we can study the extent to which the differences correspond with different road safety policies. If a country is a lot less safe than others in one aspect, this country may perhaps adopt an approach used in other countries. That is why an analysis of the total number of road deaths in a country is insufficient. To penetrate to those aspects where real safety differences occur, in-depth analyses are necessary. This, among other things, was the topic of the SUNflower projects (Wegman et al., 2005; Wegman et al., 2008. See also SWOV fact sheet *Dutch road safety in international perspective*).

Using the data currently available, only limited comparisons between countries are possible. In the recent past, some international projects were executed concerning the harmonization of data and comparability of definitions (SafetyNet and PENDANT). The results of these projects will hopefully lead to better comparisons.

Conclusion
It is difficult to compare road safety data of different countries. When interpreting them one should always allow for missing information and differences in definition. Documentation on these definitions is available, making rough comparisons possible. At present, many initiatives are being developed to improve the quality and comparability of the data.

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Data sources

The websites below publish road safety information. Some express it in data and others focus more on facilitating and communicating research.

- European Transport Safety Council (ETSC)
- Social Attitudes to Road Traffic Risk in Europe (SARTRE)
- International Road Federation (IRF)
- United Nations Economic Commission for Europe (UN-ECE)
- World Health Organization (WHO)
- European Union CARE public part
- European Union DG Energy and Transport
- European Union Eurostat
- European Union European Road Safety Observatory (ERSO)

English language databases on the Internet

Data Denmark	Road Traffic Accidents, public Statistics Denmark, public
Data New Zealand	Crash analysis system (CAS), password, contribution
Data Netherlands	SWOV Knowledge base, public, including related data (exposure, numbers of vehicles, population, driving licences, offences, causes of death, ratios) Statistics Netherlands (statline), public
Data USA	Fatality Analysis Reporting System (FARS), public
Michigan State	Michigan Traffic Crash Facts (MTCF), public
Illinois	EMS Reporting System (info on Mortality Hospital Discharge Traffic Crash Trauma Registry)
Ohio	Google Earth map showing *road crashes in 2007-2009* for a limited number of characteristics
Data UN-escap	Asia-Pacific Road Accident Database (APRAD), public (United Nations Economic and Social Commission for Asia and the Pacific), public
Data EU	Community database on Accidents on the Roads in Europe (CARE), limited availability via secured link
Data ITF/JTRC	International Road Traffic and Accident Database (IRTAD), password, contribution (Joint OECD/ECMT Transport Research Committee)