White Papers for: *"Toward Zero Deaths: A National Strategy on Highway Safety"*

—White Paper No. 9—

Lessons Learned from Other Countries

Prepared by:

Ezra Hauer, Ph. D.

Toronto, Ontario

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FOREWORD

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NOTICE

PREFACE

While many highway safety stakeholder organizations have their own strategic highway safety plans, there is not a singular strategy that unites all of these common efforts. FHWA began the dialogue towards creating a national strategic highway safety plan at a workshop in Savannah, Georgia, on September 2-3, 2009. The majority of participants expressed that there should be a highway safety vision to which the nation aspire, even if at that point in the process it was not clear how or when it could be realized. The Savannah group concluded that the elimination of highway deaths is the appropriate goal, as even one death is unacceptable. With this input from over 70 workshop participants and further discussions with the Steering Committee following the workshop, the name of this effort became "Toward Zero Deaths: A National Strategy on Highway Safety." The National Strategy on Highway Safety is to be data-driven and incorporate education, enforcement, engineering, and emergency medical services. It can be used as a guide and framework by safety stakeholder organizations to enhance current national, state, and local safety planning and implementation efforts.

One of the initial efforts in the process for developing a National Strategy on Highway Safety is the preparation of white papers that highlight the key issue areas that may be addressed as part of the process for developing a National Strategy on Highway Safety. Vanasse Hangen Brustlin was awarded a task order under the Office of Safety contract (DTFH61-05-D-00024) to prepare nine white papers on the following topics:

1. Future View of Transportation: Implications for Safety
2. Safety Culture
3. Safer Drivers
4. Safer Vehicles
5. Safer Vulnerable Users
6. Safer Infrastructure
7. Emergency Medical Services
8. Data Systems and Analysis Tools
9. Lessons Learned from Other Countries

Experts in these areas were retained to prepare these papers. The authors were challenged to be thought provoking and offer strategies and initiatives that, if implemented, would move the country towards zero deaths.

In this paper, Dr. Ezra Hauer, noted international highway safety expert, examines how five European countries developed their safety programs, what successes they achieved, and most importantly, what lessons can be drawn that would guide the development of a National Strategy on Highway Safety for the United States. This is an initial draft that may be modified based on comments from FHWA and its partner stakeholders and a workshop to be held in Washington, D.C. on August 3&4, 2010.

Hugh W. McGee, Ph.D., P.E.

Principal Investigator

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INTRODUCTION

Several countries have well thought out road safety strategies that have been in place for some time. France, Sweden, Norway, Holland, the United Kingdom, Australia, New Zealand, and others have implemented national strategies, set targets, monitored progress, and made impressive strides in reducing the toll of crashes. In the U.S.A. there is no national strategy in place. When thinking about formulating a strategy for the U.S.A. it is sensible to review the experience of countries that have one[1].

The safety performance of a country is usually measured by aggregate yardsticks such as 'fatalities per person', 'injuries per unit of travel', etc. Success or failure in the delivery of road safety is usually visualized by a time series of such 'safety yardstick' values. Thus, e.g., as shown in Figure 1, during the past four decades France has done better than the U.S.A[2]. Is there a lesson to be learnt?

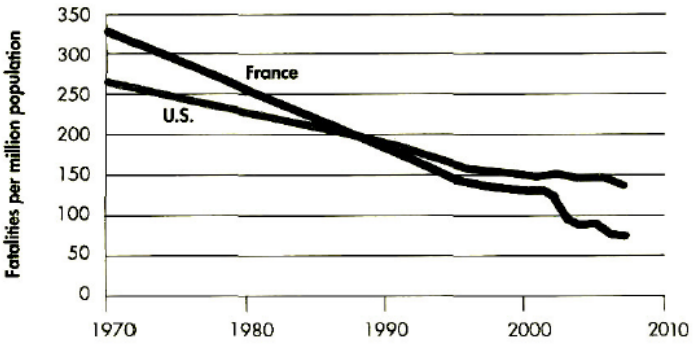

Figure 1. Time series of safety yardstick values. Copied from Kwasniak and Kuzel (2009)

When trying to learn from someone else's success the key questions are ones of explanation and attribution: what are the causes of the difference; can they be attributed to something that has been done or not done? Thus, e.g., Kwasniak and Kuzel (2009) express the view that the cause of the French success is in their actions; they say that: *"Published reports indicate that this decreasing rate of fatalities (in France) was achieved through four specific policy changes implemented since 1972, as well as through intensive communication with the public and an increase in sanctions and enforcement systems."* (p. 32). The easy confidence of this quote has several natural allies. First, of necessity, we rely on what is published. Most of what is published has partly a public relations function and those who publish are inclined to attribute success to action. Second, our psychological predisposition is to believe in simple explanations. In truth however, there are many factors that shape time series' such as those in Figure 1. At times major interventions leave no trace in the time series, at

[1] The intent was to study the experience of all the aforementioned countries. Unfortunately time and budget did not allow me to complete the study of Australia and New Zealand. There is a great deal that can be learned from their experience.

[2] France was way behind the US in 1970 but nowadays, the chance of a person to die in a car accident in the US is almost twice that of a person in France.

other times the trend breaks and we know of no specific cause for it. Inasmuch as the aim of this white paper is to extract lessons from the experience of others, it is important to be cautious; not all that glitters is gold; not every change in the time series is the result of the most recent intervention. More about the difficulty of attributing change to cause is in the Appendix.

FRANCE

EVOLUTION OVER TIME.

The evolution of French road accident fatalities over time is in Figure 2. The left part covers nearly 40 years and is indexed to 1970 when there were 16,445 fatalities and 235,109 injury crashes. It leaves the impression of forty years of steady decline in injuries and fatalities. By the year 2000 the number of fatalities has been about halved (to 8170) and so has been the number of injury crashes (to 121,223). The right part of Figure 2 covers the more recent 18 years and the index year is 1990. Here the decline shows more detail; a period of diminishing declines (1990-2002) followed by a jolt of rapid decline followed by an intimation of another plateau. By the end of 2008 fatalities were almost halved again to 4278 and injury accidents to 74,487. The impression is one of a remarkable success story.

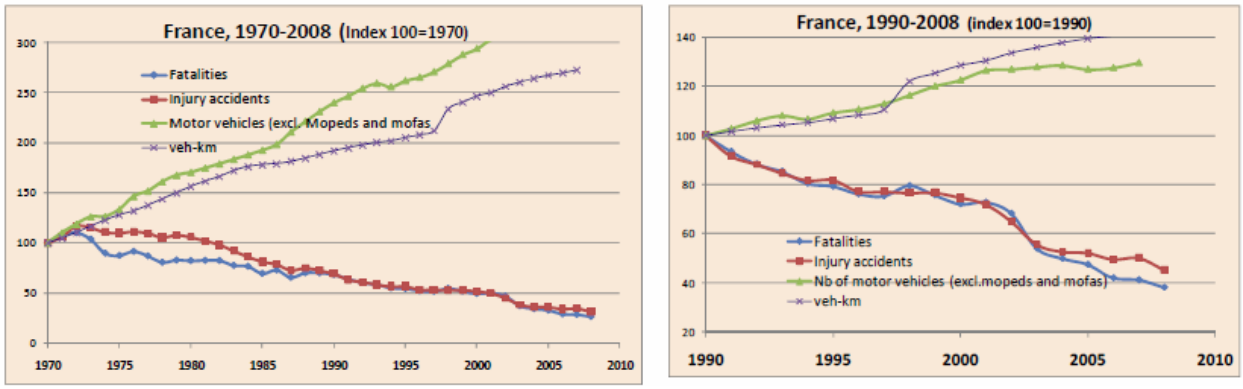

Figure 2. Adapted from IRTAD (2009)

Figure 3 shows a longer history than Figure 2 and thereby reveals the existence of a period in which fatalities were on the increase.

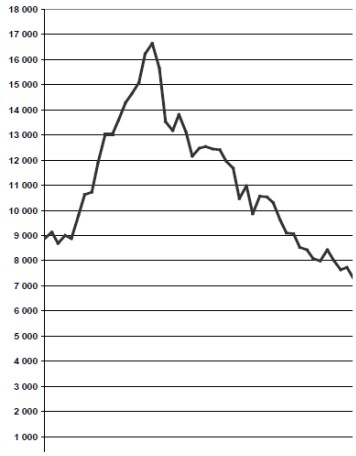

Figure 3. Road accident fatalities in France. Adapted from Gerondeau (2006)

The peak in the French fatalities mountain is sharp and distinct. It is tempting to think that such a sharp break has a definite and corresponding cause. Gerondeau (2006) explains that *"In France, the reversal of the trend was particularly sharp thanks to the impact of two key measures, which were followed a few years later by a third. The first two were the introduction in 1973 of blanket speed limits and the compulsory wearing of seatbelts, measures which were reinforced in 1978 by a major law on drink-driving limits*." (p. 10). However, Gerondeau continues: *"…it is especially interesting to note that crash statistics in France fell sharply a year **before** (emphasis in original) the first two above-mentioned measures were adopted."* He thinks that the decline in fatalities was caused by the publicity following his appointment by the prime minister and says: *"The initiative immediately attracted extraordinary media attention which in turn had the effect of building up the expectations of public opinion. In the course of endless interviews on television, radio and in the press, the newly-appointed National Delegate dinned into all ears the importance of the three golden rules that form the basis for any road safety policy with regard to the behaviour of road-users (keep your speed down, wear your seatbelt, don't drink and drive) and the need for them to be obeyed."* (p. 11).

In truth, a 'fatality mountain' such as the French one Figure 3 characterizes all developed countries. As is explained in Appendix A, it most likely has nothing to do with any action or initiative and is merely to logically necessary consequence of a constantly rising amount of travel and a constantly declining risk of fatality per unit of travel.

HISTORY, CULTURE, AND ACTION

Muhlrad (2004) notes that for the first time in 1997 the French Inter-ministerial Road Safety Committee (CISR) adopted a quantitative target. The number of fatalities was to be halved in five year from about 8,000 to about 4,000. It was not much more than a declaration. No feasibility study was done, no new programs to produce short term effects were implemented, and no new funding and manpower were made available. The safety activities during these five years were a continuation of those initiated earlier: traffic education programmes, rehabilitation courses for multiple offenders, Urban Mobility Plans (PDU) were published for the larger cities, and research was done vehicle safety technologies. Such strategies may have some long-term effect but could contribute little to

meeting a five-year target. Due to the opposition of various lobbies attempts to implement automatic speed control and to fit vehicles with speed monitoring devices failed as did initiatives to increase police enforcement. The introduction of daytime running lights for cars was postponed in view of the protests of motorcyclists associations and of supporters of the Kyoto agreement. Road safety audits were not popular with the road administration. The road safety target was not reached in 2002. However, road safety became a more visible issue and was more and more frequently taken up by media, as the Road Safety and Traffic Directorate of the Ministry of Transport (DSCR) published fatality figures month. This, Muhlrad says prepared a change of public opinion on road safety.

Then, in 2002, after an election campaign focussing on the security of the citizens as a leading national issue, road safety was declared one of the three priorities of President Chirac's new mandate in June 2002. A "Road Safety Convention" took place in September 2002, involving 470 participants as well as seven ministers, and was a major media event. Its main conclusion was that it was urgent to enforce existing laws and regulations, in particular on drinking-and-driving, speed, and seat-belt wearing. The newly invigorated CISR backed by the ministerial political will acted in December 2002 to increase enforcement and penalties, to improve the collection of fines, and to automate the speed enforcement process. Other priorities were to improve traffic education and to mobilize actors at the local level in order to develop a "safety culture". No quantitative target was chosen.

The "new" safety policies were characterized not so much by their content as by the amount of publicity and institutional communication surrounding them. Efforts were made to implement decisions quickly and there was obvious seriousness with which the traffic safety issue was tackled. Safety was tied to fight against violence and to prevention and control of delinquency and there was determination to get laws and regulations actually enforced.

Muhlrad (2004) thinks that the causes of the unprecedented improvement in road safety recorded in France around 2004 are partly the maturing of the effect of policies implemented in the more distant past and partly of the increased and improved enforcement which targeted mainly speeding and drinking-and-driving. In her view *"There is no doubt that changes in speed behaviour have played a major role in the sudden improvement of the road safety situation… While it was estimated that 40% of motor vehicles were over 10 km/h above the speed limit in 2001, the proportion fell under 25% for cars in 2003;… safety gains …in primary safety (-17 % of injury accidents) and in secondary safety (-19 % of injuries and - 21% of fatalities, indicating lower severity of accidents). Better compliance with speed limits has also probably generated positive perceptual and behavioural side-effects influencing traffic collision risk. One can think, in particular, of: more homogeneous traffic flows leading to better perception by traffic participants of the speed of other road users ; better control of the distances between vehicles (some improvement has actually been observed, except on secondary roads) ; smoother flows inducing a "calmer" way of driving and less aggressiveness ; a decrease of stress for drivers."*(p. 4)

From the perspective of the lessons to be extracted from the French experience the interesting question is how the change from lax to serious speed enforcement came about. What Muhlrad describes as the attitude prevailing in France before 2002 is most likely

similar to what exists in parts of the U.S. today: drivers believing that speed has no effect on their risk, car manufacturers emphasizing the protection afforded by modern cars, the view of speed control as an infringement on liberty, the wide 'tolerances' in speed limit enforcement and the non-payment of fines (in France) which eroded the credibility of speed control etc. Muhlrad says that: *"once it became obvious that the target of 4000 fatalities per year would not be reached by 2002, the "road safety barometer" started being used … to dramatic effect, conveying the idea that traffic accidents and injuries weren't unavoidable and therefore should be prevented, with the citizens playing a part in the process. The media became more interested …. For a period of several months, road injuries came more often to the forefront and this, coupled with activities of road victims' associations and mobilization of local public and private actors, may well have initiated a change in the French society, as had been hoped by the road safety authorities. …. The intervention of the President soon after his re-election seems to have marked a turning point in two ways: it boosted the priority level of road safety in some key ministries…by making it a real political issue; and it showed the media and the public that road safety was considered as part of security and violence prevention, and was therefore not to be joked with. Why wasn't this done before? After all, it was Jacques Chirac's second mandate! One can assume that the moment was right to take formerly unpopular measures because public opinion had already changed."*(p.5)

Another event that may have influenced attitudes was the first World Health Day on road violence prevention held in Paris in 2004. It *"served to acknowledge road traffic injuries as a health problem, thus giving road safety a totally different dimension : after all, severely restrictive measures with strong economic impact have been found acceptable to eliminate the "mad cow" problem, so why couldn't the same be done to prevent traffic trauma ? The World Health Day showed this approach to be mainstream."*(p.5)

Muhlrad (2004) writes about the French experience that *"… only political commitment at the highest level can make road safety a priority across the board. Political commitment is also the best way to ensure that road safety action is kept in the eyes of the media and regarded as a key issue for society" and that "Political commitment can be obtained only when the society is nearly ripe to accept a goal and the constraints to achieve it, and only active and sound road safety work coupled with information and intelligent communication can make the society evolve in the right direction."Thinking about the future Muhlrad writes (in 2004) that "Recent spectacular improvement in road safety in France has been obtained through one strategy: increased enforcement, especially of speed limits. As every other road safety measure, this one will reach a limit. How will progress be sustained then?"*

It is interesting to note that no recent publication speaks about seat-belt or helmet use. When I inquired in person I was told that this has been a non-issue for a long time; that usage is now almost universally accepted and automatic. This is supported by IRTAD (2009): "*Seat belt usage rate is very high, and among the best in OECD/ITF countries*". (See

Table 1.) Also*: "Helmet use is mandatory for motorcyclists (including mopeds). It is not compulsory for cyclists. The data available (site soundings) show an almost 100% rate."*

Table 1. Based on Table 7 (IRTAD, 2009, p. 78)

	1980	1990	2000	2008
Motorway – driver	94%	91%	96%	99%
Rural roads – driver	79%	87%	94%	99%
Urban areas –driver	55%	55%	78%	98%

POLITICS AND SCIENCE

At the centre of the web sits the The Inter-Ministerial Road Safety Delegate who is in charge of road safety in France. The political influence of the first Delegate, his media savvy, charisma, and his role in getting the show on the row were mentioned earlier and are described in Gerondeau (2006). The Delegate works through the Inter-Ministerial Road Safety Committee (CISR) which makes decisions and implements them. Chapelon and Lassarre (2010) say that in the CISR decisions are made by officials mainly on the basis of administrative and legal considerations, not technical and scientific ones; that *"Comprehensive studies of the cost- effectiveness or cost–benefit outcomes are rare, whereas this was a common practice in the 1970s."* However, assisting the Road Safety Delegate is the National Inter-Ministerial Road Safety Observatory, the mission of which is to gather scientific information in order to improve the quality of decisions, as well as to guide the activities of departmental road safety observatories. It relies in its work on a small committee of experts.

