Serious road injuries in the Netherlands

SWOV fact sheet, November 2022

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Summary

In 2021, the number of serious road injuries in the Netherlands was estimated at 6,800. This is similar to the number in 2020, but lower than was to be expected considering the upward trend up to and including 2019: after years of increase, the number of serious road injuries in 2019 amounted to 6,900. That the numbers in 2020 and 2021 were lower than expected is probably also due to the COVID-19 social distancing measures, which resulted in less traffic.

In the Netherlands, serious road injuries are defined as persons admitted to hospital for road injuries with a maximum severity of 3 or more on the medical injury scale AIS (MAIS3+)[1], and that have not died within 30 days after the crash. The international definition is similar to the Dutch one. The estimate of the number of serious road injuries in the Netherlands is based on a combination of police crash registration (BRON) and hospital patient registration (LBZ).

The number of serious road injuries in 2021 represents 20,500 years lived with disability (YLD). More than seven out of ten (71%) seriously injured road users are cyclists. A large majority of them were injured in a crash that did not involve a motor vehicle. More than half of the seriously injured road users were aged 60 or over, while one in six (17%) was aged 80 or over.

1 How many road users were seriously injured in the Netherlands in 2021?

In 2021, an estimated number of 6,800 road users were seriously injured in the Netherlands. This number is similar to the number of serious road injuries in 2020. Like in 2020, the number of serious road injuries in 2021 is lower than the number expected on the basis of the trend up to and including 2019, when the number amounted to 6,900 [1] [2].

In the Netherlands, serious road injuries are defined as persons admitted to hospital for road injuries with a maximum severity of 3 or more on the medical injury scale AIS (MAIS3+), for the complete definition, see the question *What is the official definition of a serious road injury?*). Up to and including 2020, hospitalised road injuries with a moderate injury severity (MAIS2) were also included in the number of serious road injuries. The MAIS2 injury group amounted to 15,900 casualties in 2021, which is higher than the 2020 number. This continues the upward trend, observed up to and including 2019 [1] [2].

1. Up to and including 2020, road injuries with an injury severity of MAIS2 were also included in the definition of serious road injuries.

Other sources also mention road injuries with an injury severity that could be considered serious, but for which different definitions are used. According to these sources, in 2021, 66,000 road injuries with an injury severity of MAIS2 or higher paid a visit to an accident & emergency (A&E) department [3] and 13,795 road injuries were acute clinical A&E admissions [4].

2 What is the official definition of a serious road injury?

In the Netherlands, serious road injuries are defined as casualties admitted to hospital with serious injuries due to a road crash, not having died within 30 days after the crash [1] [2] [5]. A road crash is internationally defined as a crash on a public road, in which at least one moving vehicle is involved. To express the severity of the injury, the Maximum Abbreviated Injury Score (MAIS) which extends from 1 (slight injury) to 6 (maximum injury) [6] [7] is used. MAIS is an international standard to indicate the severity of an injury. This score can be derived from the various injuries coded for a patient. The injury severity of the casualty must be MAIS3 [1] [5] or higher to count as a severe injury. Examples of MAIS3 injuries are skull base fractures, hip or femur shaft fractures, or wrist or ankle amputations.

Up to and including 2020, road casualties in the Netherlands were defined as 'serious injuries' if their injury severity was MAIS2 or higher (MAIS2+).The national road safety target for 2020 was, linked to the number of serious road injuries according to this definition [8]. Examples of MAIS2 injuries are bone fractures and concussions with brief loss of consciousness. After 2020, the Netherlands switched to a definition starting at MAIS3+ in order to match the international and medical definition of 'serious injury' (see the question *What is the target for the number of road casualties?*).

Up to 2010, the term 'in-patients' was used in the Netherlands [9]. This term was abandoned as not all of them proved to have been hospitalised or seriously injured.

