5th International Conference Workingonsafety.net
7-10 September 2010 Røros Norway

"On the road to vision zero?"

Vision Zero – principles and experiences in Switzerland

Raphael D. Huguenin

Introduction

The idea "Vision Zero" (VZ) has been developed by our Swedish colleagues (Swedish National Road Administration, 1996). In Switzerland road safety experts took up this principle in 1998. At various conferences VZ has been presented and proposed as a new basis for road safety (e.g. Rumar, 1999; Fussverkehr Schweiz, 2000). During the European Conference of Ministers of Transport (ECMT) in 1999 the Swiss Minister of Transport discussed the possibilities of developing a road safety policy based on VZ. In the year 2000 he commissioned the Federal Roads Authority (FEDRO) to carry out such a policy for Switzerland. FEDRO mandated the Swiss Council for Accident Prevention (bfu) to prepare a report which should show how VZ could be implemented into concrete actions and measures. Meanwhile many other reports concerning VZ have been established, among others by the OECD (2008). A similar approach (sustainable safety) has been presented by SWOV (Wegman, Dijkstra, Schermers & van Vilet (2005).

The report (UVEK, 2002 a & b) lead to vehement critic, especially regarding a measure for motor bikers. Therefore, after opening the opportunity to make representations, FEDRO (2005) initiated a new report called "Via Sicura". Within this process, apart from experts, political circles were involved in order to enhance the chance that the proposed measures would be accepted at the political level. Since 2008 the report has been discussed and another opportunity to make representations has been arranged by the government. This year (2010), the final report should be discussed in parliament.

Although the process has been very long, the discussions were fruitful and of positive influence on road safety. Some of the proposed measures have already been introduced and accepted by a great part of road users. The targets which have been determined have partly been reached.

How to improve road safety?

ELVIK (2001; see WHO, 2004) says: “Setting quantitative targets can lead to better programs, more effective use of resources and an improvement in road safety” (p. 25). EC and many other countries have followed the principle of setting intermediate and long-term goals in order to improve road safety successfully. It is neither reasonable to try, nor possible to achieve VZ by direct approach; it is obvious that one needs to proceed step by step. However, less obvious is the answer to the question: Why should we reach “zero”, i.e. no road users killed or seriously injured.

Primarily the answer is clear:

a) Worldwide (at least) 1.2 million people are killed in road traffic per year. That means 3300 per day, about 140 per hour. In 2030 we will probably have to deplore twice the number.
b) Compared to other important causes of death, road traffic crashes should be more intensely considered (see fig.1). In Switzerland road traffic crashes causes a loss of 27.4 life years.
c) Compared to other activities road traffic is…
   … 40 times more dangerous than leisure activities,
   … 12 times more dangerous than household activities and
   … 14 to 27 times more dangerous than travelling by aircraft or train.

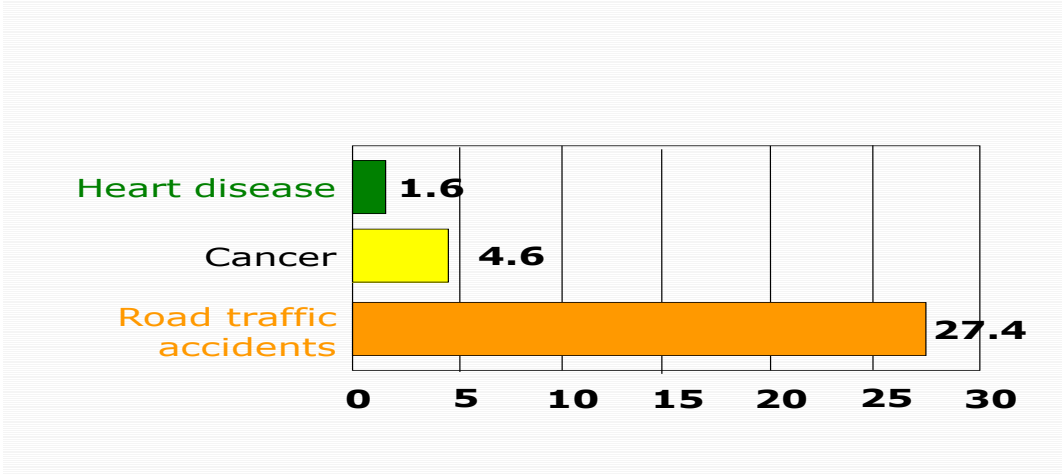

Figure 1: Life years lost according to cause of death (Stat. Jahrb. D. CH)

The main reason however, not only to reduce the amount of killed and seriously injured people considerably but even drop it to zero, is due to the fact that the traffic system is an artificial system. Therefore the natural risk of dying has not to be considered as a valid

criterion. Nobody should be killed in an *artificial* system. The second question then arises: How can we realize VZ *and maintain mobility* on the road? (Safety guarantees mobility!)

