

Sustainable Safety: principles, misconceptions, and relations with other visions

Summary

In the early 1990s the Sustainable Safety vision was launched in the Netherlands. This vision, which was implemented during the following years and was updated in 2005, is a success. The purpose of the Sustainable Safety principles is prevention of (serious) crashes where possible, and prevention of severe injuries when a crash happens. Sustainable Safety is characterized by a pro-active approach. This means that the weak spots in the traffic system are dealt with generically. Compared to a scenario wherein policy and crash and fatality rates would since 1998 have remained unchanged, the introduction of all the measures that are based on the Sustainable Safety vision had in 2007 decreased the number of road deaths by approximately 30%. These measures have turned out to be socially profitable.

Background and content

Road traffic is inherently unsafe. Our traffic system is designed in such a way that it does not (sufficiently) prevent crashes and severe injuries. The most dangerous in traffic are the large differences in speed and mass that the human being has to deal with. The human being is physically vulnerable and, moreover, makes errors and commits offences. Each year this results in hundreds of road deaths and many thousands of severely injured in the Netherlands.

The idea that traffic is inherently unsafe should be a starting point in improving road safety. This insight was inspired by developments in other sectors, such as aviation and the process industry. The Bruntland report about sustainable development was the inspiration for choosing the term 'sustainable' for this vision of road safety. 'Sustainable' refers to a development that answers to the needs of the present generation without harming future generations' possibilities to answer to their own needs.

This fact sheet presents the current principles of Sustainable Safety. It discusses the goals, the human measure, the integral approach of working with the factors people, vehicles and roads, the proactive character, and the five principles on which the vision is based: functionality, homogeneity, predictability, forgivingness, and state awareness. It also addresses a number of misconceptions, such as effective policy in relation to human measure, the elaboration, and the costs and benefits of Sustainable Safety. Finally, Sustainable Safety will be compared with the Swedish Vision Zero and with Shared Space, a traffic concept within spatial planning.

How has the vision developed since 1997?

During the last few decades, the main approach for tackling dangerous locations was a reactive method known as 'the black spot approach'. Sustainable Safety proposed a proactive approach which involves a mainly generic approach to the weaker spots in the traffic system. The weak spots are determined on the basis of their potential danger as a result of the possible conflict situations and the conditions under which these occur. The launch of the Sustainable Safety vision found political support, which resulted in a number of demonstration projects, and finally in the Sustainable Safety Start-up Programme in 1997. Striking elements were the large increase of urban 30 km/h zones and the implementation of residential 60 km/h zones in rural areas. This gave Sustainable Safety a strongly infrastructural character, even though measures in other areas, such as education and enforcement, are also essential components of the vision and have developed strongly, separate from the Start-up Programme.

More than a decade after the introduction of Sustainable Safety, the time had come to evaluate the vision and the direction it had taken. This was to give the vision a new impulse and to give it a chance to respond to new developments. The evaluation resulted in the updated vision entitled *Advancing Sustainable Safety* (Wegman & Aarts, 2006). The updated vision:

- continues the successful infrastructural measures of the past;
- places more emphasis on education, regulations, and enforcement;
- emphasizes technological developments;
- argues the necessity of a quality assurance system;
- argues the necessity of an integrated approach of measures, safety principles, and policy areas;
- points out the importance of thorough assessments, knowledge storage, and knowledge exchange.

What is the essence of the vision?

Sustainable Safety aims to prevent (serious) crashes, and where this is not possible, to eliminate the risk of severe injury as much as possible. *Man as the measure of all things* has been adopted to achieve this goal. Man's measure is determined by physical vulnerability as well as psychological characteristics: human beings, irrespective of background, education and motivation, do make errors and do not always abide by the rules; that is why the human being is an important cause of crashes.

Sustainable Safety aims to prevent these errors and offences as much as possible or to mitigate their consequences by designing the traffic system according to the human measure. First of all, the surroundings, such as the *road* and the *vehicle*, should be tuned to man's capabilities and should offer assistance and protection. In addition, information and education must prepare people for the traffic task, and, finally, his traffic behaviour must be checked for safety.

What are the principles of Sustainable Safety?

In order to achieve a sustainably safe road traffic, five guiding principles have been drawn up (see table). The current principles are all based on scientific theories and research (see also the Fact sheet [Background of the five Sustainable Safety principles](#))

| Sustainable Safety Principle | Description |
|--|--|
| <i>Functionality</i> of roads | Monofunctionality of roads as either through roads, distributor roads, or access roads in a hierarchical road network |
| <i>Homogeneity</i> of mass and/or speed and direction | Equality in speed, direction, and mass at moderate and high speeds |
| <i>Predictability</i> of road course and road user behaviour by a recognizable road design | Road environment and road user behaviour that support road user expectations through consistency and continuity in road design |
| <i>Forgivingness</i> of the environment and of road users | Injury limitation through a forgiving road environment and anticipation of road user behaviour |
| <i>State awareness</i> by the road user | Ability to assess one's task capability to handle the driving task |

What do we know about the effects of the Sustainable Safety measures?