3 How is the number of serious road injuries determined in the Netherlands?

In the Netherlands, SWOV annually assesses the number of serious road injuries [10] based on two sources:

- *Database of registered road crashes in the Netherlands (BRON).* In BRON, the Ministry of Infrastructure and Water Management collects and publishes road crash data based on police registration, notifications by road inspectors of the Dutch national road authority and information from media reports. This database contains information on crash characteristics

such as road and vehicle characteristics and crash circumstances. BRON does not contain reliable information about injury severity, and a lot of casualties are missing, particularly those resulting from crashes not involving a motor vehicle.

- *The national hospital discharge register (LBZ).* LBZ is a database maintained by Dutch Hospital Data (DHD). It contains injury data of patients discharged after hospitalisation. Examples of data that are registered are crash type, injured body parts and injury types. We assume that LBZ contains all road casualties admitted to hospital. Yet, in the database, not all casualties are identifiable as road casualties. Moreover, LBZ does not contain much information about the crash. For instance, information about crash location is entirely missing.

SWOV estimates the number of serious road injuries in the Netherlands by linking and analysing the data from both data sources, and also estimates how many serious road injuries are missing in both databases or are not recognised as such [1]. The quality of both data sources is crucial for a reliable estimate of the number of serious road injuries. A sufficiently large number and share of casualties must be registered in BRON as well as in LBZ. Since the year 2010, the quality of, most notably, BRON has greatly decreased [11] and has been insufficient to allow making reliable observations concerning the developments in serious road injuries with certain characteristics (such as type of road user, age group etc) [1]). About 10% of serious road injuries in crashes without motorised traffic (for example cyclists crashing with a bollard or with another non-motorised road user) are to be found in BRON; and about 60% of serious road injuries in crashes with motor vehicles are thus registered [1]. This implies that BRON registers the different types and numbers of serious road injuries (rather) incompletely and therefore presents an incomplete picture of actual road safety problems. Hospital registration (LBZ) does provide a more reliable indication of the most common characteristics of serious road injuries. About 95% of serious road injuries are registered there [1]. The hospital registration does, however, not register the location of the crash. It is hoped that, in the future, ambulance data will add more information about crash location.

4 How did the number of serious road injuries in the Netherlands develope from 2000 to 2021?

Figure 1 shows the development of the number of serious road injuries between 2000 and 2021 [12] [13] [14]. Since 2007, the trend in serious road injuries has mostly been upward. The decrease in MAIS3+ casualties between 2013 and 2014 can be attributed to a change in the determination method [1] [15]. In 2020 and 2021, the number of serious road injuries was lower than was to be expected considering the trend up to and including 2019. This was probably partly due to the COVID-19 social distancing measures, which resulted in less traffic.