How to realize Vision Zero?

In order to implement VZ we are obliged to change the philosophy of road safety activities. This means to change the basic paradigm, the system-approach and the target:

(1) Change the paradigm

Everybody has the right to survive. This is stated in the Swiss Constitution (Müller,1999). Therefore, we cannot accept the price of individual mobility which is based on an artificial system. The traffic system has to be adapted to human beings, their behavior and their limits. Consequently, the system managers have to assume their responsibility. The general tendency to adapt human behavior via learning, teaching or influencing to the existingtraffic system has to be changed. It is not possible to live without learning; but when conceiving roads and vehicles, we have to take into account that people make mistakes. Human beings are limited regarding the reliability of their behavior. They have strength but also weaknesses (see table 1). The latter leads to crashes and this has to be taken into consideration when establishing the road system. The chain of mistakes has to be interrupted by adapting vehicles and roads according to driver's limits. The design of the road system has to "understand" human behavior. It is not the road user who has to understand the design!

This approach has already been introduced within different fields; e.g. for avoiding electricity accidents (fault-current circuit breaker) and in using consequently ergonomic methods in aircrafts or trains. The result is positive. The fatalities per 100 million people-kilometer's exposure is 0.08 for air-traffic (public transport) and busses or coaches, and 0.04 for rail transport. The corresponding figure for road traffic is 1.10.

A second relevant criterion, apart the call for adaptation to human being's *behavioral* limits, is the biological tolerance of man. Even if precautions have been taken to avoid crashes, they will occur. Thus, we should also consider the *biological* limits of road users. This has been shown in the Swedish models (see Vägverket 2008; figure 2). Human (biological) tolerance is the basis in conceiving dynamic systems. And driving behavior has to be the result of vehicles and roads which are conceived according to the biological limits of man (table 2). A typical example is speed and speed limits which are technically

embedded in the vehicle and / or the road.

Strength	Weaknesses
Flexibility	Physical and psychic fluctuations
Capacity of anticipating	Emotionality
Manysidedness	Suggestible and defectable

Table 1: Driver's possibilities and limits of adaptation

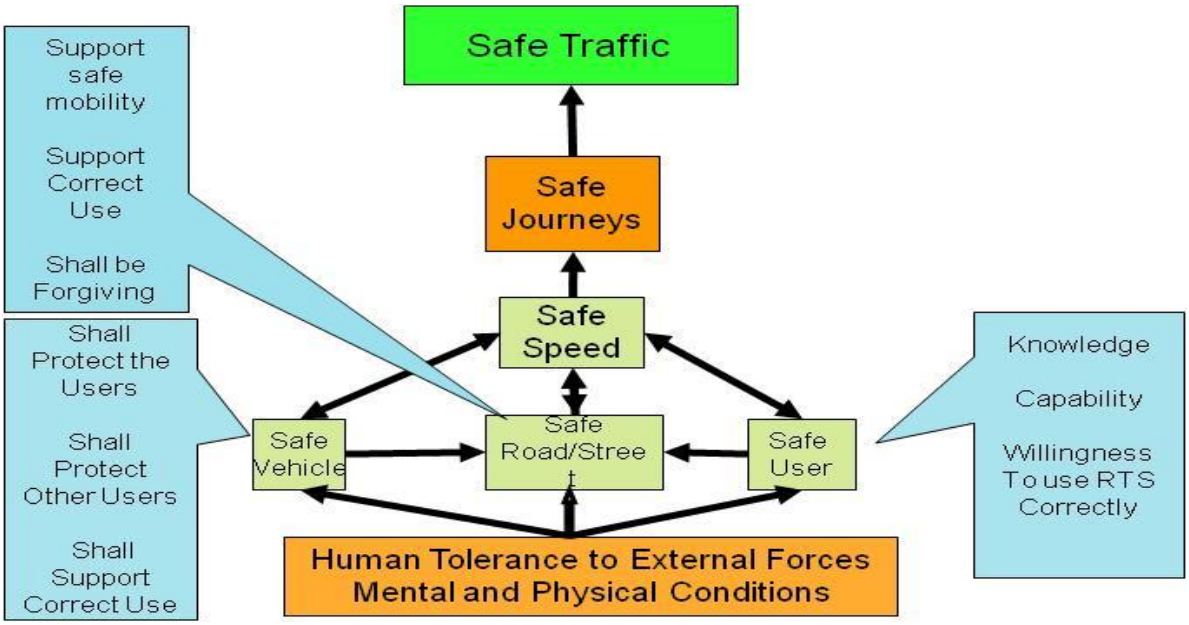

Figure 2: Model for safe traffic (after Vägverket, 2008)