According to Chapelon (General Secretary of the Observatory) and Lassarre (Directeur de Recherche INRETS) a science-based road safety policy is founded on:

1. Reliable information (accident records, exposure data, measurements of speed and of the use of mobile use etc.),
2. Estimates of the risks attributable to major factors (such as alcohol, speeding, use of mobile phones)
3. The management of risk by monitoring, bench-marking, and policy making.

France has made strides in all three areas. In North America accident statistics often take a long time to materialize in usable databases; in some cases they are more than a year late by which time they are of little relevance to management and little interest to the media. France modernized its system. It enables departmental police forces to return information to the national level within 3 or 4 days after the end of each month. *"The advantage …is that the monthly publication of road accident data by means of a press release is a big event"*(Chapelon and Lassarre, 2010, section 3.1.1). In 2000 a project was launched in 2000 to modernize accident records. Under-reporting was reduced, quality improved, forms simplified and harmonized, the data collection decentralized and the database shared between local and national levels.

The Road Safety Observatory conducts surveys of vehicle-kilometers of travel for roads and certain road-user categories; it monitors speed at some 362 representative locations, and monitors cell phone use at 81 sites. Using their data the Observatory estimates the risk

attributable to various factors (Alcohol, speeding, use of mobile phones). These, in turn drive risk management. Risk management is based on three components: – monitoring, which makes it possible to track what is happening; – bench-marking, which enables the performance of each administrative unit to be compared with that of the others; – policy making which makes policy more effective. In sum, the Observatory sees itself as an interface between experts and decision-makers in the transmission of information of a scientific nature for the purpose of formulating road safety policy.

Chapelon and Lassarre (2010) believe that *"the experience of the past few years has shown the importance of developing simple but rigorously constructed methods and tools, providing telling results for decision-makers and the public. Nevertheless, the situation is far from perfect…".* No matter how good the tools and how solid the results *"a permanent concern is getting decision-makers to assimilate and validate them."*

For an outsider it is difficult to be confident in impressions gained from reports and a few conversations. As everywhere, there seems to be a measure of disconnect and caution between the two solitudes; those who make decisions and face their public consequences and those who place their trust in data and evidence. It seems however, that a mutually satisfactory modus Vivendi has been found and progress is being made.

THE MAIN ACTION: AUTOMATIC SPEED ENFORCEMENT

A general speed limit on the rural road network was introduced in 1973 and later for urban areas. However, but the level of enforcement in France was one of the lowest in Europe. Muhlrad (2006) says that: *"As early as 2000, it had become clear that only an automatized system including the whole chain from detection of speed offenses to penalties (CSA or "Contrôle Sanction Automatisé" in French) would make a significant difference in the enforcement level."* Technical experimentations were carried out in 2001-2002 and a magistrate worked out a solution to legal obstacles (Chapelon et al, 2006). The legal framework for the CSA was set up in June 2003, the first speed cameras were installed in November 2003 and use of the CSA was confirmed in 2004. *"Public opinion had been thoroughly prepared, both through institutional communication and through the public activities of road accident victims' associations, to recognize that 8,000 fatalities per year were an unacceptable burden and that a change in road user behaviour was one of the key factors to improve the situation. This was indeed needed to make implementation of automatic speed enforcement acceptable."* (Muhlrad, 2006, p.2). The point-demerit system was used to ensure that drivers who got caught became more careful. A large-scale road safety campaign on the effects of speeding was prepared at the end of 2005.

The Main feature of the CSA is that it is fully automated. Exceeding the speed limit by more than 5 km/h is a violation. When a violation is detected, a photograph is taken, showing the registration plate at the front of the vehicle. The photograph is sent to the national treatment centre. At the treatment centre, the photograph is decoded, the registration number is automatically read by a computer and double-checked by an operator on video and stored in a data base. A search is done for the vehicle owner's name and address by interrogating the national vehicle registration file, as well as the files of stolen vehicles and of rented cars. A violation and penalty notice is then automatically printed and mailed to the owner who is requested to pay a standard fine within 45 days. The notice is received in

a few days and the recipient has three choices. To pay the fine within the set period (after 45 days the fine is increased) and a number of demerit points will be taken from his bank of points; to pay the fine but send a protest to the Public Prosecutor who will review the case; to state that he/she was not the offender and give the name and address of the person who was using the car.

In 2002, the plan was to install 700 fixed speed cameras and to use 300 mobile ones. In June 2005, the CISR decided to increase the number to 1000 fixed speed cameras and 500 mobile ones. Warning signs are posted on the roads a few hundred meters ahead of speed cameras, and regional maps show their location on the Web.

The functioning of the CSA was evaluated and the results published (see Chapelon, 2006). In general the system is estimated to check 500 times as many drivers than traditional speed enforcement procedures. Each fixed speed camera records over 1,000 violations per month. At the end of 2005, each driver was checked by a fixed speed camera about 7 times a month. About 0.33% were offenders. The system costs 100 million Euro per year and was planned to bring in 375 million Euros per year.

The local effect of speed cameras was to reduce speeding on about 3km. Over 6 km stretches of road centred on fixed speed cameras, injury accidents and fatal accidents decreased by respectively 40% and 65%, which was much higher than the decrease observed at the national level during the same period (19% and 28%). The global effect of CSA was to reduce the average speed on French roads by 5 km/h over three years. The highest reduction was obtained for dual carriageways (speed limit of 110 km/h, reduction of average speeds of 16 km/h). Speeds started decreasing with the announcement of CSA before the first speed cameras were actually installed. The rate of very severe violations (more than 30 km/h) was divided by 5. Between 2002 and 2005 road fatalities in France decreased by over 30% and the CSA was estimated to account for roughly 75% of this decrease.

A survey of attitudes to the CSA was done in 2005. The survey showed that the institutional and press information introducing CSA as a preventive measure was correctly understood by 78% of the public. Nearly three quarters of drivers felt that warnings for fixed speed cameras were adequate. However, only 57% of drivers trusted that speed cameras were placed at the most hazardous locations and 24% believed the contrary. The fact that local speed limits were not reviewed before implementing CSA and that some of them may be inadequate or inconsistent is likely to account at least partly for such protest. Most drivers believed the automatic procedure was reliable, although a non-negligible proportion of them (27%) thought there was still a high risk of error in identifying offenders. CSA was generally found equitable, and 79% of drivers thought it had become impossible, or at least more difficult, to avoid penalties once a violation had been detected. Three quarters of drivers did not consider that automatic photographs interfered with private life (an issue that had been raised a number of years earlier when automatic detection of driving offenses had first been tried). The effectiveness of the CSA was broadly acknowledged as 77% of drivers thought it improved safety and 86% declared that speeds had been going down a little or a lot. Only 19% of the drivers interviewed were found opposed to CSA, or even more generally to speed enforcement.

Muhlrad (2006) concludes that: *"Implementation of automatic speed cameras had a strong local impact and also generated unprecedented gains in road safety in France. The proportion of very high speeds particularly decreased, which made speed patterns more homogeneous. The global system has been rather well accepted, its value as a road safety measure has been broadly recognized, and behavioural adaptation has been significant. Drivers' attitudes towards speed and the risk of detection showed, however, that the use of mobile speed cameras was an indispensable complement to fixed ones whose location is known to drivers."*

The average speed in French roads continued to decrease as shown in Table 2.

Table 2. Speed statistics for French roads (Table 6 from IRTAD, 2009, p.78)

	Sept-Dec 2006	Jan-April 2007	May-August 2007	Sept-Dec 2007	Jan-April 2008	May-August 2008
Average speed of passenger cars (km/h, all networks)	82.2	81.3	81.7	81.6	80.8	80.4
% of drivers above the limit	42.9%	37.4%	35.7%	37.7%	35.7%	32.3%
% of drivers 10km/h above the limit	16.7%	13.4%	11.7%	16.2%	13.3%	10.9%

TARGETS AND INITIATIVES

In 2007 President Sarkozy set a national target of reducing the number of road fatalities in France to 3000 by 2012, an annual reduction by 8.3%.This is shown in Figure 4.

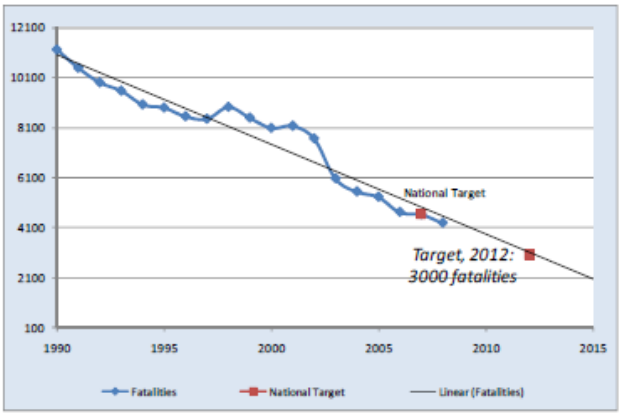

Figure 4. Trend and target (from Figure 5 in IRTAD, 2009, p.78)

The expansion of the CSA system is to continue till 2012. The implementation of 500 red light cameras/year was planned to begin in 2009. Legislation mandating alcohol interlocks for convicted drivers and vehicle confiscation for recidivists was to be presented to Parliament at the end of 2009.

LESSONS

Not all credit-taking should be believed. Still, it would be unreasonable to think that the large reduction in fatalities in a period of increasing travel is not due, in part, to a sequence of safety management actions. What lessons can be extracted from this success?

Public support and political will

Around 2002 the French started to take road safety seriously. This seems to have come about after a gestation period during which the population got convinced that road deaths and injuries are a serious health problem and are preventable. What brought about this change of attitude is perhaps debatable; I can certainly not speak about it with authority. Nevertheless, the change in public sentiment made it possible for President Chirac to see advantage and popularity in making road safety an election issue. (I recall and opposite example when the Liberal government of Ontario introduced photo-radar and lost the election (partly) because the Conservative opposition better gauged the public sentiment on this issue). Thus, in France, there was a change in public attitude which made it possible for the President to act. Once the President made road safety an issue, he had a functioning government machinery to act intelligently and with resolve.

No Infrastructure Programs?

Political and administrative will seems to have directed attention to behaviour: speeding and drink-driving. Unlike in some other countries, I have not found traces of significant infrastructure-oriented initiatives. I do not think that this should be regarded a 'lesson'. It is a hallmark of governmental action that programs that can be implemented without burdening the public purse are more attractive than those that have to be paid for by the treasury.

Timely Facts Help

The Road Safety Observatory was set up as a part of organizing for serious action in road safety. Its role is to bring the facts and the science to the table. It has been quite successful in getting the facts and doing the science; to what extent it has access to the decision-making table is unclear. What does seem to be clear is that the timely availability of facts and numbers helps to shape the public debate and thereby the politics.

Automatic Speed Enforcement Works

One of the main lessons must be the success of the CSA, the implementation of automatic speed control. No more the antiquated cops-and-robbers game of chasing down a few speeders but the modern and efficient ensuring that justice is swift and almost certain. It would be too easy to say that what can be done in France cannot work in the U.S.A. While countries and cultures truly differ, the consequence of their differing is often exaggerated and exploited. Thus, e.g., 86% of Swedes agreed to be organ donors but only 17% of Brits did so. On first thought one might attribute the difference to the peculiarities of Brits and altruism of Swedes. The difference is in governance and public policy. In Sweden you have to opt out from being a donor, in the U.K. you have to tick your agreement box. Countries where you have to tick a box to opt out have very high donation rates; countries where you have tick to agree have low donation rates. The difference is not in attitudes but in public policy. Serious enforcement worked for Giuliani on the streets of New York.

Amongst scholars there is consensus that lowering the average speed reduces fatalities and injuries. Automatic speed enforcement lowers the average speed. It follows that modern automatic speed enforcement deserves serious consideration.

Seat Belts and Helmets Work.

In France seat-belt and helmet wearing seems to be an issue of the past. There may be a lesson in it for the U.S.A. Not only are these devices, beyond reasonable doubt, cheap and effective countermeasures. They are important symbols. Persons who initially buckle-up because to do so is the law will, in time, adopt new attitudes towards risk-taking; they will avoid cognitive dissonance by internalizing safety conscious behaviours. Attitudes are not god-given and therefore should not be viewed as primal or not sacrosanct.

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NORWAY

EVOLUTION OVER TIME

Norway is comparable in population to Colorado or Alabama and in size to New Mexico. The evolution of Norwegian road accident fatalities over time is in Figure 5. It shows the fatality mountain typical of all developed countries. Seeing the sudden turnaround it is natural to think that something that occurred around 1970 caused a change in the trend. The truth is that no concerted action is needed to create such a shape in a time series. The usual explanation for the shape in Figure 5 is that it is a necessary consequence of two monotone time trends: the continuing increase in the amount of travel and of the steady decline in the risk of a fatality per unit of travel (see Appendix). The steady decline in risk is usually attributed to nearly continuous improvements in medicine, EMS, safer vehicles, better roads, changed social norms etc.