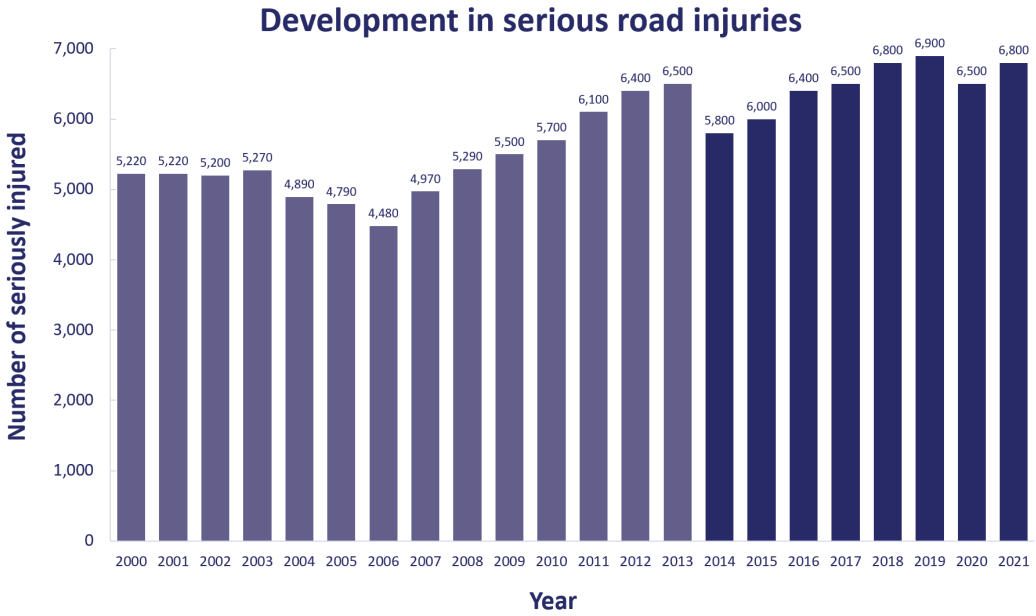

Figure 1. The number of serious road injuries in the Netherlands since 2000, according to the current definition. From 2014 onwards, a new determination method has been used. Sources: DHD, IenW and SWOV.

5 How are serious road injuries distributed by transport mode?

Since 2010, the number of serious road injuries by transport mode has been hard to determine due to poor registration in BRON (see *How is the number of serious road injuries in the Netherlands determined?).* The casualty characteristics based on LBZ appear to be a reasonable alternative.

In the hospital registration, cyclists are by far the largest group among serious road injuries (see *Figure 2*). In 2021, 71% (about 4,600) of the serious road injuries in the hospital registration were cyclists. In comparison: about one third of the road deaths are cyclists and the number of road deaths among cyclists roughly equals that among car occupants (see SWOV fact sheet *Road deaths in the Netherlands*).

In the hospital registration, the number of cyclists among seriously injured road users increased over time (not in figure), and amounted to 66% (about 3,700) in 2014. The number of serious road injuries for other modes of transport decreased, particularly for motorised two-wheelers (motor cyclists, (light) mopeds): while in 2014 this had amounted to 17% (about 1,000) of the hospital-registered serious road injuries, the number decreased to 14% (about 900) in 2021.

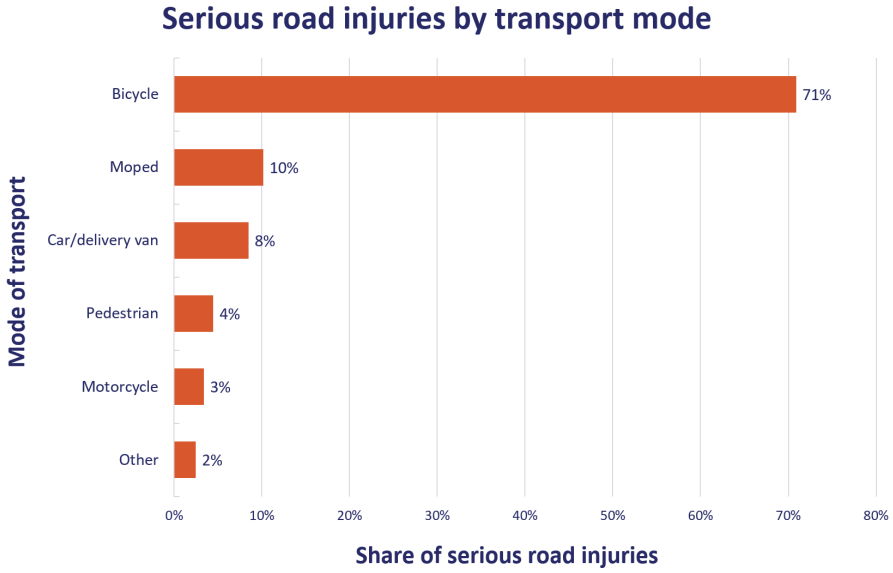

Figure 2 Distribution of serious road injuries in the Netherlands by transport mode in 2021, based on LBZ registration. Source: DHD and SWOV (see [1] [2]).

In 2021, 63% (about 4,300) of the serious road injuries were injured in a crash not involving a motor vehicle. Among hospital-registered seriously injured cyclists the share amounted to 82% (about 3,800).

The *risk* of being seriously injured (serious road injuries per distance travelled) is highest for two-wheelers (motorised or non-motorised) and increased in the last two years, compared to the two previous years. For car occupants, the risk is lowest (*Figure 3*). *Figure 3* provides the average *biannual* risk, because risks calculated on an annual basis fluctuate too much due to uncertainties in mobility data and casualty numbers. By aggregating the 2020 and 2021 data, we have taken into account the change in mobility patterns during those two years due to the COVID-19 social distancing measures.