(2) Change the system-approach

The second change which has to be undertaken refers to the Man-Vehicle-Road-System approach. Usually experts, politicians and other players in the domain intervene at one or the other level of the system. Basically this is not wrong but it has to be coordinated. Road corrections, vehicle controls or –adaptations, education,

training and driver improvement (fig.3) has *not* to be carried out independently. Unfortunately this is often the case and leads to one-sided measures.

Independent variable (iV)	Intervening variable (ivV)	Dependent variable (dV)
Biological tolerance	Vehicle / road	Driving behaviour

Table 2: Criterion for modeling the system

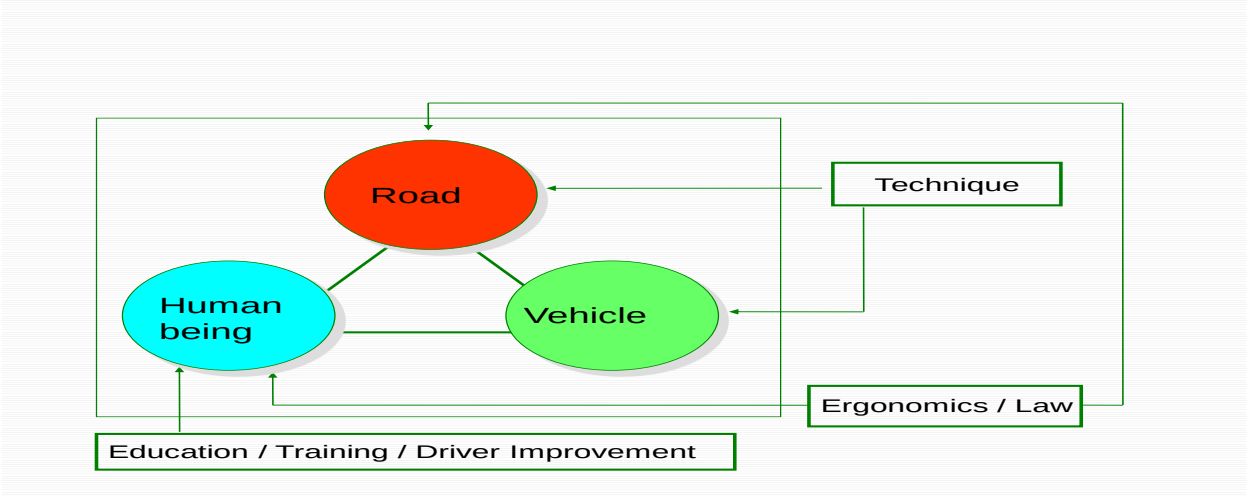

Figure 3: Man-vehicle-road system

(3) Change the target

The third change which has to be made refers to the target. In order to achieve VZ the road safety system should be target-oriented. At the beginning the goals which should be reached have to be used as a basis:

a) developing safe behavior, or, if not possible,

b) guaranteeing that wrong behavior does not lead to seriously or fatally injured road users.

According to figure 4, a hierarchy of measures has to succeed the definition of targets.