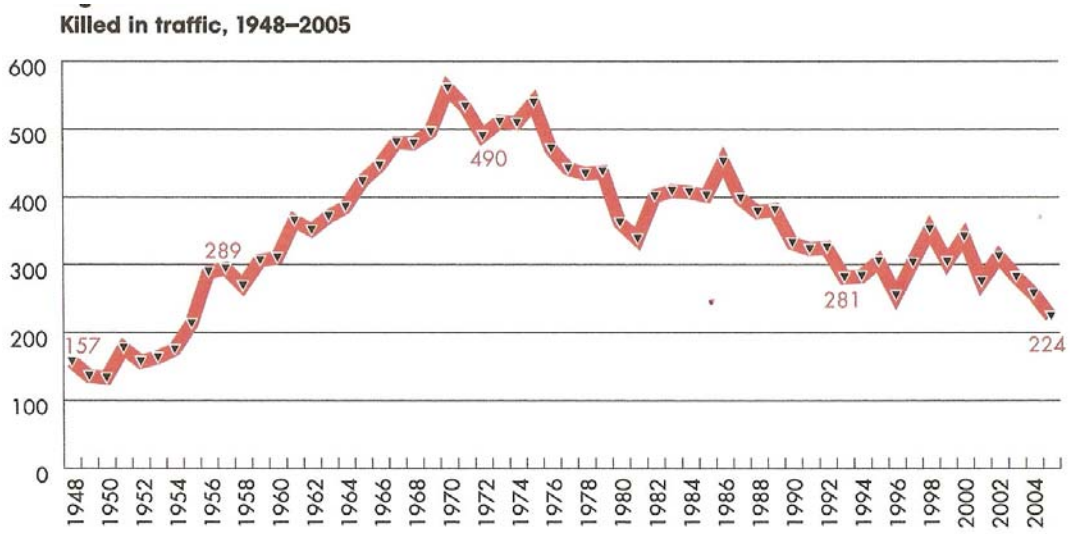

Figure 5. Based on Figure 3 from Norwegian Public Road Administration (2006)

The growth in travel and the indexed change in injury crashes and in fatalities is shown in Figure 6. Its left part covers nearly 40 years and is indexed to 1970 when there were 560 fatalities and 9266 injury crashes. The impression of forty years of steady decline in fatalities but only a modest decline in injury crashes. While the number of fatalities has been about halved (to 255 in 2008) the number of injury crashes was reduced only by about 20% (to 7537). The right part of Figure 6 covers the more recent 18 years and the index year is 1990. Here the decline in fatalities is more erratic because the numbers are small and the effect of random variation more pronounced.

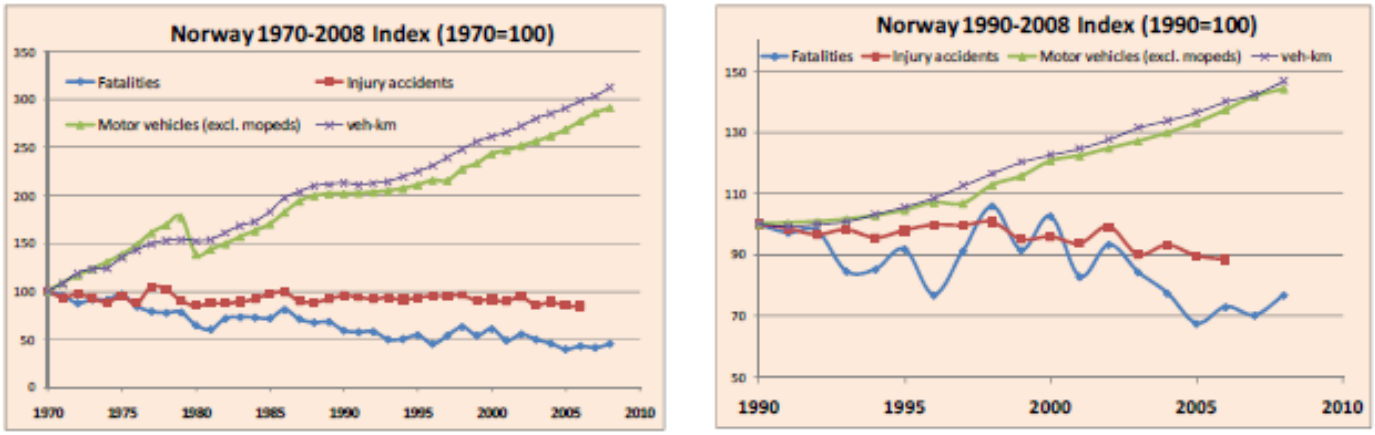

Figure 6. Adapted from IRTAD (2009, p. 163)

PLANNING AND POLICY

According to Elvik (2009) *"Road safety policy making at the national level of government in Norway largely takes place within the framework of the national transport plan. This plan covers a period of 10-years and is developed by the Ministry of Transport… The final plan is presented to Parliament as a report."* (p. 817). The National Transport Plan is produced every four years and elaborates on how the Government intends to prioritize resources within the transport sector over the next ten years. Thus, e.g., The Ministry of Transport and Communications presented the transport policy document National Transport Plan 2002-2011 to the Norwegian Parliament on 29 September 2000. The plan was adopted by the Parliament on 15 February 2001. Four years later another plan (Norwegian Public Roads Administration, 2006) was produced and presented. The latest plan is for the period 2010-2019 (Norwegian Ministry of Transport and Communications, 2009).

Safety is one of the four stated objectives as shown the excerpt in Figure 7. The statement of policy objective for safety contains two important elements:

1. Commitment to Vision Zero and
2. Quantitative target for fatalities and severe injuries.

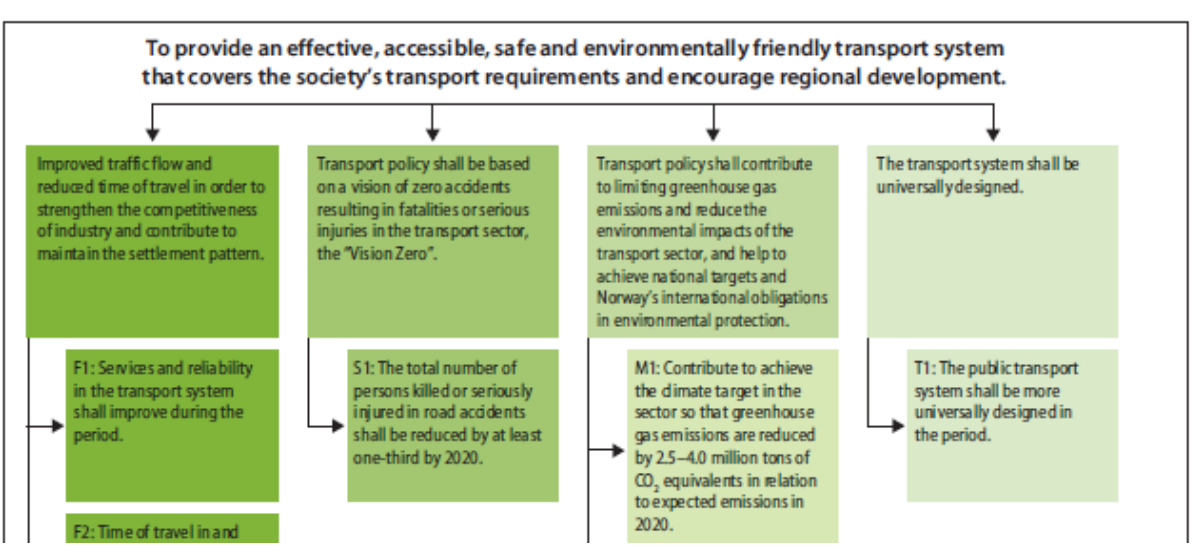

Figure 7. Excerpt from the objectives of the national transport plan.

THE NORWEGIAN VISION ZERO AND SAFETY TARGET

The Vision Zero concept was first coined and implemented in Sweden and will be discussed in Section 3. Norway found its own way to Vision Zero as is shown in the box below. Two elements deserve mention. First, the hallmark of Vision Zero is in the shift from "blame the user" attitude to the explicit recognition that the Government's is responsible for the safety of the infrastructure which it produces. But where should one draw the boundary between the responsibility of the user and that of the Government?

The Norwegians say that*: "Road users and authorities have a joint responsibility for traffic safety. The road users are responsible for their own behavior; they must be cautious and avoid conscious violation of rules. The authorities are responsible for offering a road system adapted for as safe behaviour as possible and protect against fatal consequences of unconscious erroneous actions."* (p.3).

The second element of note is in their reservation about the literal meaning of 'zero' that is manifest in the following quote: *"It is difficult to imagine a transportation system as currently designed without fatalities or severe injuries. Vision Zero is therefore imagined as a curve where the*

Vision Zero

Through NTP (the National Transport Plan), the Government has established that Vision Zero shall form the basis for the traffic safety activities in Norway. Vision Zero was first discussed in the national parliament during the handling of NTP 2002-2011, and subsequently with the handling of NTP 2006-2015. In the document "Road Traffic Safety 2002-2011" the Government states that:

The Government views the large number of killed and injured in road traffic as a serious national concern. Therefore, a vision of no one being killed or permanently disabled has been established as a basis for the long-term traffic safety effort. The vision means that the Government, in addition to conducting a policy with the goal of reducing the total number of accidents, will focus strongly on measures that can reduce the most serious accidents. .

From Norvegian Public Roads Administration. (March 2006) p.3

numbers of killed and seriously injured approach zero. …it is difficult to imagine that the curve will reach zero, but it is realistic to anticipate a continuous reduction …" (p. 3)

In accord with this vision the most recent plan (Norwegian Ministry of Transport and Communications, 2009, p. 11) announces that*: "the aim will be to reduce by 2020 the number of fatalities or serious injuries by at least a third, compared with 2005-2008. … This will be ensured through an increased investment in targeted measures and close to a 50 per cent increase in the length of four lane roads."*

ISSUES AND LESSONS

Norway is a relatively small country and does not seem to be a source of some unique action programs from which lessons for the U.S.A. can be extracted. However, in the course of the review several issues arose which merit airing and may contain valuable lessons.

Safety as Part of a National Transport Plan

In Norway a National Transport Plan covering a future period of ten years is presented to parliament every four years. The plan for road safety is a part of the National Transport Plan. Within this framework road safety can take its natural place as a cost of mobility and not as an independent or overriding goal. Note, e.g., that in Figure 7 the two leftmost policy aims, that of reducing travel time and that of gradually eliminating fatalities and serious injuries can be in conflict. Similarly, land-use plans, transport plans, and safety plans affect each other's outcomes. If separate agencies prepare their separate plans the danger is that interdependencies of this kind are not considered and plans work at cross purposes.

A TZD initiative implies concerted action; targets, action plans and a network of inter-relationships between agencies that fosters symbiosis. The thinking about TZD should not be confined to a search of "what new actions and programmes initiatives should we take" assuming that the present field of actors, institutions and responsibilities should remain without change and the now prevailing division of labor to continue. Rather one should ask how the prevailing arrangements need to be modified to increase the chances of TZD to succeed. One such issue that demands thought is the apparent imbalance between resources and attention devoted to urban and rural road safety.

Setting Targets?

As noted earlier, in Norway, the National Transport Plan sets out overall quantitative safety targets (e.g.*,"reduce by 2020… by at least a third, compared with 2005-2008."*) To achieve these one has to prepare a plan of diverse actions and these, in turn, also require quantified targets. Some of these 'intermediate' targets for Norway are illustrated in Table 3.

Table 3: Extract of the first few rows from Table 1 in Elvik, 2008, page 1117

	State in 2007	Target for 2020
Targets set for road safety indicators		
1. Share of traffic complying with speed limits	52.6%	75%
2. Seat belt wearing in built up areas	85.4%	95%
3. Seat belt wearing outside built up areas	92.3%	97%
4. Use of bicycle helmets among children below the age of 12 years	62.9%	90%

Management by quantitative objectives is well accepted and makes good sense. However, in spite of the optimistic tone of OECD (2008) there is no clear evidence to show that countries that adopted overall quantified safety targets did substantially better than countries that did not do so. (Wong et al., 2006). The problem is that both success and failure are hard to tell. The count of fatalities and injuries is affected by many factors the influence of which is not well understood, difficult to separate out, and hard to predict. As a result one may see large change in the counts of injuries and fatalities when no new actions are implemented and, conversely, little change in spite of major interventions (see Appendix).

The first chapter of OECD(2008) provides a comprehensive discussion of road safety targets and recommends their adoption based on the following reasoning: *"The setting of quantitative targets communicates the importance of road safety, motivates stakeholders to act and holds managers…accountable for achieving defined positive results. …the message is conveyed that the government is serious about reducing the current road toll. … Further, ambitious targets raise media and public awareness and hence motivate politicians…"*(pp. 37-38) Norway, Australia and New Zealand serve as examples in OECD (2008) for how quantified targets are set.

Besides the aforementioned merits, there are also difficulties. One usually chooses a number (or percentage) X by which fatalities and severe injuries are to be reduced by a certain date and then prepares a plan of actions (such as that in Table 3) which promises to meet the target efficiently. How is one to decide whether X should be 20% or 50%? Perhaps a 20% target will see many cost-effective actions unfunded, perhaps 50% will imply that money is spent on actions that cost more than they achieve? That X is based on some unspecified judgment is a clear drawback.

A lower limit on X is that reduction which would be attained with 'business as usual'; if no new programs were funded, no new interventions implemented. This lower limit is difficult to estimate because we neither well understand the factors that shape the time series of fatality or injury counts nor can satisfactorily predict their future magnitudes.. Thus, e.g., Elvik (2007, pp.17-18) shows that three statistically indistinguishable fits to the Norwegian fatality count data from 1970 to 2005 predict that if present trends continue in 2020 one should expect 125, 188 or 259 fatalities. With this range of uncertainty as baseline it is difficult to set a sensible target.

Another obvious problem is that, in view of the many uncontrollable and poorly understood factors which will determine the future counts, the setting of a quantitative carries a risk of visible embarrassment. The attractions of quantitative targets which the OECD (2008) lists must be balanced against the possible damages to road safety programs of a perceived failure.

In the final account what matters are the actions that bring about the achievement of indicator targets such as those listed in Table 3. These can be selected on the basis of cost-effectiveness considerations and the best present understanding of cause and effect. An overall quantified target is not necessary for the formulation of an efficient program of action. The attraction of specifying overall quantified targets must be balanced against their blemishes.

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SWEDEN

EVOLUTION OVER TIME

The evolution of Swedish road accident fatalities also has the by now familiar mountain shape. Fatalities increased till they reached a peak between 1964 and 1970 at around 1300 deaths/year and declined thereafter. As noted in earlier sections, seeing the change in trend may lead one to think that something in the late sixties that caused the turnaround. The truth is that no concerted action is needed to create such a shape in a time series (see Appendix).

The growth in travel and the indexed change in injury crashes and in fatalities is shown in Figure 8. Its left part covers nearly 40 years and is indexed to 1970 when there were 1307 fatalities and 16,636 injury crashes. The impression is of forty years of wavy decline in fatalities but stagnation and modest increase in injury crashes. While the number of fatalities has been cut to less than a third (from 1307 in 1970to 397 in 2008) the number of injury crashes increased by 12% (from 16,636 in 1970 to 18,642 in 2008). The right part of Figure 8covers the more recent 18 years and the index year is 1990 showing another halving of fatalities and a slight increase in injuries.