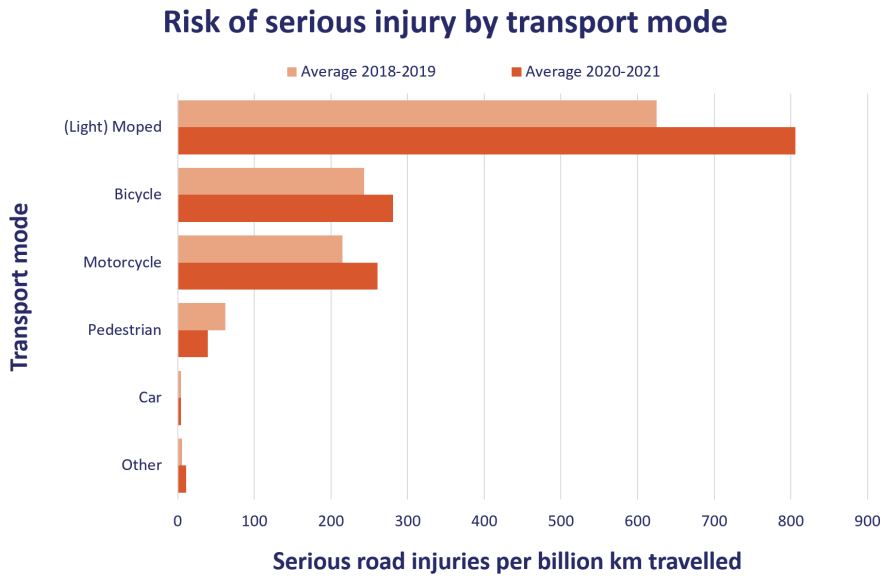

Figure 2. The risk of serious injury (serious injuries per distance travelled) in the Netherlands for various transport modes, averaged over 2018-2019 and 2020-2021, determined on the basis of the hospital discharge register LBZ. Sources: Statistics Netherlands, DHD and SWOV.

6 How are serious road injuries distributed by age and gender?

Figure 4 shows the 2021 age distribution for serious road injuries, based on the hospital discharge register LBZ. An ever-growing share of serious injuries is sustained among older road users. In 2021, 59% (about 3,800) of the hospital-registered seriously injured road users were aged 60 or over, while in 2014 this had amounted to 51% (ca. 2,800). The growing share is related to demographic developments, but the share of older road users sustaining serious injuries grows faster than their share of the population. Older people are physically more vulnerable, also see SWOV fact sheet *Older road users*. Among older seriously injured road users, the share of cyclists exceeds that of other age groups.

In 2021, children made up around 3% (about 200) of the hospital-registered serious road injuries; in 2014 this was about 6% (about 300). Also see SWOV fact sheet *Children aged 0 to 14.* Most children are injured while cycling or walking. In 2021, the share of hospital-registered seriously injured young people aged 15 to 19 remained virtually unchanged at 5% to 6% (about 400) compared to previous years. Because they have just started participating in motorised traffic, crash risk for this age group is higher; also see SWOV fact sheets *Young drivers* and *Young road users (teenagers and adolescents)*.

