

## 3. Safe System

### Introduction

The Safe System concept grew as a reaction to realizing that ‘doing more of the same’ and scaling up activities within Education-Enforcement-Engineering framework will not provide the ultimate solution to the traffic safety problem. The core idea behind the Safe System is that a transport system should be designed so that a mistake by a road user does not lead to a fatal or serious injury. Safe System became a major paradigm shift when it was first introduced in Sweden and the Netherlands. At first it was met by scepticism and resistance from the traffic safety community. Nowadays, it is considered the state-of-the-art within traffic safety management.

### Learning outcomes

After studying this module, the students should be able to:

- explain how the Safe System approach is different from traditional views on traffic safety
- explain how the Safe System approach changes traffic safety priorities, policies, and measures
- discuss causes and solutions for specific safety problems from the Safe System perspective
- criticise/defend given traffic safety measures for a specific traffic safety problem using Safe System reasoning
- suggest possible traffic safety measures for a given traffic safety problem using Safe System reasoning.

### Key messages to learners

- The Safe System concept grew in countries like Sweden, Norway, and the Netherlands in 1980–90s as a reaction to realization that ‘doing more of the same’ (more Education and Enforcement, better Engineering, etc.) will not provide the ultimate solution to the traffic safety problem. Safe System became a major paradigm shift when it was introduced.
- There is no ‘one and only’ definition of the Safe System, but generally there is a broad agreement on a number of core principles for the design of the road transport system (in the broad sense), as described below. The practical implementation of these principles may vary between countries.
- Nearly all accidents could have been prevented, or their damage minimized, if the right measures were in place from the beginning. Therefore, traffic injuries are not an inevitable price to be paid for mobility, safe mobility is possible and achievable.
- Safe System prioritize prevention of fatalities and severe injuries in traffic. These represent just a small share of ‘all accidents’, thus allowing to focus the efforts and resources on elimination of the most severe consequences of the traffic (un-)safety. In a trade-off situation of preventing a fatality/severe injury at a cost of increased frequency of minor accidents, human life and health are considered more valuable. For example, presence of a middle barrier increases chances for hitting it (usually as property damage accidents), however, it prevents frontal collisions that tend to have very severe, often fatal, consequences.

- The biomechanical tolerance of the human body to external forces is used in the Safe System as the fundamental design constraint. People should not be exposed at any time to external forces that may cause severe injury or death.
- The concept of safe speed is closely related to the previous principle. For a given traffic environment, the safe speed limit is set so that in any likely accident scenario, and given the protection provided by the vehicle and infrastructure, and worn by the road users, the external forces on the human body should not exceed its biomechanical tolerance. The 'safe speeds' are usually retrieved from 'survivability curves', a visual representation of the statistical probability for a fatality in each collision scenario (road users involved, collision angles, etc.) as a function of the collision speed. Such curves are derived from large amounts of data on individual accidents and severity of injuries they resulted in.
- The Safe System admits that humans are likely to make mistakes in traffic. Such mistakes should be taken care of by other system components (vehicle, infrastructure, system regulations, etc.) and should not result in severe injuries or death.
- The principle of redundancy departs from understanding that no traffic safety measure can be 100% efficient in all circumstances and scenarios. Therefore, multiple protection layers are necessary to minimize the possibility of severe injuries and fatalities. It is common to consider how each of traffic safety pillars (safe speeds, safe vehicles, safe infrastructure, safe road users, post-crash care, safety management) can contribute to the problem solution.
- Finally, the Safe System advocates for shared responsibility for traffic safety. While road users should know and obey traffic rules, the system designers are ultimately responsible for designing the road system; moreover, if a road user fails to comply due to an error, lack of knowledge, ability, or acceptance, it is the designer's responsibility to take further steps to prevent severe injuries or deaths. Even intentional violations by road users should eventually be taken care of by the system design (for example, alcolocks in cars prevent drunk driving; intelligent speed adaptation devices, ISA, prevent driving above speed limits).
- The ultimate objective of the Safe System is Vision Zero—the state when no one gets killed or severely injured in traffic. Until Vision Zero is reached and secured, the traffic safety work must continue. Continuous improvement is sometimes mentioned as another Safe System principle.
- The Safe System is not built overnight and there is a maturity process involved in its implementation. However, even countries in which the current road transport system is far from the Safe System ideal state can start taking steps in the right direction, which over time will accumulate to noticeable changes. Guidance on that (where do I start from my current situation?) is available.
- The experience of countries that adopted Safe System clearly shows the efficiency of the approach. Sweden and Norway introduced Safe System in late 1990s and reduced traffic fatalities by over 70% since then. Other European countries, many with quite poor initial traffic safety records, reached 40%–50% decrease in fatalities in just one decade. Even low- and middle-income countries, particularly in Latin America and partly in Asia, show significant improvements after adoption of the Safe System thinking. Projective studies show that by scaling up already known traffic safety measures that are in line with the Safe System, traffic fatalities can be reduced by more than 70%, putting us very close to reaching the Vision Zero objective.