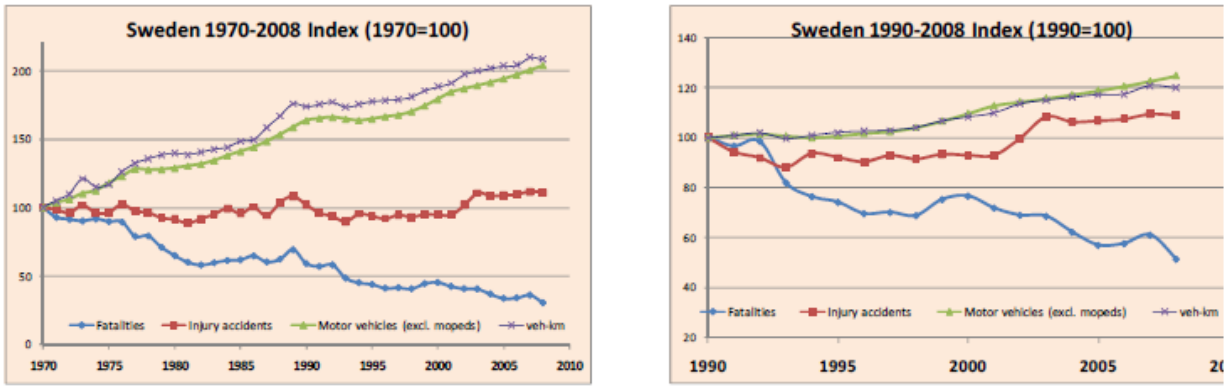

Figure 8 Adapted from IRTAD (2009, p. 197)

VISION ZERO: POLICY AND PROGRESS

The root of the renaissance of road safety management is in Sweden and it's Vision Zero. This section describes the emergence of this policy, the philosophy behind it, the practical principles emanating from it, and how it evolved till today.

Policy

Johansson (2009) writes that: *"Following the elections in the autumn 1994 Sweden got a new Minister for Transportation. The Minister declared that traffic safety would be one of her priorities. A dialog was started between the Minister's Staff and the SRA (Swedish Road Administration[3]) on how the Minister could make traffic safety a prioritized subject."* (p. 826).

[3] The Swedish Road Administration (SRA) had an overall responsibility for Road Traffic Safety in Sweden. Administrations like the SRA often have semi-political tasks like development of policies and targets.

Shortly thereafter the SRA developed Vision Zero. It is based on the premise that even if crashes cannot be avoided altogether, one can ensure that they do not lead to death or severe injury. The Minister adopted the basic idea and presented it to Parliament in 1997 where it was accepted by all parties. Much of the political debate preceding the adoption of Vision Zero was about how many road traffic fatalities are tolerable. In the event it was concluded that *"….a zero fatality target was the only justifiable target for road traffic." (Johansson, 2009, p.826). The 1997 bill on Traffic Safety says that:"* Vision Zero means that eventually no one will be killed or seriously injured within the road traffic system."

This premise and wording are a game-changer. By Vision Zero one does not ask how to reduce the number of accidents; now the question is what must be done to eliminate the risk of chronic health impairment. To illustrate the implication for road design Johansson says that the dominant strategy for reducing accident frequency was to build *"wider lanes, straighter roads, larger crossings etc."* However, *"The strategy…has not been successful in reducing fatalities and other severe injuries… A wide, strait road has more fatalities than a narrow road with many curves if everything else is the same. The reason is simple: the most predominant effect of creating more space is an increase in driving speed, which means higher levels of kinetic energy in crashes. Higher energy levels lead to more severe health losses, all other things being equal. This increase in speed has two reasons; first road administrations normally set a higher speed limit on roads that are wide and straight because they are said to have a higher safety standard, and drivers tend to drive faster anyway on these roads*."(pp. 827-828). Instead of trying to reduce accidents, Vision Zero design strategy is to reduce the injurious energy to which the road user is exposed by following some simple rules. Thus, e.g., that pedestrians should not be exposed to cars exceeding 30 km/h; that car occupants should not be exposed to right-angle collisions with cars exceeding 50 km/h and head-on collisions with cars moving faster than 70 km/h. These rules have clear implications for what speed limits to use where, when to use roundabouts, which traffic streams must be separated by barriers etc.

Implied by Vision Zero is a new allocation of responsibility:

> *"1. The designers of the system are always ultimately responsible for the design, operations and use of the road transport system and are thereby responsible for the level of safety within the entire system.*
>
> *2. Road users are responsible for following the rules for using the road transport system set by the system designers.*
>
> *3. If road users fail to obey these rules due to a lack of knowledge, acceptance or ability, or if injuries do occur, the system designers are required to take the necessary further steps to counteract people being killed and seriously injured."*Johansson (2009, p. 827).

The shift is from a 'blame the user' paradigm to *"the producer is responsible for the safety of the product"* attitude; from basing road design on an unspecified 'safety factor' to designing and operating roads so that the level of violence that humans can tolerate is not exceeded. Stated differently: *" Since we can never escape the fact that human beings are not infallible, the road transport system must be designed so that any mistakes will not cause serious or fatal injury. This approach means shifting a major share of the safety responsibility from road*

users to those who design the road transport system. System designers primarily include road managers, the automotive industry, the police, politicians and legislative bodies. These are the ones responsible for providing a system that can deal with the mistakes that road users will undoubtedly be making. However, there are also many other players who have a responsibility for road safety: transport carriers, health services, the judicial system, schools and road safety organizations…It is the responsibility of individual road users to abide by laws and regulations." (Vägverket, 2006)

Progress

In their 'Independent Review' Breen et al. (2008) note that: *"Vision Zero was adopted as the basis for future road safety work in the National Transport Policy 1998, but as one of six transport goals, Parliament also set an interim quantitative target to reduce deaths by 50% by the year 2007. As noted by the SRA in its last annual report, the system is far from being designed on the basis of the Vision Zero decision and the rate of fall (in fatalities and severe injuries) is too slow, viewed in relation to the interim goal for 2007."* A year later Lie and Tingvall (2009) noted that while the target of a 50% reduction for 2007 set in 1997 was not met; 541 persons were killed on the Swedish roads in 1997, whereas 471 were killed in 2007.

"In May 2009, the Swedish Parliament decided (on) a new road safety target for 2020 - a 50% reduction in fatalities from the base year 2006-2008, as well as the new management by objectives approach to road safety work. The core of the new system is collaboration of different stakeholders. The Parliament also decided on a target of a 25% reduction in severely injured persons, as defined by functional capacity after the injury rather than police reports." (IRTAD, 2009, p.202).The old and new targets for fatalities are depicted in Figure 9.

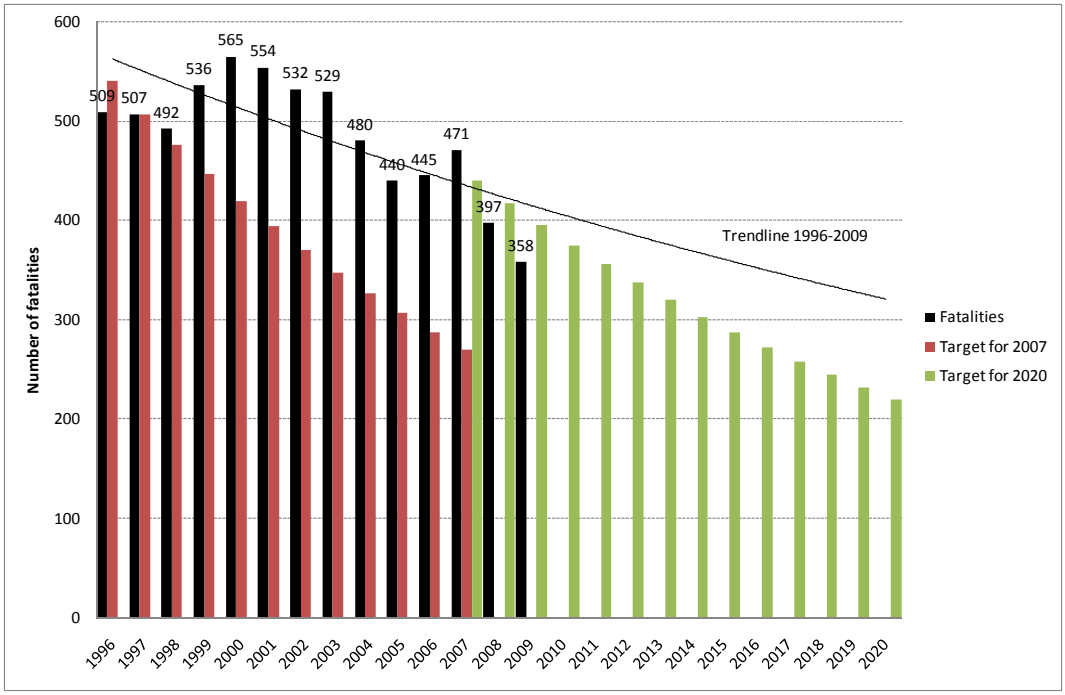

Figure 9. From Elvik et al., 2010

Management by Objectives, Interim Targets, and Safety Indicators

The failure to meet the 2007 target triggered an inquiry which concluded that the target was missed mainly because too few effective measures were implemented (Vägverket, 2008, p.3).The SRA was commissioned by the Government to propose new interim targets and to make suggestions on continuing road safety work in accordance with Vision Zero. The original 2007 target *"was set without consultation with or commitments from parties"* (Lie and Tingvall, 2009). To ensure that the new interim target for 2020 is met the aforementioned management-by-objectives mechanism was put in place It consists of three main elements:

1. Cooperation between all parties when drawing up interim targets;
2. Use of interim targets and measurable 'Safety Performance Indicators';
3. An annual conference to review trends and target achievements.

One of the lessons learnt was that the target for the number of fatalities did not provide sufficient guidance to stakeholders for activity planning; that *"More action-related interim targets are needed"* (Vägverket, 2008, p.6). Actions were to be planned to reach interim targets. Specifically, that by 2020 80 per cent of vehicle kilometers on state roads be below the speed limits, that compliance on municipal streets be increased by 86 per cent., that 99.90 per cent of vehicle kilometers be driven by drivers with BAC below 0,02 per cent, that at most 5 per cent of drivers are to state that they have fallen asleep fallen asleep while driving, that 99 per cent of drivers and passengers use seat belts, that 70 per cent of cyclists wear helmets, that all new cars have the highest safety rating Euro NCAP , that 75 per cent of vehicle kilometers on roads with speed limit above 80 km/h is to take place on traffic-flow separated roads, etc. (Vägverket, 2008, p.11, Berg et al., 2009).

Progress towards these is to be discussed by stakeholders at annual 'Results Conferences'. Thus, in preparation for the 2009 'Results Conference'

Table 4 was prepared showing the current state and the end value of the interim targets.

Table 4. From Vägverket (2009)

Indicator	Starting point	2008	Target 2020
Share of vehicle kilometrage within the speed restrictions	43 %	-	80 %
Share of vehicle kilometrage within the speed restrictions	52 %	-	Increase of 86 %
Share of vehicle kilometrage with sober drivers	99.76 %	-	99.9 %
Share of passengers using seat belts in the front seat of a passenger car	96 %	95 %	99 %
Share of cyclists wearing a helmet	27 %	28 %	70 %
Share of new passenger cars sales with the highest EuroNCAP score	66 %	71 %	100 %
Share of new heavy vehicles with automatic braking system	0 %	0 %	100 %
Share of vehicle kilometrage on roads with speed limits over 80km/h of dual-carriageway roads	50 %	52 %	75 %
Share of safe pedestrian, cycle and moped passages for the main municipal street network	Approx 25 %	-	Not defined
Percentage of safe junctions on the main municipal street network	Approx 50 %	-	Not defined
Average time from injury to adequate rescue/medical care	-	12.3 min	Not defined
Share of drivers who stated that they have fallen asleep or nearly fallen asleep while driving	11.9 %	12.7 %	6 %
Prioritisation of road safety	-	-	Not defined

Each of these interim targets is supported by a corresponding analysis. Thus, e.g., the action needed to reach the interim target for bicycle helmet wearing and its expected results are shown in Figure 10.

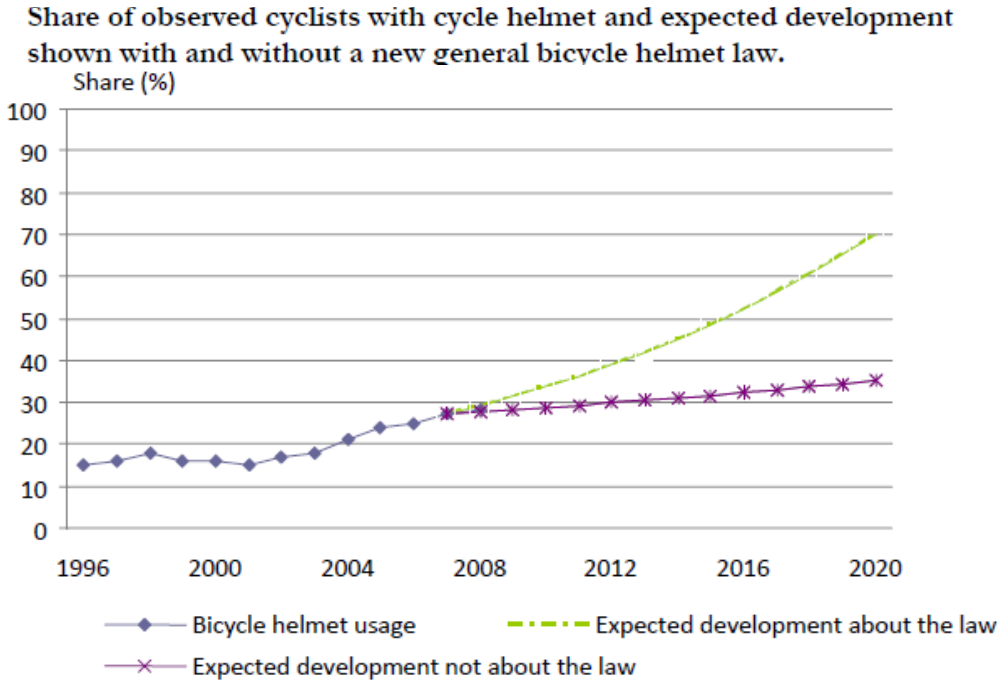

Figure 10. Based on Diagram 16, Vägverket (2009)

In sum, stakeholders define and adopt a set of safety-related actions and goals that need to be achieved in order to reach the target for fatality and serious injury reductions by the set date. These goals imply a set of actions and the ability to estimate how many fatalities and serious injuries will be saved by what action. Thus, e.g., one must be able to tell how many fatalities and serious injuries are expected to be saved if the proportion of helmeted bicycle riders increased from x to y. Progress toward towards these goals is reviewed by the stakeholders annually. This implies a system of data collection for monitoring. Thus, e.g., one must conduct and annual survey to determine the proportion of helmeted bicycle riders.