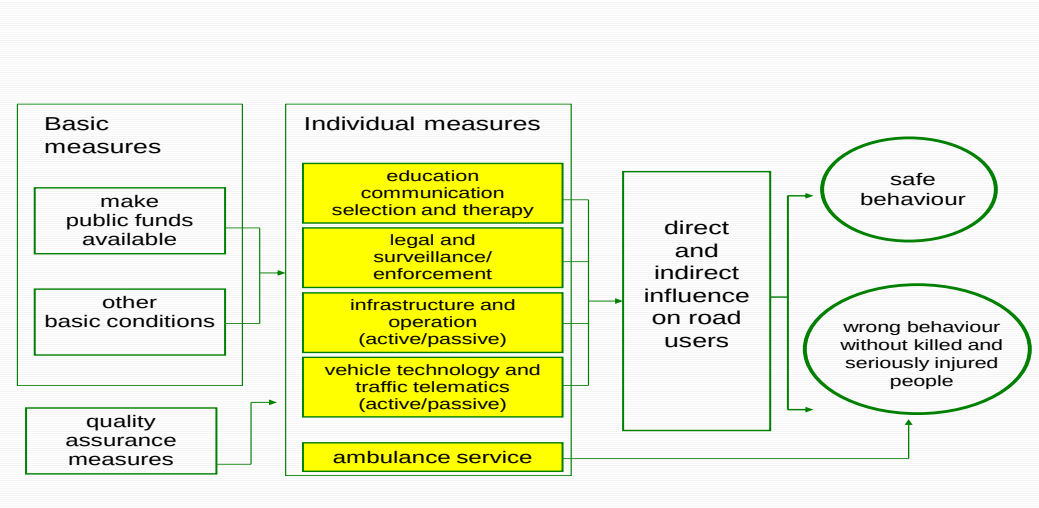

Figure 4: Target oriented safety measure

Direct influence on road users is mainly based on influencing or training them. Indirect influence is mainly implemented by legal measures, surveillance and enforcement, as well as infrastructure or vehicle technology (e.g. inserting roundabouts [correctly!] instead of “normal” intersections, influences the driver to reduce speed to a relative safe level). In order to work out safety measures adequately, basic measures (e.g. national road safety committee) including financing and organization of safety procedures have to be set up. The same is the case for quality assurance measures (e.g. safety audits).

The Swiss study

In Switzerland the way to VZ began with a basic study. The aim consisted in developing a national road safety policy. Therefore the first step was to analyze the state of affairs and the need for action. Moreover evidence-based measures had to be selected and worked out. The scientific approach used for defining the safety deficits in Switzerland and finding relevant measures was as follows:

a) Determining the amount and causes of damages caused to health because of road crashes (statistics)
b) Determining the potentials for prevention measures. In which domains is it possible to achieve good results? (E.g. how many lives can we save if more car occupants wear safety belts?) This process was carried out by focusing on accidents, i.e. considering gravity and probability of crash (frequency). If both parameters are high, the relevance for intervening is accordingly high.

c) Determining adequate measures, especially by improving already existing measures.

The first steps lead to the identification of the main road crashes and problems. In Switzerland we have to focus on groups such as:

- Young drivers involved in accidents with cars
- Young drivers involved in accidents with motorcycles
- 10 to 17 year old drivers involved in accidents with bicycles
- Up to 9 year old children and over 60 years old people involved in accidents as pedestrians

The main problems refer to alcohol consumption, speeding and not wearing safety belts.

This basis leads to generate and select adequate measures. For the first report (VESIPO), referring on literature, expert-questionnaires and -interviews, initially about 150 measures were registered. 97 of them were identified as relevant for road safety and finally 77 were followed up on. The potentials of the prevention measures were estimated through a process of economical quantification. This procedure allowed comparing every measure regarding their effect on a common basis. The valorization at this time was

- 1.92 Million Swiss Franc (CHF; 1.3 Million Euro) for a killed person
- 2437'000 CHF (160'000 Euro) for a seriously injured person
- 9'000 CHF (6'000 Euro) for an injured person.

Based on the economical value of a measure we can select and evaluate it according to the effect, and eliminate – if financially speaking necessary – expensive but less effective measures (priority-setting). The procedure is described in the appendix.

In the VIA SICURA report about 56 measures were accepted after the process of representation. The final selection took place in due consideration of political aspects. (The report can be found via *www.astra.admin.ch/themen/verkehrssicherheit/00236/index.html?lang=en*, where the measures are listed on page 64/1 ff.)

Finally the targets were set and the potential results could be estimated. Starting in the year 2000, Switzerland counted 600 fatalities and 6'200 seriously injured victims. The set targets at this time were:

Year	2005	2010	2020
Fatalities	500	300	200
Seriously injured	5000	3000	2000

In 2009 in Switzerland 348 road users were killed. In 2010, only a part of the measures that are foreseen will be introduced. Therefore the target of 300 will not really be reached. Due to

the federal system and political opposition new policies can only be implemented slowly. Nevertheless, compared to other developed countries, our position (about 5) regarding fatalities on the road (per capita) is relatively positive.

Conclusion

The Swiss experiences show that positive results are based on a target in order to start a planning process. Moreover you need a policy on basic and quality-assuring measures as well as the goals of intervention. In addition, at safety-measure level, it is essential to be very clear and evidence-based. It is counterproductive to work out every possible individual measure.