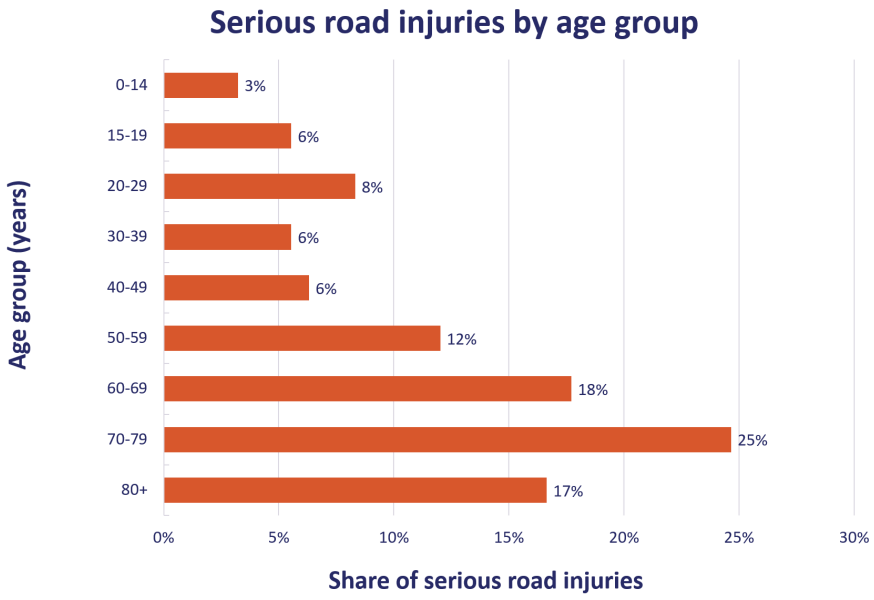

Figure 3. Distribution of serious road injuries in the Netherlands by age group in 2021, based on hospital discharge register LBZ. Sources: DHD, SWOV.

The risk of sustaining serious injuries (serious injuries per distance travelled) is highest for older road users and has increased further in recent years. Comparatively, risk for young road users (aged 15-29) increased most (*Figure 5). Figure 5* provides the average *biannual* risk, because risks calculated on an annual basis fluctuate too much due to uncertainties in mobility data and casualty numbers. By aggregating the 2020 and 2021 data, we have taken into account the change in mobility patterns during those two years due to the COVID-19 social distancing measures.

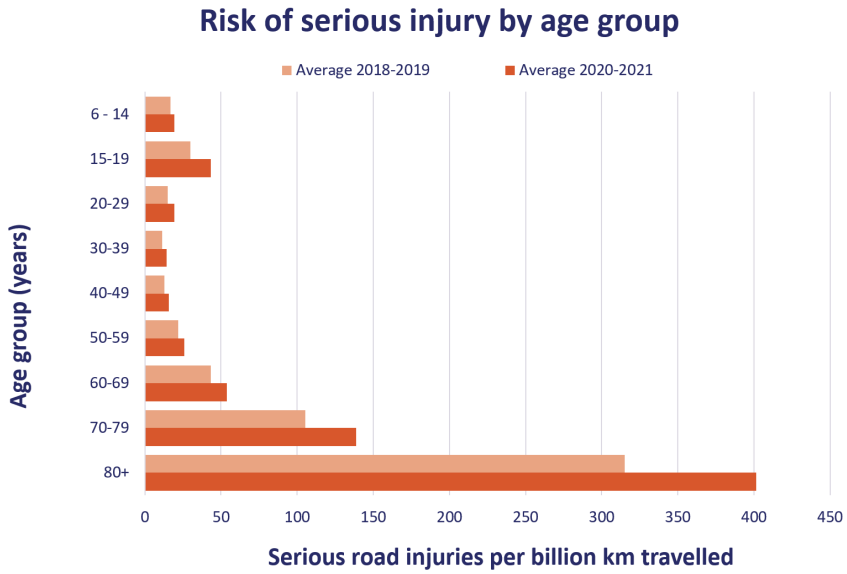

Figure 4. The risk of sustaining serious injuries (serious road injuries per distance travelled) in the Netherlands, for different age groups, averaged over 2018-2019 and 2020-2021 based on hospital discharge register LBZ. Note: the risk for age group 6-14 is a slight overestimate. Sources: CBS, DHD and SWOV.

In 2021, 59% (about 3,800) of the LBZ-registered serious road injuries were male and 41% (about 2,700) were female. In general, women are more often injured in crashes not involving a motor vehicle than men are. This partly relates to mobility differences between men and women: men drive more, women more often walk [16].

7 What is the distribution of the number of serious road injuries across different road types?

In addition to casualty characteristics, crash location characteristics (type, location) are also important for road safety research and policy making in this field. Currently, hardly any data are available about crash locations of serious road injuries, because crash locations are only available in BRON, which only includes part of the serious road injuries (see the question *How is the number of serious road injuries determined in the Netherlands?*). Particularly for serious road injuries sustained in crashes without involvement of a motor vehicle, hardly any crash location information is available. The reason for this lack is that the data of these crashes are almost all derived from the hospital discharge register LBZ which does not register location characteristics.