ISSUES AND LESSONS

The New Paradigm

Upon hearing the phrase 'Vision Zero' the first reaction is to think that a functioning road transport system with no fatalities cannot exist and therefore it is unrealistic to aim for one. In this sense 'Towards Zero Deaths' (TZD) is a better choice of phrase. But if TZD is to mean what the words imply then one will not be content with seeing in the U.S.A. 20,000 deaths/year, nor will one stop at 10,000, and perhaps even 5,000 may not be deemed close enough to zero. In this sense there is little difference between Vision Zero and TZD; neither can be achieved by just chipping away at the fatality mountain with picks and chisels; both require a change in paradigm. To think that sharper chisels and a few new picks will achieve what the TZD words mean is, in my opinion, an illusion.

There is a fundamental difference between Vision Zero and the current North American attitudes to managing road safety. It may be useful to put the difference in sharp relief so that it is clear what choices we face. The Swedes (as well as the Norwegians, Dutch, New

Zealanders, Australians, World Bank, OECD etc.) say that the workplace, the rail or the air transport system are designed so that there will be no fatalities. In those systems, when fatalities occasionally occur, they are viewed as a failure the causes of which need to be remedied. The road transport system, so the Swedes (and the others) say, was not designed to be fatality free. This, they say, is not acceptable any more in their society. Through the workings of politics, so they say, their society chose to strive for a road system that is designed and operated so that fatal and incapacitating injuries do not occur.

In North America, in contrast, the guiding principle seems to be one of comparing benefits and costs. Even if we do not do the benefit-cost calculations explicitly, the thinking is that one should invest public money in the same manner in which citizens would elect to spend their own money. You do not spend public money on saving an anonymous life if doing so costs more than what people say (or imply by action) is the Value of a Statistical Life (VSL). Civil servants and politicians place their trust in the ability of economists to come up with a reasonable guidance VSL.

To saves lives one has to pay in money, time and freedom. It must be clear that to adopt TZD as a guiding principle is to abandon the cost-benefit frame of thought[4]. With TZD the customary trade-offs between travel time and chance of injury will not be made. Choices will have to be guided by the primacy of saving life and this primacy will have to rest on a choice made by politicians as representing the will of the public, not by the methods of economists as the interpreters of people's values.

Personally I do not believe that economists can relied upon to obtain reasonable VSL estimates; nor do I believe that the VSL estimates now in use are reasonable. But my opinion is a minority view. The Office of Management and Budget under both Democratic and Republican administrations insisted on examining all major regulatory initiatives from a benefit and cost perspective. The adoption of TZD would be a break with this long-standing tradition and with the convictions deeply rooted in North American culture.

Does the reader think that the U.S.A. should adopt the new paradigm? Can the politicians at the highest level be persuaded that such a break with tradition would be supported by the road users? Or does the reader think that one can make substantive progress towards zero deaths relying only on new countermeasure and on technological innovation? In answering these questions one should remember that there is no reason to think that the recent downturn in fatalities will continue and there is good reason to believe that when the economy rebounds, so will the fatalities.

How to Deal with Speed

The success of France in reducing fatalities is usually attributed to its determination to strictly enforce speed limits. While strict enforcement may not be popular, speed limits have been around for long enough for their enforcement to be acceptable. In Vision Zero, however, speed is not just something to be enforced; it is the organizing principle for

[4] Cost-effect considerations may still be used to determine which of two measures should be implemented first. However, one will have to implement life-saving programs in which the cost (in time, money and freedom) will exceed the benefit if measured in what the econometricians say is the VSL.

practice. Thus, where pedestrians cross the road traffic must not move faster than what the pedestrian can usually survive. That is, unless pedestrians can be given their physically separated right of way, traffic must be limited to 30 km/h. Similarly, where vehicle paths cross at right angles, the speed of conflicting streams must be less than 50 km/h. You may build a roundabout with an appropriate deflection angle so that traffic moves at less than 50 km/h or, if not, you have to correspondingly limit the approach speed. Similarly, where vehicles can collide head on the speed must not exceed 70 km/h; either you build a barrier or you limit the speed.

This kind of attitude to speed does not prevail in North America. And therefore the question is whether it is possible for the U.S.A to approach the 'Zero Death' goal without a fundamental change of thinking about speed. Vision Zero and similar national programs are built on the premise that the human body inside a car cannot withstand collisions at the speeds at which cars and roads are now used. It follows that to approach zero death one must either eliminate the possibility of collisions at death-generating speed or reduce the speed.

Are we ready to make the investment in the road system which will substantially reduce the opportunities for high-speed collisions? If not, are we ready to substantially reduce speed limits and enforce them? If not, can one keep the present disparity between the speed in use and the tolerance of the human body and still approach Zero Deaths?

How to Deal with Infrastructure?

According to Vision Zero when the speed exceeds 70 km/h oncoming vehicles must be separated by a barrier. This led Sweden to embark an innovative program of road re-design. Thus, e.g., rural two-lane rural roads are being converted to the innovative 2+1 design[5]. Similar innovative upgrades are applied to run-off-the-road accidents, intersections etc. For a description of what is being done see e.g., Larsson et al. (2003). Similarly, considerations motivate the conversion of right-angle intersections with high-speed approaches to roundabouts. In short, implied by Vision Zero and its TZD cousin is a commitment to large scale re-thinking, re-design and reconstruction. Are we ready for it?

Where is the Box?

The authors of the white papers are being urged to think outside the box. I hope that this does not mean that we are to propose novel countermeasures, technological marvels and miracle cures. Such a tack would be, in my opinion, a prescription for future disappointment. The creators of Vision Zero took the opposite approach. They asked: "What do we know now that will allow us to make progress towards our vision?" We know that people die because the kinetic energy of a crash is more than what the human body can withstand. Either we can remove or shield the body from the incompatible energy or

[5] There is one continuous lane in each direction and one middle lane alternating the permitted direction of travel at intervals of 1.5-2.5 km. The 1.25 m flush median has a continuous flexible barrier, there are to 3.25 m wide traffic lanes in the two-lane direction and another 3.75 m wide lane alternating direction plus 0.75 m outer hard shoulders (2×0.75+2×3.25+3.75+1.25=13.00m).

we need to reduce that energy. This is plain logic and is based on knowledge that is already in the box. It leads to action that is usually costly; costly in money as well as road user time and freedom.

There are those who balk at the need to pay the piper; those who believe that there are actions (interventions, countermeasures) that can reduce the toll of crashes cheaply; those who hope that through invention and discovery one can somehow obviate the need to pay the price which the Swedes (and others) maintain is necessary. To build the TZD on this belief and hope would be a gamble, perhaps a deception.

TZD and Management by Objectives.

Sweden's failure to meet its 2007 target triggered a thorough rethinking. It became obvious that:

1. There needs to be a knowledge-based plan of actions designed to meet the target;
2. For the actions to be implemented there needs to be buy-in by those who have to implement the required actions;
3. One has to specify several measurable indicators or interim targets;
4. Change in these indicators need to be monitored;
5. Progress towards the interim targets has to be periodically discussed by all involved parties.

The lesson for TZD is obvious. If there is to be a target and a target date then there should exist a plan of actions. That plan of actions has to be prepared on the basis of cost-benefit considerations[6] and it has to be prepared with the participation of those will have to implement it. The actions to be undertaken will have consequences which have to be measurable and have to be periodically measured. This too requires some doing. Thus, e.g., if speed enforcement to be one of the actions then one has to have a system in place to periodically get a picture of the representative prevailing speed distributions. Finally, progress on the actions of the plan has to be monitored and discussed by the stakeholders and the plan adapted in accord.

Do we need a Vision, Do we need a Target?

The difference between Vision Zero and TZD is just a nuance of wording. In terms of action the two phrases have similar meaning. That is, that one cannot get close to zero deaths without sacrifices which cannot be justified in cost-benefit terms. I doubt that in the U.S.A. such a change of paradigm is going to fly.

If TZD is to be a slogan but cost-benefit considerations will continue be the principle, and if the econometric VSL will continue to determine the size of the live-saved benefit, then there is something not quite honest afoot. Therefore, unless a genuine change of paradigm is desired and possible one should ask:"Do we need this TZD 'Vision'?" I am not competent to speculate. However, it is perfectly possible to prepare a plan of action that is guided by

[6] Elvik reviews the methodology in his 2007 and 2009 papers.

cost-benefit considerations just as described in section 0. For that purpose neither 'Vision' nor 'Target' are required.

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HOLLAND

For an outsider it is difficult to get the right picture of how road safety in a country is being managed. The delicate and complex interrelationships between jurisdictions are seldom described directly in the written and publicly available text.

EVOLUTION OVER TIME

The evolution of the Dutch road accident fatalities has the familiar mountain shape shown in Figure 11. As in the other countries, the turnaround was not due to something that was done or happened around 1970. Rather is seems to be due two separate time trends: the continuous increase in the amount of travel and the steady decline in the risk of a fatality per unit of travel (see Appendix.) The latter is usually attributed to nearly continuous improvements in medicine, EMS, safer vehicles, better roads, changed social norms etc.

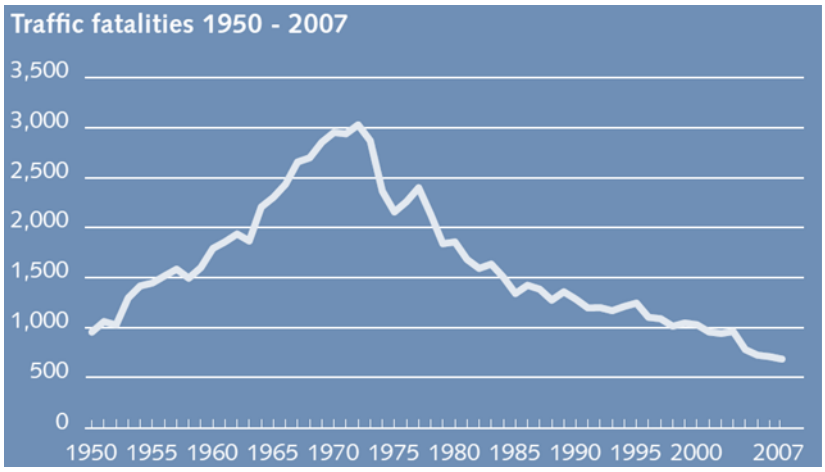

Figure 11. Traffic fatalities since 1950

The growth in travel and the indexed change in injury crashes and fatalities in Holland are shown in Figure 12.

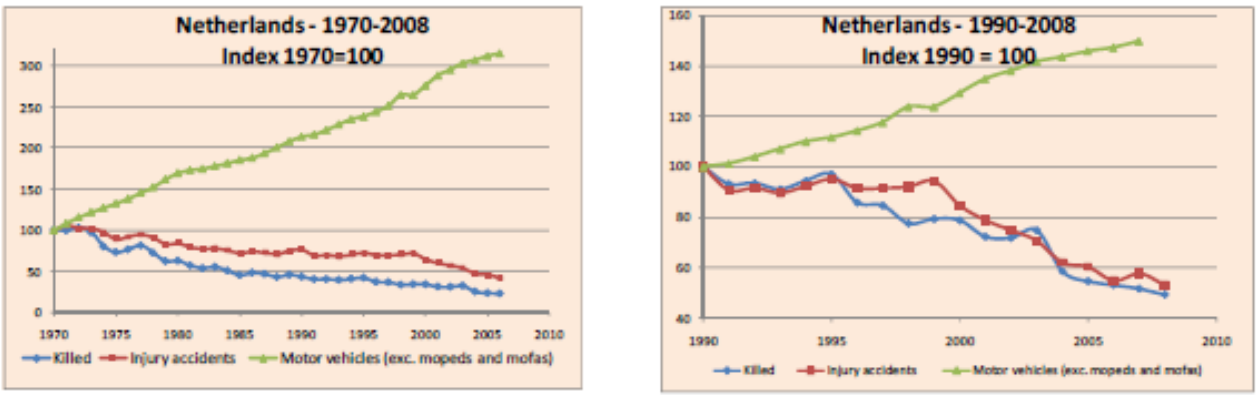

Figure 12 Adapted from IRTAD (2009, p. 145)

The left part of Figure 12 covers nearly 40 years and is indexed to 1970 when there were 3181 fatalities and 48,883 injury crashes. The impression is of an initially fast and later slower decline in fatalities. The number of fatalities has been cut to less than a quarter

(from 3181 in 1970 to 677in 2008) The right part of Figure 12 covers the more recent 18 years and the index year is 1990 showing another halving of fatalities and injuries.

SUSTAINABLE ROAD SAFETY: POLICY AND PROGRESS

The Swedes started on their road towards Vision Zero around 1994. The Dutch embarked on defining their vision around the same time, perhaps few years earlier (Koornstra et al., 1992). They called it 'Sustainable Safety'. At their core they both Vision Zero and Sustainable Safety rely on the same notion that *"efforts of education and enforcement notwithstanding, road users will remain fallible. The primary task, therefore, is to design the transport system and the road network in particular, to accommodate human error."* (Fildes and Langford, 2003)

Policy

The first Dutch 'Long-term Road safety Plan': MPV-I, was issued in 1987. Its theme was: 'More kilometers, less accidents'. The plan set a target of minus 25 % injury accidents for the period 1985 - 2000. Its focus were the traditional activities; speed, alcohol, blackspots etc. (Wegman and Wouters, 2002). The next plan (MPV-II) , released in 1989, was to be 'Ambitious, but attainable'. The targets were a 50% reduction in fatalities and a 40% reduction in serious injuries in 2010 compared with 1986 (van Schagen and Janssen, 2000).

In 1991, it seemed that these targets would not be met if traditional policies were continued. According to van Schagen and Janssen,(2000): *"…it became clear that strong, innovative measures were required to bring the road safety targets into reach. That was the immediate reason that in the early nineties the concept of sustainable safety was developed…"* (p. 18). In response, MPV-III, issued in 1991, adopted a 'twin pronged' policy of renewing and intensifying the traditional focused approach on the one hand, and the implementation of this 'Sustainable Safety' vision on the other.

The aim of Sustainable Safety is to leave for future generations an inherently safe road environment. If in such an environment accidents still occur, the conditions of the road and the vehicle are to be such that serious injuries almost never occur. As originally conceived, the sustainably-safe system is based upon three principles: functionality (there are to be only three road types, those that serve through traffic, those that distribute it, and those which serve for access) , homogeneity (there are to be no big speed and mass differences on the road), and predictability (the infrastructure should be "self-explaining" and elicit from the user the required, safe behaviour.)