## Learning activities

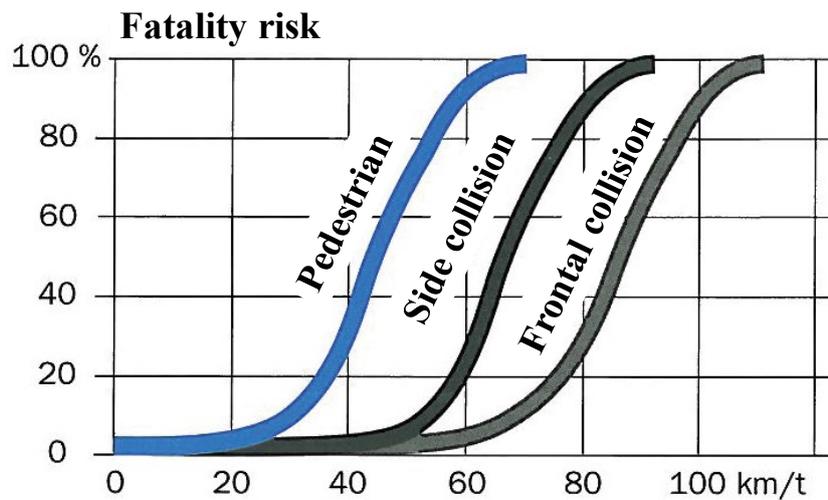
### Exercise 1

Look at the different types of environments and discuss:

- what typical accident scenarios can one expect here?
- at what speeds?
- referring to the survivability curves provided, what are the chances that people involved in such a collision will survive?
- what should be the 'safe speed' for such collisions?
- what traffic safety solutions can be implemented to ensure 'safe speeds'? (note that sometimes there is no good solution and certain types of manoeuvres/interactions simply cannot be allowed)



Survivability curves showing the fatality risk for different types of collisions as a function of the impact speed:

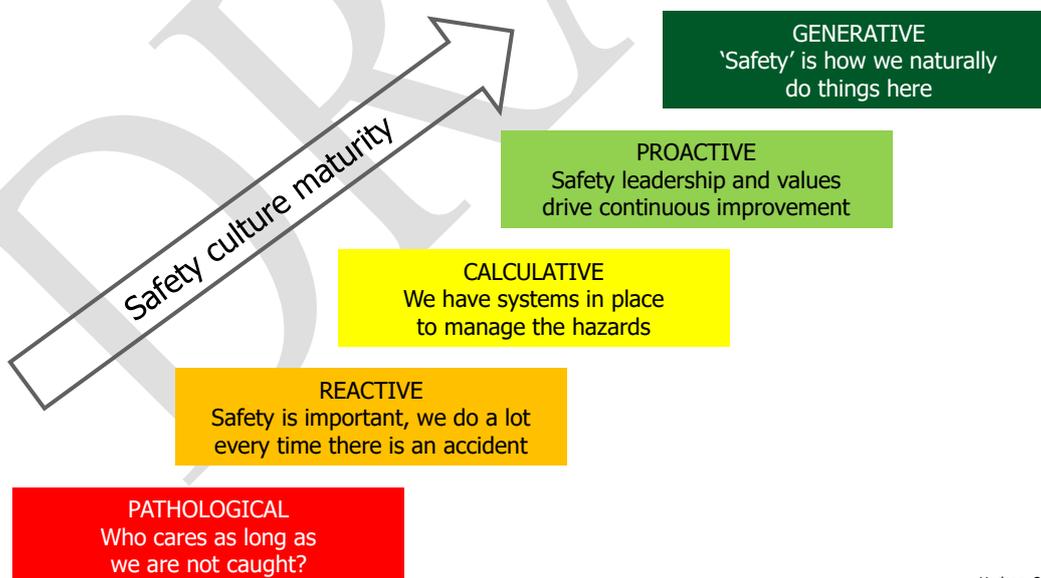


## Exercise 2

Use one of the models describing the maturity of the traffic safety system (e.g. Fosdick et al. 2024, Hudson 2007) to discuss at what stage you would place your country in its current situation:

- Are all aspects of traffic safety appear to be at the same stage? Think about the perspective on the road users, the design of the infrastructure, vehicle fleet management, assignment of responsibilities for safety, stakeholders involved in traffic safety work, etc.
- If in some aspects you think the development went further than others, what do you think are the reasons for that?

**Example.** Traffic culture maturity ladder by Hudson 2007:



Hudson, 2007

## Assessment quiz

The assessment quiz can be used as a part of the examination, or as another form of learning activities (e.g. students take the quiz in class individually and then discuss the results with the teacher).

