

## 2. Evolution of traffic safety theory and practice

### Introduction

Our understanding of traffic safety has changed significantly over time. Both the theories on why accidents occur and how to prevent them, and practices aimed at improving traffic safety have evolved since the early start of western motorization. This module focusses on the main road safety paradigms that have shaped our thinking and practices in different periods of time.

### Learning outcomes

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

- to know and understand the historical context of traffic safety theory, research and practice
- to describe and explain the main paradigms and concepts in the evolution of traffic safety paradigms: from bad luck and fate, accident proneness, through the three E's, and Haddon's matrix, to systems thinking.
- to discuss the relations between different periods and paradigms on the one hand, and traffic safety research and countermeasures on the other.
- to apply the learned paradigms and concepts in real use cases.

### Key messages to learners

- The understanding of traffic safety has undergone a transformation over the last century, moving from viewing accidents as random events to recognizing the complex interplay of human, vehicle, and environmental factors within a larger system. Systematic pro-active approach (Safe System), and possible integration of traffic safety with other relevant domains, are currently considered to be the state-of-the-art (more will be learnt in the modules 3 'Safe System' and 17 'Traffic safety as a part of sustainable development').
- **Early 20th century:** Traffic safety was not a major concern in the early days of motorization. Accidents were often seen as a result of bad luck. Research was limited to collecting statistics and descriptive analysis ('what happened?'). Traffic safety actions were mostly reactive and addressed issues revealed by single accidents.
- **1920–1950s:** As a reaction to rapidly increasing motorization in the Western world, Reuben Jacob Smeed published in 1949 his famous formula relating road deaths as to motor vehicle registrations and population. The concept of 'accident-prone drivers' emerged suggesting that a small subset of individuals was responsible for a disproportionate number of accidents. This led to research on psychological testing to detect 'accident proneness', with solutions sought in legislation, enforcement, and driver re-education.
- **1950–1970s:** The focus shifted from solely blaming drivers to considering the roles of vehicles and road infrastructure in accidents. Research during this period led to significant advances in vehicle safety standards, including crash testing and the development of safety features like seatbelts. Road design principles also evolved, incorporating elements like driver reaction time and sight distance to enhance safety.
- **1970–1980s:** The period of marked the beginning of a multi-causal approach, acknowledging that accidents result from a combination of factors, and introduction of William Haddon's

matrix, and the ‘three Es’ (Engineering, Education, Enforcement). More sophisticated (statistical) models were introduced.

- **Late 1980s:** The systems approach to road safety has become the leading paradigm. Road safety became viewed as the result of interactions within the entire transportation system. Countries like the Netherlands (with the Sustainable Safety concept) and Sweden (with Vision Zero) have been pioneers in implementing comprehensive, system-wide road safety policies. At the same time, better understanding of how human reaction to changes in perceived and objective safety (behavioural adaptation) was developed.
- In modern days, the main burden of global traffic fatalities (90%) lies on the low- and middle-income countries (LMICs). The current Safe System approach, developed and implemented in the high-income countries, requires adjustments to the LMIC conditions (rapid motorization, limited resources, different road user behaviours and safety cultures, weak state institutions). Safe System has been criticized for not sufficiently accommodating active modes such as cycling and walking. Traffic safety must be seen as a part of a bigger puzzle including the problems of public health, climate change, urbanization, social and gender inequalities, etc.

## Learning activities

### Exercise 1

The view on traffic ‘unsafety’ and how it is to be improved has been changing over time. Place the following ideas about traffic safety into the most relevant time period:

- An accident has one major cause.
- Roads should be ‘adapted’ to limitations of road users.
- Seat belts developed.
- Seat belts recommended as standard equipment in all vehicles.
- Cost-benefit analysis tells precisely when the ‘optimal number of fatalities’ is reached.
- An accident has multiple causes.
- Traffic safety should be integrated with others sustainability goals.
- Education and punishment are the primary measures to improve traffic safety.
- System approach is necessary to prevent accidents.
- Accident is a result of bad luck.
- Some people are just not ‘wired’ to be good drivers.
- No one should be killed or injured in road transport.

Early motorization	1920–1950	1950–1970	1970–1985	1985–
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## Exercise 2

### Preparations (teacher only):

- Identify several traffic problems, risky environments or situations.
- Prepare supportive materials for each—relevant news articles or online sources, photos or screenshots from Google Street View, accident statistics (if available), personal observations and experience.

### With the students:

- In smaller groups, discuss for each situation:
  - what makes it risky (e.g. poor visibility, high speed, mixed traffic)
  - who is at risk (e.g. pedestrians, cyclists, children)
  - whether the risk is objective (supported by data and scientific knowledge) or perceived.
- Analyze each situation from the perspectives of different time periods. For each period, explain:
  - what would be seen as the main cause of the risk
  - what countermeasures would likely be proposed (e.g. revoke driving licences from ‘menaces behind the wheels’, educate users, increase enforcement, add signage, redesign the road, etc.).

## Recommended reading and resources for students

- Hagenzieker, M. P., Commandeur, J. J. F., & Bijleveld, F. D. (2014). The history of road safety research: A quantitative approach. *Transportation Research Part F: Traffic Psychology and Behaviour*, 25, 150–162. <https://doi.org/10.1016/j.trf.2013.10.004>
- Hakkert, S. (2021). The history of transportation and road safety research. ICTCT webinar, 4 June 2021. <https://www.ictct.net/webinars/june-2021/>
- Hakkert, S.A., & Gitelman, V. (2014). Thinking about the history of road safety research: Past achievements and future challenges. *Transportation Research Part F: Traffic Psychology and Behaviour*, 25, 137–149. <https://doi.org/10.1016/j.trf.2014.02.005>
- Shinar, D. (2022). Moving from Crash Causation and Countermeasures to Road Safety Policy. ICTCT webinar, 25 February 2022. <https://www.ictct.net/webinars/webinar-february-2022/>

## Recommended (additional) reading for teacher

- Baker, S. P., & Haddon, W. (1974). Reducing injuries and their results: the scientific approach. *The Milbank Memorial Fund Quarterly. Health and Society*, 52(4), 377–389. <https://doi.org/10.2307/3349509>
- Haddon, W., Suchman, E., & Klein, D. (1964). *Accident research: methods and approaches*. Harper and Row.
- Loimer, H., & Guarnieri, M. (1996). Accidents and acts of God: a history of the terms. *American Journal of Public Health*, 86(1), 101–107. <https://doi.org/10.2105/AJPH.86.1.101>
- Norton, P. (2015). Four paradigms: traffic safety in the twentieth-century United States. *Technology and Culture*, 56(2), 319–334. <https://doi.org/10.1353/tech.2015.0065>
- Smeed, R. J. (1949). Some statistical aspects of road safety research. *Journal of the Royal Statistical Society, Series A*, 112(1). <https://doi.org/10.2307/2984177>
- Visser, E., Pijl, Y. J., Stolk, R. P., Neeleman, J., & Rosmalen, J. G. M. (2007). Accident proneness, does it exist? A review and meta-analysis. *Accident Analysis & Prevention*, 39(3), 556–564. <https://doi.org/10.1016/j.aap.2006.09.012>

## 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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