Sustainable road safety was adopted as the Dutch national policy in 1996. *"The main challenge then was to convert the largely theoretical notions into functional requirements and operational criteria for actual design."* (van Schagen and Janssen, 2000, pp. 20,21). *"A Steering committee on Sustainable Safety, consisting of representatives of all tiers of government, developed an implementation strategy. It was decided to implement Sustainable Safety in two phases. The first phase was called the Start-up Programme."* (Weijermars and Wegman, 2011)

In December 1997 the Minister of Transport and representatives of the main road authority bodies signed an agreement for the "start-up programme" on sustainable safety

which covered the period 1998–2002. This Programme started in 1998. All were required to re-categorize their roads into one of the three sustainable safety categories (through-roads, distributor roads, or access roads). In addition, the 30 km/h zones in residential areas were to be extended to 12,000 km and the 60 km/h zones in rural areas to 3,000 km. Writing in 2005 Wegman and Aarts say that *"Now, there are about 30,000 kilometres of 30 km/h streets, representing just over a half of the convertible potential."* (p.57) and "*To date, the completed construction covers about half of the zones that qualify for 60 km/h conversion (more than 10,000 km."*(p. 57).Education and information campaigns helped to ensure the acceptance of these measures by users.

A system-wide implementation of the sustainable safety principles was to follow the start-up program. This was taken up in the Dutch National Traffic and Transport Plan (NVVP). Parliament rejected the plan although the relevant content of the plan found its way, in general terms, into the Mobility Paper (Ministry of Transport, 2004). The system-wide implementation did not materialize, partly, because of a pervasive policy of decentralization. While on the national level there is support for sustainable safety, implementation is at the local level and under control of regional governments. Although the second phase did not really get of the ground, the ideas of Sustainable Safety are still incorporated in national, regional, and local road safety policies.

In 2005 the sustainable safe vision was updated (Wegman & Aarts, 2006). The revision was needed mainly because the political and administrative realities have changed. To the aforementioned principles of 'functionality', 'homogeneity' and 'predictability' two new principles were added: 'Forgivingness' (creating surroundings that ensure that the consequences of errors remain limited and fostering behaviour when road users allow for each other's shortcomings) and 'State awareness' (the ability of users to match their performance capacity to the requirements of the task.) Wegman et al. (2006) estimate that the infrastructural Sustainable Safety measures (including roundabout construction) undertaken in the five years 1997-2002, led to a 9.7% reduction in road crash fatalities and a 4.1% reduction in severe road injuries nationally. In a more recent (draft paper) Weijermars and Wegman (2011) estimate that *"the risk to die in traffic decreased from 7,3 deaths per milliard km travelled in 1998 to 4,7 in 2007. We estimated that all measures together prevented 300 to 400 fatalities in 2007 and 1600 -1700 fatalities in total for the period 1998-2007. Finally, from a cost-benefit analysis we concluded that the measures were also cost-beneficial (c/b-ratio: 1:3,6)."*

The Mobility Paper (Ministry of Transport, 2004) set the following targets:

1. In 2010, traffic accidents should cause no more than 750 fatalities and 17,000 injuries.
2. In 2020, traffic accidents should cause no more than 580 fatalities and 12,250 injuries.

In the road safety strategy document for 2008-2020 the Minister of Transport (2008b?) suggests that it may be possible to aim for 500 fatalities in 2020 as is shown in Figure 13.

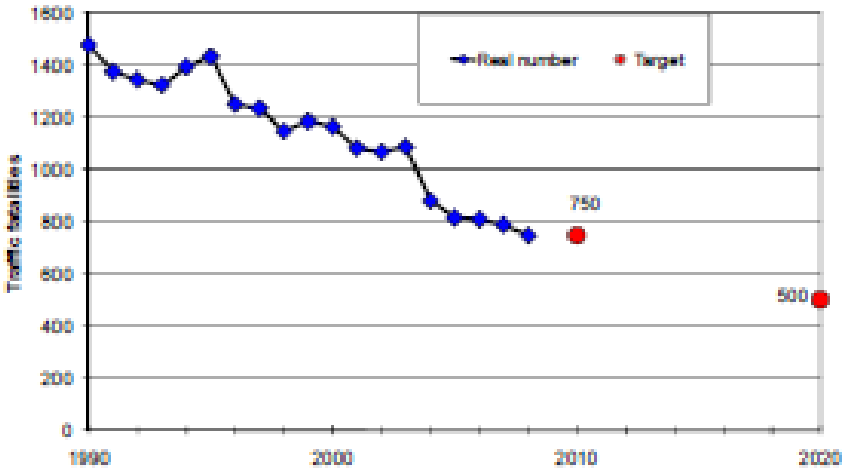

Figure 13. Based on IRTAD (2009, p. 152)

In this strategy document Sustainable Safety is reduced to just *"a source of inspiration"* (p. 10); its conceptual underpinnings are gone. Thus, e.g., in his letter to the Parliament the Minister says: *"What are we proposing? First7, we will be taking a tougher approach to people who cause unsafe situations. Relatively speaking, it is people who break the speed limit and people who drive after drinking alcohol who cause the most accidents. In a new development, these violators will be experiencing more direct consequences. This means: tit-for-tat, compulsory measures such as alcohol lock-out, speed limiting devices or behavioural modification course – paid for by the violator. Such measures would not be compulsory for all road users, only for drivers who do not follow the rules." (p.7) And furthermore, the Minister writes: "Of course the number of road casualties could be reduced far more if we were to make fundamentally different choices: free up significantly more funds for safety, or limit the freedom of drivers, cyclists and pedestrians. Those are not the choices I am making now."*(p.8)

Nothing is final; neither the commitment to the notion that 'errare humanum est' and the consequent aim to create an inherently safe environment, nor the conservative politician's inclination not to spend public money and to insist on law-and-order.

Vision Zero vs. Sustainable Safety

The Vision Zero and Sustainable Safety differ in several respects. The differences as the Dutch see them are discussed in SWOV Fact Sheet (2007)[8]. As I see it, the main difference is that by Vision Zero one has to strive for a system that is nearly free of incapacitating injury

[7] The 'Second' in the next paragraph of the letter pertains to actions to protect vulnerable road users (cyclists, motorcyclists, children, etc.)

[8] "A clear difference with Sustainable Safety is that Vision Zero only makes statements about the physical environment, i.e. vehicle, road, and other traffic. Enforcement and education are not regarded as system components. Obeying the rules is considered the road user's own responsibility; this as opposed to Sustainable Safety, which considers it to be a human weakness. 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. Furthermore, the Swedish system is less concrete about measures to be taken, whereas within Sustainable Safety the principles and how to put them into practice have been detailed". (Fact Sheet, 2007, p4.)

even if doing so limits mobility while by the Dutch Sustainable Safety the willingness to sacrifice mobility for safety is less clear-cut. Thus, when speaking of the main policy document, the Wegman and Aarts (2006a) say: *"The Dutch Mobility Paper (Ministry of Transport, 2004a) states that, while absolute safety and total risk exclusion does not exist, the number of casualties can, without any doubt, be further reduced. There is no lack of ideas, but the question is: at what cost? To this end, SWOV has proposed using the criterion of 'avoidable crashes' …. 'Avoidable' in this context means that we know what to do in order to prevent crashes and that it is cost-beneficial in societal terms to do this. In other words: the benefits exceed the costs."* (p.9)

A further difference is that the Swedish Vision Zero seems to have germinated in the administrative corridors of power and caught the imagination of the Minister while the Dutch Sustainable Safety seems to have been created at the behest of the administration relying heavily on the research institute SWOV[9].

ISSUES AND LESSONS

Why did Sustainable Safety Stall?

The ideas behind Sustainable Safety are said to still have wide support in the Netherlands. However, full-scale implementation seems to be stalled. The question is why? Part of the reason given is the policy of decentralization; it is difficult to implement a national policy if the decision-making powers are scattered amongst a myriad of small jurisdictions. Another reason is that the aims of sustainable safety are costly in freedom, mobility and money.

The concept and aims of sustainable safety were coined by scientists. Scientists are good at saying by what means these aims and targets might be reached. The aims themselves, however, are political and require the support of those in power. Policy is made by politicians, not by scientists or research institutes. Inasmuch as the political philosophy of those in power may change every few years, it is difficult to count on the same safety vision to be in place for decades. There may be two lessons in this for the TZD.

One lesson is that to ensure the survival of TZD for the long term one has to have the support of both Democrats and Conservatives. I am not competent to express views on this matter. However, there is one issue that may merit thought. Both Republican and Democratic administrations seem to have relied on the device of cost-benefit analysis for major regulatory action. The TZD should make the same its kingpin. The cost-benefit framework is adaptable in several ways. First, only actions that reach a certain limiting ratio of benefits to costs are deemed justified. An administration wanting to invest more in safety will require a smaller benefit-cost ratio. Second, there is considerable uncertainty about the Value of Statistical Life and Injury. An administration with more concern about road safety will use larger values. In this way the continued support of all future administrations could be maintained.

The second lesson is about the role of professionals and merits a separate paragraph.

[9] The SWOV is the Dutch National Institute for Road Safety Research founded in 1962. Being an independent, scientific institute its mission is to contribute to the improvement of road safety by using knowledge from scientific research.

The Role of Professionals

For some unfathomable reason the written material in Holland and elsewhere speaks about the role of visions, targets, programs, policies, funding and similar high level matters of more or less temporary nature but nothing is said about the role of professions. While high level decisions may be made by politicians and senior civil servants, how is it possible to overlook the fact that our transport environment is also (mainly?) shaped by urban planners, transportation planners, highway designers, traffic engineers and other professionals. If professionals shape our road safety future in important ways should one not examine how they play this role and think about how it should be played?

The decision which professionals make and how these affect our safety future are determined by the training they receive, by the traditions of their professions, and by the tools in their toolbox. In contrast to the unpredictable fortunes and upheavals of politics, professional practices and traditions have a long shelf-life. It follows that to ensure the continuity and effectiveness of TZD the role of the professions should not be overlooked. How is road safety considered in urban planning? How should it be considered? What must urban planners know to take road safety into account? These and similar questions should be asked and answered for transportation planners, highway designers and traffic engineers.

Like for an alcoholic, the first necessary step is to admit that, in spite of protestations to the contrary, professional practice in urban and transportation planning has little to do with road safety and that highway and traffic engineering practice leaves much to be desired in this respect. Reliance on professionals is of essence. To serve the interest of TZD in the long term the corresponding professional lore and traditions needs to be examined and where necessary changed and created.

How Far Should the Tail Wag the Dog?

The 'sustainability' idea was that we should leave to our children a road system that is 'inherently safe' even if to build it will cost a lot of money (€35 billion for Holland by some early SWOV estimates). Nowadays in Holland mobility is the dog and road safety is the tail. For the moment the Dutch are not going to spend a lot of money to make their roads inherently safe. A decade or two ago the balance may have been different. One generation's vision is not the dream of the next one.

But the nature of the road system is that its principal features lasts for generations. One can invest a lot now to make it safer for future generations or one can continue to build roads on which too many fatalities will continue to occur with statistical regularity and shift this burden to our grandchildren. Global warming and the environment in general present us with same dilemma and the same question: how much of the burden should this generation face? As far as I know the question is not answerable by objective and dispassionate economics. Nevertheless, the TZD will have to face the question and may find guidance in the corresponding environmental debate.

The Little Orphans

The Dutch embraced mainly the traditional ways to manage road safety. What is perhaps innovative and unique in their panoply of measures is the emphasis on the safety of

residential areas; the 30km/h areas, calming measures, the co-existence of cars and vulnerable users in the woonerven. In the U.S.A residential areas are road safety orphans. Look around! Much of what you see did not exist a few decades ago. It has all been built without any thought being given to how future safety of residential areas depends on the choices we make today. There is a lot to be learned from the Dutch attention to the matter and their experience.

The Big Orphans

Residential areas are the little safety orphan; the big orphans are the urban areas. In Holland an effort was made to involve all jurisdictions road safety delivery. Perhaps because of the nature of the country and its administrative setup there does not seem to be an urban-rural dichotomy. In the U.S.A. the road safety eye hovers mainly over rural roads. But fatalities and injuries occur not only on roads for which the Federal Government and the States are responsible; a large and growing share of these occurs in urban areas. In this sense there is neglect and imbalance. This imbalance should worry TZD thinkers. One cannot approach zero if nearly half of the problem will remains largely outside of the purview of TZD. Clearly a TZD management system must find legal, administrative and fiscal ways to strike a balance, to view urban and rural safety as one whole.

The Role of an Independent Research Institute

Much of what I have read about road safety in Holland was done and published by the independent research institute SWOV. The Institute for Road Safety Research (Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV) was established in 1962. It is funded by a grant from the Ministry of Transport (approximately 85%) and the EU (about 15%). SWOV's mission is to promote road safety by means of knowledge from scientific research. The research and knowledge dissemination programme is determined by SWOV itself. (Based on QANU, 2005, p.13)

The SWOV is one of the world's leading research institutes. However, its functioning in Holland goes beyond creating and disseminating knowledge. The prestige of the institute and the gravitas of its directors seem to carry weight with the Minister and influence what the Ministry does. As an outsider I cannot fairly describe how this works. However, there is no doubt that the SWOV left an indelible mark on Dutch road safety and is the principal author and mover of the Sustainable Safety process.

There are several road safety research institutes in the U.S.A. They differ from SWOV in that their main funding does not come from grants and therefore their program of research and of knowledge dissemination are not determined internally. They are contractors that compete in bidding on work the purpose and scope of which is determined by others. This lack of financial and scientific independence has consequences. First, that the relationship between government and research institute is that of source-of-money and supplier-of – research-services. This relationship is not conducive to the kind of consultative-initiating role that SWOV and its directors played. Second, that the personnel of research institutes, those who are given the lifelong opportunity to study road safety and develop good and current knowledge of this complex field, are not those who say what research needs to be done, how it should be done, or what knowledge is to be transmitted to who. It is the people who work for the source-of-money, those who are sensitive to the needs and

politics of their organizations who determine what is to be funded. The net result is that the prestige and knowledge residing in research institutes are not well used.

The U.S.A. model by which research institutes compete for research projects formulated by the government is not the only way to create and disseminate knowledge; the SWOV is another way. Outwardly the U.S.A. model may be in line with an ideological commitment to laissez faire competition. In reality, a large part of its attraction is that it gives the source-of-money control over the questions asked and, to some extent, the advice given. Those who will shape the TZD may want to consider the main options; the dependent and the independent research institutes. An independent institute must be funded by grants.

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THE UK

EVOLUTION OVER TIME

The growth in motorization and the indexed change in injury crashes and fatalities in the U.K. are shown in Figure 14. Its left part covers nearly 40 years and is indexed to 1970 when there were 7,771 fatalities and 272,765 injury crashes. In 2008 there were 2,675 fatalities and 176,273 injury accidents; a sharp decline in fatalities to about a third and a much more modest decline in injury crashes. The right part of Figure 14 covers the more recent 18 years and the index year is 1990 showing another halving of fatalities and lesser decline in injuries.