When the *Sustainable Safety Start-up Programme* was introduced, a beginning was made with the large scale implementation of Sustainable Safety measures. The categorization of the road network, the increasing number and construction of 30 km/h and 60 km/h zones, and the introduction of the 'Moped on the Carriageway' law, were the most important road safety measures in the *Start-up Programme*. Some of the developments, such as the construction of 30 km/h zones, had already begun earlier. The construction of roundabouts and the construction of safe shoulders were not part of the *Start-up Programme*, but do fit the Sustainable Safety ideas extremely well. The same is true for the application of essential predictability characteristics to distributor roads, which was only started in 2004. Based on current knowledge, we have estimated that the complete package of infrastructural Sustainable Safety measures that was introduced has resulted in a reduction of about 6% of all fatalities and inpatients in the Netherlands during the 1997-2002 period (Wegman et al., 2006). Traffic education, enforcement, and vehicle technology also are essential parts of a sustainably safe traffic system. At present, there are many developments in these areas. Of course, it is important to know to what extent these developments affect road safety.

In a recent assessment of *traffic education projects*, a (small) effect on self-reported behaviour relevant for safe traffic participation was measured in just over half the studied projects (Twisk et al., 2007).

In the late 1990s, regional enforcement teams were set up for a more efficient and effective *traffic enforcement* in five specific areas: helmet wearing, seatbelt wearing, red light running, drink-driving, and speeding. This approach has in all probability been effective (Weijermars & Van Schagen, 2009), especially for seatbelt wearing and alcohol use in weekend nights.

For many decades, there have been worldwide developments in *vehicle technology*, which aim at preventing injury, and increasingly at preventing crashes. Especially the implementation of electronic stability control, airbags and seat belt reminders have improved traffic safety. A British study reports that the introduction of vehicle measures, excluding compulsory seatbelt wearing, resulted in an annual reduction of injury crashes by about 1% during the 1983-1998 period (Broughton et al., 2000). The introduction of all these Sustainable Safety-based measures resulted in a total reduction of the number of fatalities of more than 30% in 2007 as opposed to the scenario in which policy and crash and fatality rates would have remained unchanged (Weijermars & Van Schagen, 2009). The measures were particularly effective in the prevention of severe injury in crashes involving at least one motor vehicle. The measures were socially cost-beneficial.

What are the misconceptions about Sustainable Safety?

Misconception 1: man is the cause, therefore education is the solution

Man has a central position in traffic. This means that traffic has to deal with human abilities and limitations. People make errors, even if they are well-trained and motivated: this is a universal human limitation crucial for traffic safety. This is confirmed by accident analyses. Beside vehicle and road defects, man is therefore the most important cause of crashes. A reasoning often heard is that, consequently, most effort should be put into education, since infrastructure and vehicle contribute less to the problem. However, this line of thought fails to allow for the notion that the design or layout of the road environment can contribute to the prevention of errors, or the limitation of the errors' consequences. Particularly man's surroundings influence human behaviour greatly. Clearly education also has an important role, but has limited scope. Ultimately, it is important to know the effectiveness of various types of measures in relation with the human measure and to use this knowledge.

Misconception 2: Sustainable Safety is solely an infrastructural matter

The original Sustainable Safety vision is an integrated approach which combines the elements man, vehicle and road. However, initially the sustainably safe infrastructure was elaborated the most concretely and had a leading role within the *Sustainable Safety Start-up Programme*. This gave rise to the misconception that Sustainable Safety only refers to infrastructure. On the contrary, education, rules and regulations, enforcement, and vehicle technology are just as much a part of a sustainably safe traffic system. Of course it is true that by nature infrastructure has a more sustainable character: once it is there, its effect lasts for years. Measures such as education and enforcement are different in that they require continuous efforts if they are to have a lasting effect.

Misconception 3: Sustainable Safety (i.e. infrastructural) measures are expensive

An often-heard complaint is that particularly the infrastructural Sustainable Safety measures are expensive. Still, the 'high' costs can be put into perspective by also looking at the benefits: savings on medical costs, on the costs of production-loss, loss of the quality of life, property damage, and settlement costs (see SWOV Fact sheet [Road crash costs](#)). The returns of various Sustainable Safety measures vary, but the Netherlands Bureau for Economic Policy Analysis judged the measures in their entirety as 'robust' in terms of costs and benefits (CPB et al., 2002). Recent calculations show that the Sustainable Safety policy of the last few years has resulted in 2 to 4 times higher benefits than costs (see Weijermans & Van Schagen, 2009). Furthermore, SWOV has introduced the term 'avoidable crashes' (Wegman, 2001), which means that specific crashes can be prevented by taking measures that are effective and socially profitable as well as fitting within Sustainable Safety.