### Question 1

Select which of the following items constitute the main 'pillars' of traffic safety:

- a. comprehensive traffic safety management (**correct**)
- b. safe speeds (**correct**)
- c. severe punishment of traffic offenders (**incorrect**)
- d. safe infrastructure (**correct**)
- e. safe road users (**correct**)
- f. safe vehicles (**correct**)
- g. traffic education for children from young age (**incorrect**)
- h. effective post-crash care (**correct**)

**Comment** (shown after the answer has been given): None.

### Question 2

Select the main principles of the Safe System approach to traffic safety management:

- a. Humans will eventually make mistakes. The system designer must offer solutions to prevent severe consequences resulting from that. (**correct**)
- b. Human error is responsible for 95% of accidents. Therefore, training road users for better performance is the most important traffic safety measure. (**incorrect**)
- c. Human body is fragile and should not be exposed to external forces that may cause severe injuries and deaths. (**correct**)
- d. Safe System focuses on prevention of fatal/severe injuries. (**correct**)
- e. The ultimate responsibility for safety belongs to the road users. After all, it is their decision to participate in traffic. (**incorrect**)
- f. The responsibility for safety should be shared between the road users and the system designers. (**correct**)
- g. Accidents are the price the society must pay for fast and convenient mobility. (**incorrect**)
- h. All accidents are usually caused by just one major contributing factor. Identification of the main cause in each accident, and punishment of the person responsible will result in the Safe System. (**incorrect**)
- i. A serious accident is a chain of unfortunate events leading to a fatality/injury. Multiple measures are necessary to make sure that the chain will be eventually broken and the injuries prevented. (**correct**)
- j. All accidents are equally important and should be the target of traffic safety work in truly Safe System. (**incorrect**)

**Comment** (shown after the answer has been given): None.

### Question 3

Select correct statements about the Vision Zero:

- a. Vision Zero formulation is 'No one will be killed or severely injured in traffic'. (**correct**)
- b. Vision Zero was first adopted in Sweden in 1997 as the national long-term goal. (**correct**)
- c. Vision Zero means that all traffic accidents will be eventually eliminated. (**incorrect**)
- d. Today, Vision Zero is accepted by the European Union and its members, Australia, many states and cities in the USA, and in other countries. (**correct**)
- e. Vision Zero was a flop and it was discarded after the first few years of fruitless efforts. (**incorrect**)

**Comment** (shown after the answer has been given): None.

## Recommended reading and resources for students

- ITF. (2025). Road safety in action: The Safe System tool. International Transport Forum. <https://safesystemtool.itf-oecd.org>
- Johansson, R. (2009). Vision Zero—implementing a policy for traffic safety. *Safety Science*, 47, 826–831. <https://doi.org/10.1016/j.ssci.2008.10.023>
- Welle, B., Bray Sharpin, A., Adiazola-Steil, C., Job, S., Shotten, M., Bose, D., Bhatt, A., Alveano, S., Obelheiro, M., & Imamoglu, C. T. (2018). Sustainable and safe: a vision and guidance for zero road deaths. World Resource institute | Global Road Safety Facility. <https://files.wri.org/d8/s3fs-public/sustainable-safe.pdf>

## Recommended (additional) reading for teacher

- Elvik, R. (2023). What would a road safety policy fully consistent with safe system principles mean for road safety? *Accident Analysis & Prevention*, 193, 107336. <https://doi.org/10.1016/j.aap.2023.107336>
- Hudson, P. (2007). Implementing a safety culture in a major multi-national. *Safety Science*, 45(6), 697–722. <https://doi.org/10.1016/j.ssci.2007.04.005> (the paper is not about traffic safety, but the ‘maturity ladder’ is highly applicable to describe the evolution of approaches to traffic safety)
- ITF. (2008). *Towards zero*. International Transport Forum. <https://doi.org/10.1787/9789282101964-en>
- ITF. (2016). *Zero road deaths and serious injuries: Leading a Paradigm Shift to a Safe System*. International Transport Forum. <https://doi.org/10.1787/9789282108055-en>
- ITF. (2022). *The Safe System approach in action*. International Transport Forum. <https://doi.org/10.1787/ad5d82f0-en>
- Stipdonk, H., Aarts, L., Campsall, D., Carnis, L., Feypell, V., Fosdick, T., Shelton, D., Small, M., & Vadeby, A. (2024). Maturity measurement in road traffic injury prevention. *Traffic Safety Research*, 5, e000045. <https://doi.org/10.55329/uvfc1655>

## Prepared by expert

In case you have specific questions, need a discussion partner, or just want feedback on your lecture materials, you may reach out the author(s) of this module. Please, put ‘AfroSAFE curriculum’ in the email subject.



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