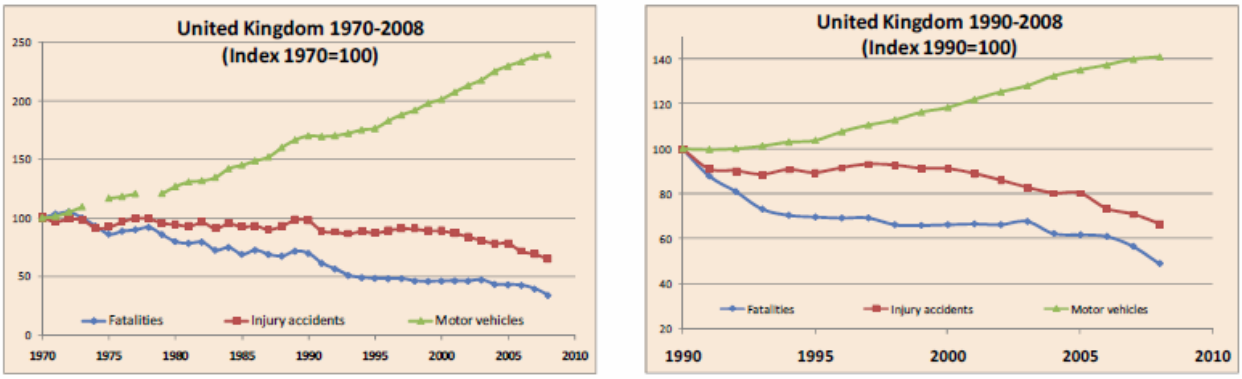

Figure 14 Adapted from IRTAD (2009, p. 214)

By now, having shown similar figures in all preceding sections (countries), they must be boring. Not only are the trends similar, but the numbers for the SUN countries (Sweden, U.K. and the Netherlands) are also quite similar as shown in Table 5.

Table 5. SUN countries, 2000 (From Table 3.2, p. 26 in Koornstra et al., 2002)

Fatality rates	Per Population (hundred thousand)	Per Motor vehicles (ten thousand)	Per Motor vehicle km (billion)
Sweden	6.65	1.21	8.44
UK(GB)	5.87	1.19	7.28
Netherlands	6.82	1.28	8.47

(In the U.S.A in the same year there were 14.87 fatalities/100,000 population, 1.93/10,000 motor vehicles and 9.49/ billion vehicle km.)

POLICY AND PROGRESS

Road safety has a long tradition in Great Britain. Driving licences and vehicle braking requirements, were introduced in 1903, a Highway Code was issued in 1931. The modern roundabout has its origin in the UK (Jacquemart, 1998). During the first 70 years of the last century, many safety-related measures were taken, often ahead of their introduction in

other countries. In the more recent period important safety initiatives were taken in order to improve the professional approach to the traffic safety problem and ensure a systematic approach to its improvement. From 1972 onwards training in accident reduction techniques has been provided for local safety engineers. The Institution of Highways and Transportation published guidelines on accident reduction and prevention in 1980 (updated in 1991). The Local Authorities Associations produced a Code of Good Road Safety Practice in 1989 (updated in 1996). The Institution of Highways and Transportation produced Guidelines for Urban Safety Management in 1990 and Guidelines on Road Safety Audit in 1990 (updated in 1996). Safety audits by independent safety experts became mandatory on motorways and trunk roads in 1991.

The first numerical target for reducing road accident casualties in Great Britain was set in 1987. By 2000 casualties were to be reduced by at least one third from the1981-85 average **(**Department of Transport, 1987). This target was based on a table that listed possible new countermeasures and estimates of the casualty reductions they might achieve. By 1998 the number of deaths on the road was reduced by 39% and the number of serious casualties by 45%.

In 2000, a new road safety strategy was published by the Government which set new casualty reduction targets for 2010: a 40% reduction in the overall number of people killed or seriously injured in road accidents, a 50% reduction in the number of children killed or seriously injured, and a 10% reduction in the slight casualty rate per vehicle kilometre, all compared to the average for 1994 - 1998. The programme consisted o f 10 themes (children oriented measures, better driver training and testing, drink drugs and drowsiness, safer infrastructure, speed measures, safer vehicles, safer motorcycling, safer pedestrians, cyclists , better enforcement, promoting safer road use. Ward et al., 2007a).

At the same time, it was announced that progress would be reviewed after 3 and 6 years to determine whether extra efforts might be required to ensure that this target would be achieved. In fact, progress towards the target has been reviewed annually at the Transport Research Laboratory, while the Department for Transport published formal reviews in 2004 and 2007. These reviews are re-calibration exercises. Targets tend to be few global numbers[10]. In terms of global targets the Ministers for Transport (Ladyman et al., 2007) say that: *"Overall progress against our targets is good. Using 2005 data, we can report that there has been a reported reduction in killed or seriously injured (KSI) casualties on Britain's roads: now 33% below the 1994-1998 baseline, against a 40% target by 2010."*(p. 2.) However, when examined in detail there were areas of concern. Thus, e.g., Ladyman et al. (2007) say that *"Our most pressing concern is the slow progress we are making on deaths. There has been a marked divergence in recent trends of deaths and KSIs."* This divergence is seen in Figure 15. Concerns, once identified, lead to a search for reasons and these, in turn, to a search for remedies (see, e.g., Ward et al., 2007a).

[10] In the UK targets are specified in KSI=Killed and Seriously Injured. In other countries the two categories tend to be kept separate.

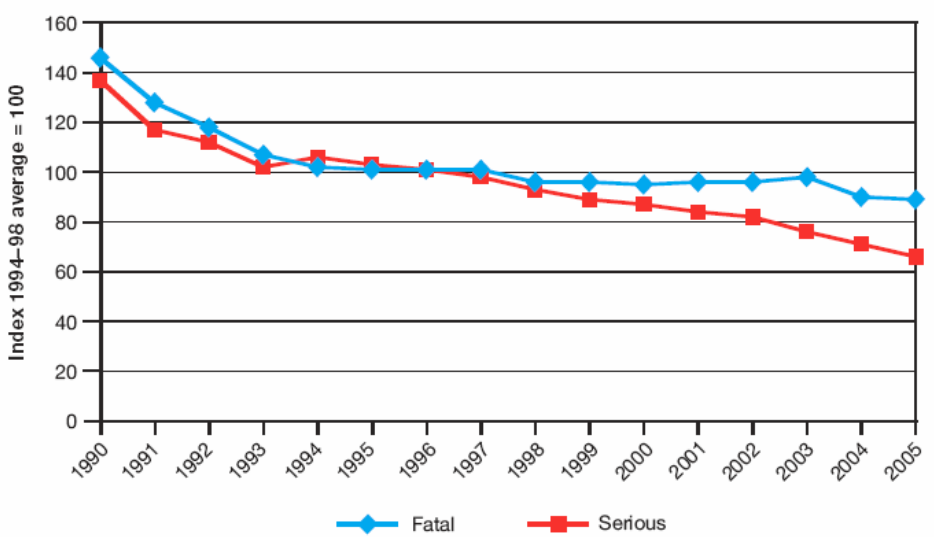

Figure 15. From Ladyman et al. (2007, p. 13)

In April 2009 the Department for Transport published its consultation document that "*seeks views on the vision, targets, and measures for improving road safety in Great Britain for the period beyond 2010*." (p.6) Till then the UK relied on targets and plans to deliver road safety; there was no 'Vision', no principles, and no guiding ideology. The consultation document breaks with this tradition and proposes to adopt the vision of *"Making Britain's roads the safest in the world"* (Chapter 3, Department for Transport, 2009). The yardstick for comparison with other countries is to be the number of road deaths/100,000 population. On this score, as seen in Table 5, in 2000 the UK was better than Holland and Sweden. In 2008 the rate for the U.K. was 4.3, the same as Sweden, but Holland was slightly better, at 4.1. Thus the intent of the proposed vision is to do what it takes to have fewer fatalities/100,000 population than Sweden and Holland[11].

This wording of vision is sufficiently devoid of specific commitments and programmatic or ideological overtones. In this sense it does not alter the traditional UK approach to road safety delivery and may serve its intended purpose. As Broughton et al. (2009) say: *"At a political level, the existence of a vision can make it easier to explain and justify shorter-term policies, in the context of their contribution towards a longer-term goal, particularly if the latter is expressed in terms that appear to follow ethical or environmental principles that are difficult to refute."*(p. 36) However, as noted in one of the subheadings: "*A vision is not a substitute for safety strategy"* (p. 29).

The context for the proposed (2009) UK road safety strategy is the policy document '*Towards a Sustainable Transport System'* (DfT,2007). This document tries to find a political middle ground between the Eddington Report (which emphasizes the role of mobility in the economic well-being of a nation) and the Stern Report (which underscored the environmental responsibility of this generation towards the coming ones). Accordingly, the

[11] In preparation for Consultation (Department for transport, 2009) in November 2007 a presentation was made for DfT representatives. The presentations are assembled in a useful document (Broughton et al, 2009b). Chapter 3 is entitled "Visions" .

first two goals for a 'Sustainable Transport System' (DfT, 2007) are: 1.To maximise the competitiveness and productivity of the economy; 2. To address climate change, by cutting emissions of carbon dioxide and other greenhouse gases. The third goal is "*to protect people's safety, security and health. The safety of transport users and workers is critical, and we will continue to seek improvement. But public transport users and workers are also concerned about crime, and there is an enduring terrorist threat to be addressed. We need to address the negative impacts of transport on people's health (for example, from air and water pollution), but also promote the health benefits of cycling and walking."* (p. 10). It seems that in this document which provides the context for road safety policy, the topic of road safety is given relatively little play. (The remaining two goals pertain to quality of life issues such as noise and vibration and the promotion of equal opportunity.)

In the consultation document (DfT, 2009) the proposed goals for the safety strategy are:

1. to reduce road deaths by at least 33 per cent by 2020 compared to the baseline of the 2004–08 average;
2. to reduce the annual total of serious injuries on our roads by 2020 by at least 33 per cent compared to the baseline;
3. to reduce the annual total of road deaths and serious injuries to children and young people (aged 0–17) by at least 50 per cent against a baseline of the 2004–08 average by 2020.
4. to reduce by at least 50 per cent by 2020 the rate of KSI per km travelled by pedestrians and cyclists, compared with the 2004–08 average.

To reach these targets several actions are mentioned specifically. Thus, on rural two-lane roads with many casualties the current speed limit (of 60 mph) may have to be reduced. Engineering measures are to be used to reduce pedestrian and cyclist deaths and the speed limit in residential and other streets with many pedestrians reduced to 20 mph. To support responsible use of roads various initiatives will continue. Similarly, various measures will be considered to reduce irresponsible road use (drink-driving, failure to wear a seatbelt, careless or dangerous driving, and excessive speed). To monitor progress towards the target to be reached in 2020, thirteen 'Key Performance Indicators' will be used[12]:

To sum up, the UK was and is a road safety leader. It leads by research and innovation – many practices started in the UK, and it leads by performance – it is amongst the best in road safety no matter what yardstick is used to measure it. All this has been achieved

[12] 1. Rate of road deaths per 100 million vehicle kilometre; 2**.** Rate of killed or seriously injured pedestrians per 100 million kilometres walked; 3. Rate of killed or seriously injured pedal cyclists per 100 million kilometres cycled; 4. Rate of killed or seriously injured motorcyclists per 100 million vehicle kilometres; 5. Rate of killed or seriously injured car users per 100 million vehicle kilometres. 6. Number of killed or seriously injured casualties resulting from collisions involving drivers under the age of 25; 7. Number of people aged over 70 killed or seriously injured in road collisions per 100, 000 population aged over 70; 8. Number of people killed in road collisions on rural roads. 9. Number of pedestrians killed or seriously injured per capita in 10 per cent most deprived areas compared with 10 per cent least deprived; 10. Number of people killed where at least one of the drivers or riders involved was over the legal blood alcohol limit; 11. Number of car occupants killed who were not wearing a seatbelt; 12. Proportion of vehicles the exceed speed limits; 13.Cost of road traffic casualties.

without the fanfare of a 'vision'. It seems to be the result of solid, science and common-sense based work. If I can speculate, it is also the result of a civil service tradition that respects knowledge and has the respect of politicians.

ISSUES AND LESSONS

Is there something that stands Out?

In France there is automatic speed control, in Sweden median barriers on two-lane roads, in Holland the woonerven. Is there some program that is characteristic of the UK that should be considered for implementation in the U.S.A.? While road safety delivery in the UK is a success story, there is no specific program or countermeasure that is not already being used in the U.S.A. The lesson is that for TZD to succeed it is not necessary to pull new rabbits out of the road safety delivery hat. Rather, than thinking in terms of breakthroughs (SHRP2), nano-technological wizardry (some FHWA proposals) or place one's hope in inventing novel countermeasures in causation studies, the UK relied professionalism, and on co-operation between research, civil service and elected representatives.

Do we need the TZD vision?

I raised this issue earlier, in section 3.3.6. Of the country experiences reviewed, Sweden, Norway and Holland make use of a vision; France does not and the UK did not in the past but considers adopting one. Why the difference? In reviewing the experiences of Sweden, the UK and the Netherlands (the SUN Countries) Koornstra et al. (2002) say*: "Stating a difference in safety vision is one matter, but answering the question why this difference has arisen between countries that have so much in common regarding their safety problem and policies, is another. A clue might be the fact that achieving the safety target was no longer taken for granted in the Netherlands and Sweden at a certain point in time, while simultaneously it was concluded that some safety problems could not be addressed as before. This situation stimulated a search for a new approach. Possibly, an intensified application of existing measures still offers enough improvement opportunities, as the current British programme is aiming to realise."* (p. 21) The UK experience shows that road safety can be successfully delivered without having a vision.

Perhaps the U.S.A. is at that point in history where a new start on road safety delivery is needed. On the other hand, perhaps one can achieve substantive reform without invoking a vision the wording of which is bound to be misinterpreted, and the intent of which runs counter to the tradition of spending public money only when benefits exceed costs by a substantial margin.

Setting Targets and Monitoring Progress

The wisdom, attraction, and risk of target setting were discussed earlier in Section 2.4.2. If a numerical target is to be set and announced, the oft-used phrase is that it should be ambitious but achievable. How then to set an achievable target?

To begin with there has to be a baseline; one has to predict how many traffic fatalities and injuries will occur, say, ten years from now if current programs were to continue but no new initiatives implemented. Inasmuch as this will depend on demographic, economic, travel and technology forecasts, one can say that a prediction of this kind will not be very

accurate. Next one has to compile a list of new[13] programs and initiatives for which there is likely to be support and which meet the requisite benefit-cost criterion. The target fatalities and/or injuries are those predicted by the baseline minus those saved by the investing in the new programs and initiatives. In this respect the UK practice and experience hold important lessons. The prediction method used for setting the 2010 UK target is described in Broughton et al. (2000) in Broughton and Knowles (2010).Predictions for 2020 and 2030 are in Broughton (2009). These and related issues are the subject of a special issue of *Safety Science* to be published in 2010.

When the target was announced in 2000, the Department of Transport also decided that progress would be reviewed after 3 and 6 years to determine whether extra efforts might be required to ensure that this target would be achieved. In fact, progress towards the target has been reviewed annually at the Transport Research Laboratory while the Department for Transport published formal reviews in 2004 and 2007. The purpose of these is to check whether the targets remain appropriate, whether the strategy works and whether it needs to be adjusted as new trends, ideas and technology emerge.

In sum, the setting of numerical targets presents significant challenges. One has to prepare a counterfactual prediction of what would happen with 'business–as-usual' if no new programs and initiatives were implemented, one has to prepare a cost-effective program of initiatives and predict its impact on fatalities and serious injuries, and one has to set up a system for monitoring progress. To do all this is not a trivial undertaking.