How does Sustainable Safety relate to other visions?

Vision Zero: striving for 0 severely injured

Starting point of the Swedish Vision Zero (e.g. Tingvall & Haworth, 1999) is that it is immoral not to do everything possible to prevent road deaths and injuries. Like Sustainable Safety, Vision Zero also maintains that, although a human being is often the cause of a crash, the crash can be prevented by a safe design of the traffic system. The safety level of the system is measured by whether crashes can lead to severe injury or not; it is not measured by the number of crashes. This assumes a joint responsibility of the road user and the traffic system designer. The user's responsibility is to obey the rules, and the system designer's responsibility is to arrange the system in such a way that it can be used safely. Moreover, the system designer must take further steps in the system design if road users commit offences or if users get severely injured.

Vision Zero thus also sees man as the measure of all things and assumes that physical laws influence the risk and severity of a crash. Vision Zero as it has recently been put into practice, focuses mainly

on rules and regulations, enforcement and man's physical environment (vehicle measures and infrastructural measures; see Vägverket, 2009). Public information and education are not at all, or hardly, regarded as system components or effective measures for the prevention of severe injury. Educational aspects of man in traffic and his moral and social actions (principles such as social forgivingness and state awareness) are not included in Vision Zero.

Meanwhile, in the Netherlands some regions have made striving for zero severely injured the motto for their policy. As in Vision Zero, it mainly concerns the starting point that it is immoral to be satisfied with policy that accepts road deaths. Apart from that, the manners in which it is put into practice differ quite a lot, among the various regions as well as when compared to Vision Zero. For example, one of the regions focuses on a further elaboration of the Sustainable Safety vision, while another region focuses mainly on a change in culture, working with mentality and people's own responsibility.

Internationally, Sustainable Safety and Vision Zero are often bracketed together as the examples of a 'safe system approach' such as is already being used in air and rail transport (e.g. OECD, 2008).

Shared Space: a spatial planning and road design vision

Another vision that is interesting to compare with Sustainable Safety is Shared Space (Monderman, 2004). This Dutch vision refers to the creation and design of residential areas – in fact only the access roads, although the idea is sometimes applied to other road types. Shared Space is based on the point of view that residential areas are 'shared areas'; shared by people who live there and road traffic. Traffic is a guest in these areas and the layout should clearly indicate that the primary function of the area is residential. Access roads, however, are also meant to facilitate traffic to and from destinations. Shared Space can in practice be considered a vision of how the design of residential areas can be made more credible (and more beautiful) by making use as much as possible of natural and historical elements that match the road's function. As little use as possible is made of road signs and markings to allow people to settle potential conflicts by eye contact. This approach is also expected to result in lower driving speeds. In fact, the traditional traffic engineering development of residential areas often uses conspicuous speed limiters such as speed humps, which raises opposition. According to Shared Space, such traditional measures strongly reflect a 'traffic area' and do not appeal to social behaviour, whereas traffic features should be less prominently present in residential areas. Further study is being made of the extent to which a layout according to the starting points of Shared Space is in line with Sustainable Safety elements, such as recognizability and social forgivingness.

Finally, Shared Space emphasizes the importance of a well designed road network. Without well designed through roads, there will only be more cut-through traffic on the secondary road network, which has negative consequences for safety and liveability. It must be noted that at present no thorough research has been done into the road safety effects of Shared Space.

How to advance with Sustainable Safety?

A number of Sustainable Safety principles have already been translated into practical implementation. In the coming years, where necessary, more research will be done. As proposed in *Advancing Sustainable Safety*, a system of quality assurance, as well as valid data collection and evaluation studies, will play an important part.

Sustainable Safety also plays an important role in recommendations for achieving road safety targets in the near and more distant future. SWOV continues to argue for a traffic system that has an inherently safe design. This does require a 'system leap' in current policy towards future policy that will put such a system into practice.

Safety is not the only matter of importance for traffic and transport policy. Policy also needs to take accessibility, pollution, quality of life, and spatial planning into account. Because all of these wishes have to be achieved with limited budgets, the various interests would benefit from further integration. Therefore, road safety policy not only needs to aim at more integral measures, but also at integration with other policy areas. In the coming years, this issue will also be subject to an undiminished search for dialogue and cooperation.

Finally

It should be possible to force road safety firmly in the right direction, using a proactive and integral approach of the traffic elements man, vehicle, and road and an integral application of the Sustainable Safety principles. In the current complex world, it will be necessary to more often join in with other developments such as mobility, pollution, quality of life, and spatial planning. Continuous development in knowledge, possibilities, and social norms and values may cause an idea that is unrealistic today to be acceptable tomorrow. Ultimately, social support remains an important pillar for translating a system vision of road safety, such as Sustainable Safety, into actual policy and measures.

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