As for VZ it can only become reality if there is a fundamental change in safety philosophy. People make mistakes; therefore, the paradigm of adapting people to suit the system must be put into correct perspective. The system has to be adapted to suit people as far as possible. Roads, vehicles and emergency rescue systems must be designed to prevent mistakes from having fatal consequences.

References

- Elvik,R. 2001. Quantified road safety targets: an assessment of evaluation methodology. Report nr. 539. Institute of Transport Economics TOI, Oslo

- FEDRO 2005. Via Sicura - Federal Action Programme for Greater Road Safety. Federal Roads Authority FEDRO, Bern (*www.astra.admin.ch/themen/verkehrssicherheit/00236/index.html?lang=en*)

- Fussverkehr Schweiz 2000. Vision Zero – Verkehr ohne Gefahr. Auf dem Weg zu einer „Charta Vision Zero". Entwurf für eine Grundlage der Verkehrssicherheitspolitik der Schweiz im 21. Jahrhundert. Fussverkehr Schweiz, Zürich

- Müller, J.P. 1999. Die Grundrechte in der Schweiz. Bern

- OECD 2008. Towards Zero – Ambitious Road Safety Targets and the Safe System Approach. Summary Document. Transport Research Center. Organisation for Economic Cooperation and Devlopment & International Transport Forum, Paris

- Rumar 1999. Vision Zero. Executive Summary of a Lecture in Berne. Swiss Council for Accident Prevention (bfu), Bern

- Swedish National Road Administration (Vägverket) 1996. The Zero Vision – Aroad transport system free from serious health losses. Unpublished report, Borlänge

- UVEK (Eidg. Dep. f. Umwelt, Verkehr, Energie und Kommunikation) 2002a. Erarbeitung der Grundlagen für eine Strassenverkehrspolitik des Bundes – VESIPO. Schlussbericht. Bundesamt für Strassen (ASTRA) / Schweiz. Beratungsstelle für Unfallverhütung (bfu), Ittigen / Bern

- UVEK (Eidg. Dep. f. Umwelt, Verkehr, Energie und Kommunikation) 2002b. Erarbeitung der Grundlagen für eine Strassenverkehrspolitik des Bundes – VESIPO. Zusatzband zum Schlussbericht: Massnahmenbeschreibungen im Detail. Bundesamt für Strassen (ASTRA) / Schweiz. Beratungsstelle für Unfallverhütung (bfu), Ittigen / Bern

- Vägverket (Swedish National Road Administration) 2008. Model for safe traffic. Unpublished paper. Swedish Road Administration, Borlänge

- Wegman, F., Dijkstra, A., Schermers, G. & van Vliet, P. 2005. Sustainable Safety in the Netherlands: The vision, the implementation and the safety effects. Institute for Road Safety Research, Leidschendam

- WHO 2004. Rapport mondial sur la prévention des traumatismes dus aux accidents de la circulation. Organisation mondiale de la santé (OMS/WHO), Genève

Appendix : Evaluation of safety measures' social costs

1: Steps of evaluation

a) Detrermination of the costs of the measure
b) Determination of the benefit of the measure (expressed in social costs; see text)
c) Ponderation of the benefit according to 4 risk categories
d) Balancing cost – benefits

2: Analysis of efficacy

Efficacy of a measure is the result of avoidable death and serious injuries. In the algorithm the following factors have to be considered:

a) Potential number of accidents
b) Area of application (%)
c) Efficacy (%)
d) Degree of implementation (%)
e) Degree of compliance (%)

3: Example: Seat belt/ignition interlock

(The measure makes it impossible to start the car engine if not all passenger are wearing seat belts.)

Maximum number of preventable fatalities thanks to seat belt ignition-interlock-system:

a) Potential number of accidents
   (445 seriously injured) 136 fatalities
   that could be influenced (crashes where victims were not wearing seat belts)
b) Area of application in %
   100% (no victims wearing seat belts)
c) Efficacy in %
   45% (result of various studies)
d) Degree of implementation in %
   100% (by 2020 = maximum)
e) Degree of compliance in %
   95% (5% = exemptions and sabotage)

Formula for maximum number of fatalities preventable:

136 x 100/100 x 45/100 x 100/100 x 95/100 = 58

Raphael D. Huguenin, PhD
huguenin@swissonline.ch
Switzerland
www.huguenin-rd.ch