Of the serious road injuries in crashes that do involve motor vehicles, more crash information is available. Up to 2010, the quality of their registration in BRON was higher, although still not complete. Therefore, we know that up to 2010 about 60% of the registered serious road injuries (former definition, see the question *What is the official definition of a serious road injury?*) occurred in urban areas. Of the serious road injuries involving a motor vehicle in rural areas (about 40%), about one fifth occurred on roads with a speed limit of 100 km/h or higher [6]. No reliable data are available for the years following 2009. It is expected that, in the future, the link with ambulance data will provide more insight into the locations where serious injury crashes occur [17].

8 Which types of injury do road casualties sustain and what is the injury severity?

Figure 6 illustrates which body parts sustain serious injury and to what extent the consequences are permanent (the burden of injury, expressed in the number of years lived with disability (YLD)). Remarkable are the large proportions of hip and leg trauma, followed by head injuries. Lasting effects mainly result from injuries to the head and torso, but also from injuries to the hip and upper leg. Casualties who suffer lasting impairment mainly experience pain and problems with their daily activities. About 33% of the casualties experience lingering effects. The injuries

and burden of injury vary between traffic modes, between different age groups and also between males and females. For more information, see [29].

The injury burden of the serious road injuries in 2021 was estimated at 20,500 YLD [1] [2]. The group of MAIS2 road injuries – which also used to come under the definition of serious road injuries - was twice as large and had an injury burden of approximately 21,500 YLD in 2021.

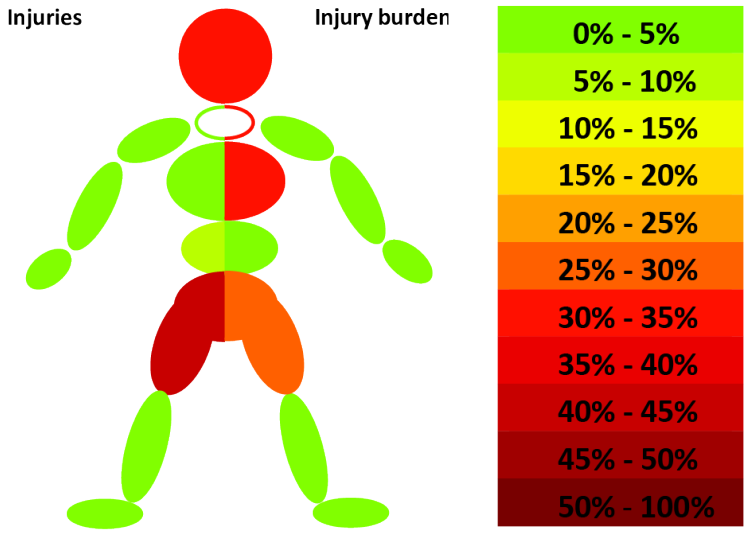

Figure 5. Distribution of injuries and injury burden by body part. The distribution is based on the serious road injuries registered in LBZ in 2014 [18].

9 Which societal costs are caused by a serious road injury?

More than half of the total societal costs of road crashes (about 52%) can be attributed to serious road injuries (situation in 2020, on the basis of the definition current at that time), while the share of road death costs is relatively low (an estimated 15%), see *Figure 7*. Casualties with slight injuries (treated at an A&E department) have a share of about 17% and other casualties a share of about 3% in societal costs.

The total societal costs of road crashes in 2020 are estimated at €27 billion (€15 to €36 billion [19]). This equals over 3% of the gross domestic product. The costs per serious road injury in the current definition are about €1,000,000 million. For more information see SWOV fact sheet *Road crash costs.*

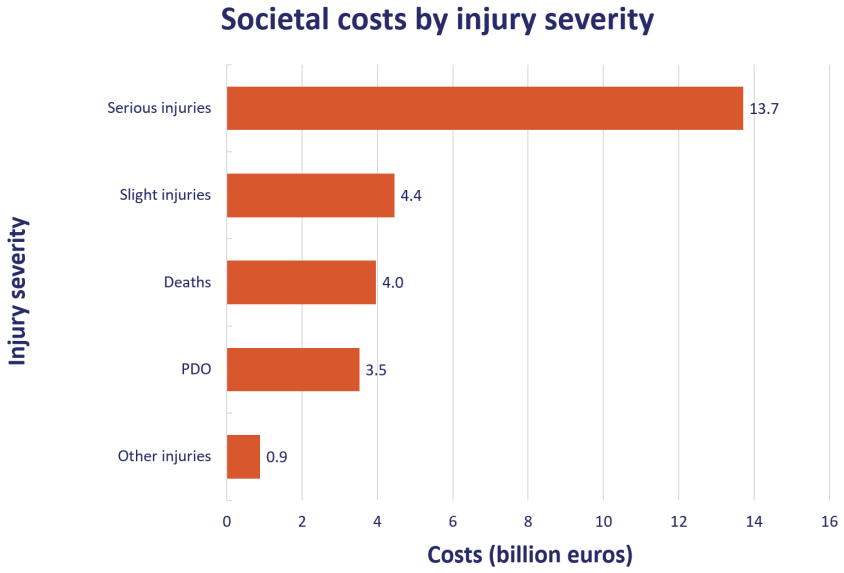

Figure 7. Proportions of road crash costs by damage type (here still according to the 2020 definition: serious road injuries based on injury severity MAIS2+). PDO = crashes with property damage only (19).

10 What is the target for the number of road casualties?

The Netherlands aims for zero road casualties in 2050 [20]. Mid 2021, a parliamentary motion was carried to apply an intermediate target of a 50% reduction in the number of road casualties in 2030 [21]. Quantification of measures that could contribute to this reduction showed that considerable casualty reductions are possible, but that a 50% reduction is probably too ambitious [22], particularly relating to the number of serious road injuries. This number is, as yet, not structurally decreasing but – disregarding COVID years 2020 and 2021 - even shows an upward trend. Up to and including 2020, a national road safety target applied [8]. This target was not met [23].

International road safety targets have also been determined. Mid-2020, the United Nations extended the previous 2010 target, which implies a 50% reduction of road injuries by 2030 compared to 2021 [24]. The European Union also set targets for the number of road injuries [25]: a 50% reduction of the number of serious road injuries by 2030 compared to 2020. In addition, the objective was that in 2018 as many Member States as possible would know how many MAIS3+ injuries they had. However, the process of gathering information about MAIS3+ injuries in all Member States has not been finalised yet.

11 How does the number of serious road injuries in the Netherlands compare to that in other countries?

Casualties are reported in many different ways in different countries. Definitions and report rates vary, which makes international comparison difficult. For years, the European Commission has been striving for a harmonised definition, based on road crash casualties with MAIS3+ injuries. After the Dutch 2020 targets for the number of serious road injuries, with a definition of MAIS2+ severity, had expired, the Netherlands also adopted the definition in which serious road injuries should at least have a MAIS3 severity. Quite a number of countries encounter problems in collecting the necessary data (police and hospital data) and performing the required data editing to determine the number of serious road injuries (MAIS3+). In 2014, the European Commission did give a first-time estimate of the number of serious road injuries in Europe: 135,000 [26].

Also at a European level, research is done on MAIS3+ casualties. In 2016, the report *Study on serious road traffic injuries in the EU* [27] was published, which focuses on data and circumstances of the crashes of MAIS3+ casualties among pedestrians, cyclists, motorcyclists and car occupants. The EU-project SafetyCube investigated the differences in methods used in countries to determine their numbers of MAIS3+ casualties, and how these methods affect the estimated numbers [28]. This EU project also studied the injury consequences [29] and the societal costs of serious road injuries [30].

Publications and sources

Below you will find the list of references that are used in this fact sheet; all sources can be consulted or retrieved. Via Publications you can find more literature on the subject of road safety.

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Colophon

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