Between the two Poles.

Sir Eddington and Sir Stern are the two poles of the transport policy are in the UK; one report stresses the positive role of mobility in productivity and competitiveness, the other report points to the harm mobility does to the environment. The road safety strategy has to fit between these poles. The interest of road safety is better aligned with that of the environment than with that of mobility. To illustrate, the consultation document (DfT,2009, p. 102) has an economic analysis of reducing the national speed limit two-lane roads from 60 mph to 50 mph. It concludes than the net benefit would be negative; the cost of added time is larger than the savings in crash severity and greenhouse gas emissions. This leads to two observation of relevance to the TZD.

First, the outcome of economic analyses of this kind depends on what is used for 'Value of Time' and 'Value of Statistical Death and Injury'. Guidance about these is currently based on estimates produced by econometric method. The scientific community as well as the DOT know that these estimates are all over the place and that the values in use may have the virtue of uniformity but lack the virtue of believability. If the profile of road safety is to be elevated while retaining the benefit-cost frame of reference, the relative values of time and life need re-examination.

[13] If there are to be no new programs and initiatives then there is neither content nor meaning to target setting.

Second, better mobility means more and faster travel while the opposite serves the interest of the environment (as well as of national security and foreign policy). This means that TZD allies will be found in the environmental camp.

Third, the job of transportation planners is mostly to provide sufficient capacity to for future needs and the job of traffic engineers is mostly to keep traffic moving. These professions are, in the main, in the service of mobility. Can they be friends of TZD? Can they be made into friends? What has to change?

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CLOSURE

The reader who is pressed in time often goes to this part of the paper in the hope to find a distillation of the main messages. I do not provide this easy comfort for two reasons. The subjective reason is that of circumstance. To do a decent summary takes time and I ran out of it. The objective reason is that the several lessons for the TZD initiative in U.S.A. that are contained in the five sections of this report are rooted in the details of the reviews. Without reading the entire report much of the reasoning would be lost.

APPENDIX: THE ROOTS OF EASY CONFIDENCE

As noted in the introduction it is tempting to attribute changes in the time series of road safety measures to contemporary initiatives and interventions. This easy confidence in our ability to link effect to cause may be unrealistic and misdirect our actions. The purpose of this appendix is to sound a note of caution; the causes of change in the time series of road safety measures is complex and, at present, not well understood.

The natural ally of the easy confidence in our ability to attribute change to action is that, of necessity, we rely mostly on 'Published Reports.' Many published reports have partly a public relations function; most are written by persons who contributed to what was done and are naturally predisposed to believe in the usefulness of their actions. Thus, e.g., as shown in section 0, Gerondeau (2006) was that confident that the sudden decline in French fatalities seen in Figure 16. From Gerondeau (2006) is attributable to the publicity surrounding his appointment to office.

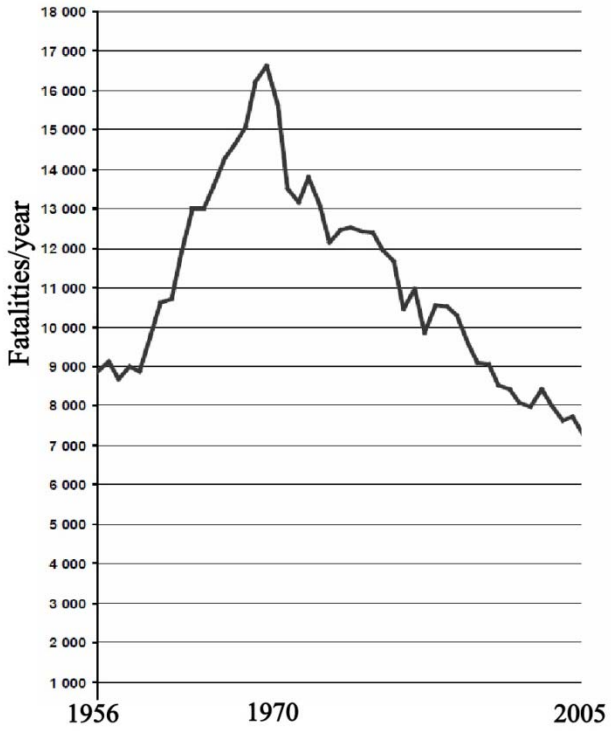

Figure 16. From Gerondeau (2006)

The peak in the French fatalities mountain is sharp and it is natural to think that such a sharp break has a distinct cause. However, real social phenomena have complex causes. The second natural ally of the easy confidence is our psychological predisposition to seek causes and our tendency to believe in conveniently simple explanations.

In truth, a 'fatality mountain' such as the French one characterizes all developed countries. An illustration is in Figure 17.

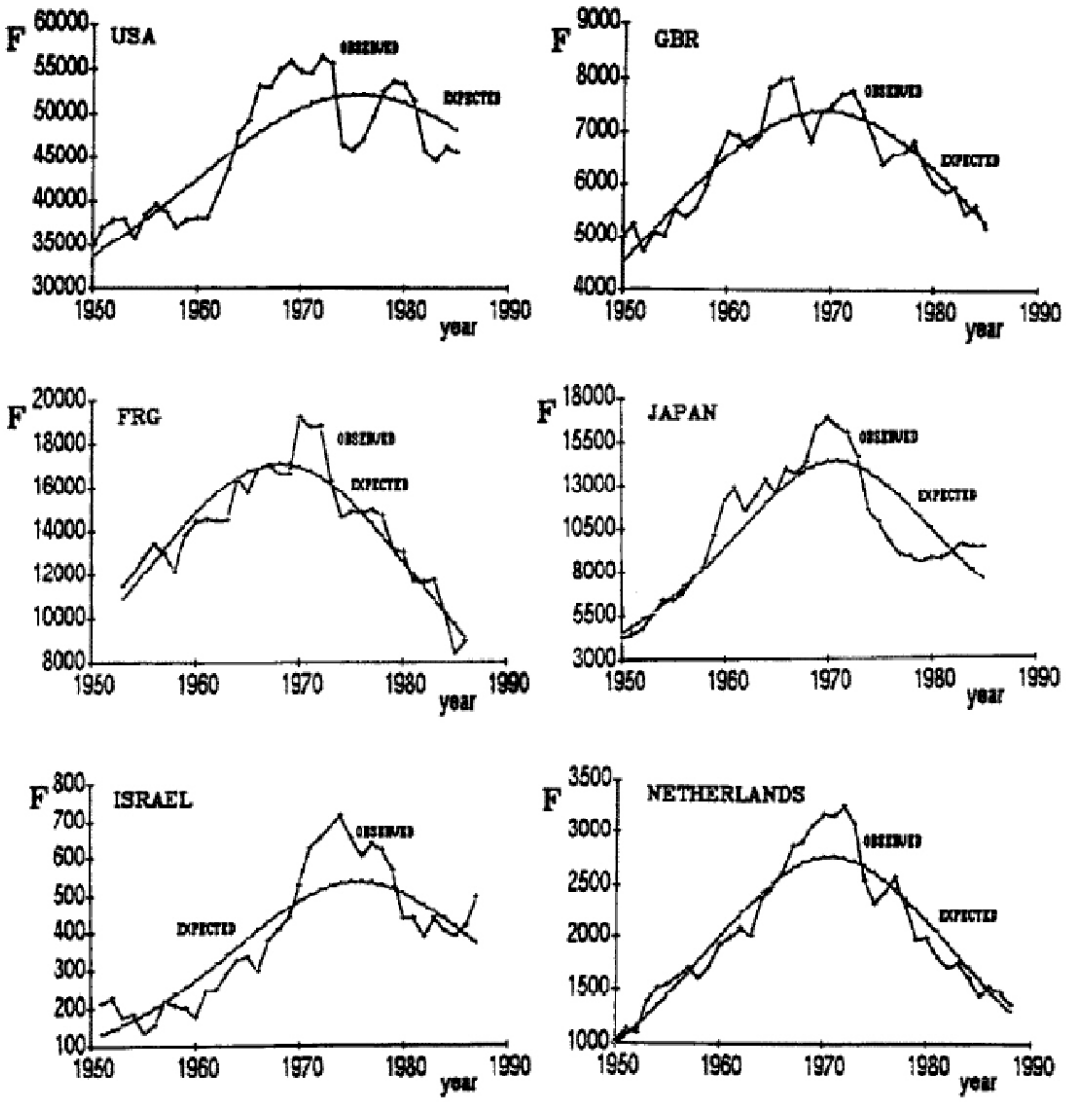

Figure 17. Time series of fatalities in several countries from Oppe(1991a)

This indicates that the French experience is not unique. Oppe's theory is that the mountain shape is the necessary consequence of two contrasting and monotone trends: the amount of travel which is constantly increasing and the risk (defined as fatalities per unit of travel) which is constantly decreasing (see Figure 18). Risk is decreasing, so the theory goes, due to a complex array of concurrent processes by which society learns to live with the car; better roads, improved behaviour (including speed choice and alcohol consumption), safer vehicles, advances in medicine and emergency medical services, etc. Because the decline in

risk stems from a complex interaction of many factors that change over time, the trace left by specific actions of countermeasures may be difficult to recognize.

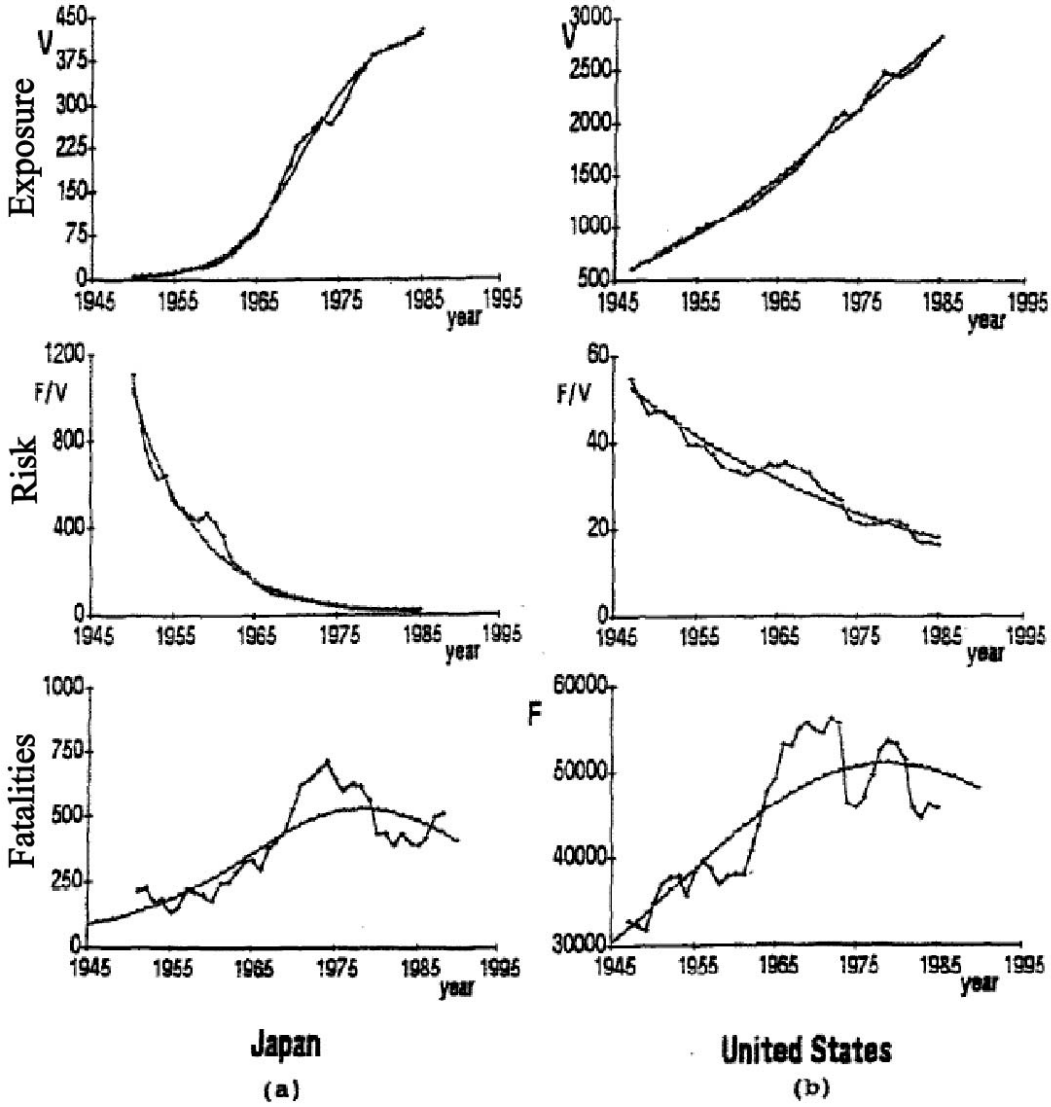

Figure 18. Annual fatalities as product of exposure and risk. Based on Oppe (1991b)

That the product of two time series, one increasing and one decreasing, always creates a curve with a peak is shown in Figure 19.

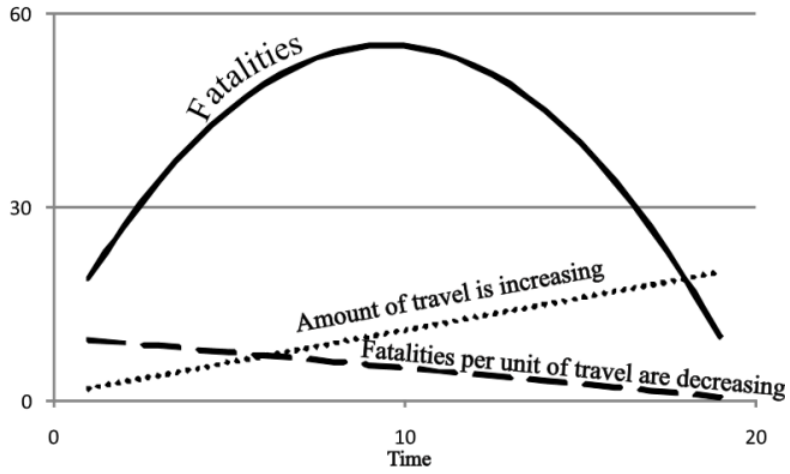

Figure 19. The product of two time trends

Thus, the second natural ally of easy confidence was the belief in the simple conjunction: if you see a change in a time trend, look for the proximate simple cause. Real processes that occur over time and involve people are often too complex for the simple conjunction to work. In the present case the peak you see may in fact be a composite of two time trends neither of which exhibits a noticeable change. Moreover, it is difficult to see the traces of discrete interventions in the evolution of risk over time.

Success is said to have many fathers. The rapid decline in fatalities and injuries is a French success story and few hesitated to attribute it to specific initiatives. But what if there is a rapid decline in fatalities and no initiatives to which is can be attributed? We live in just the right time. Figure 20 shows a peak in 2005 and a dramatic decline which roughly coincided with the 2007-2009 financial crisis.

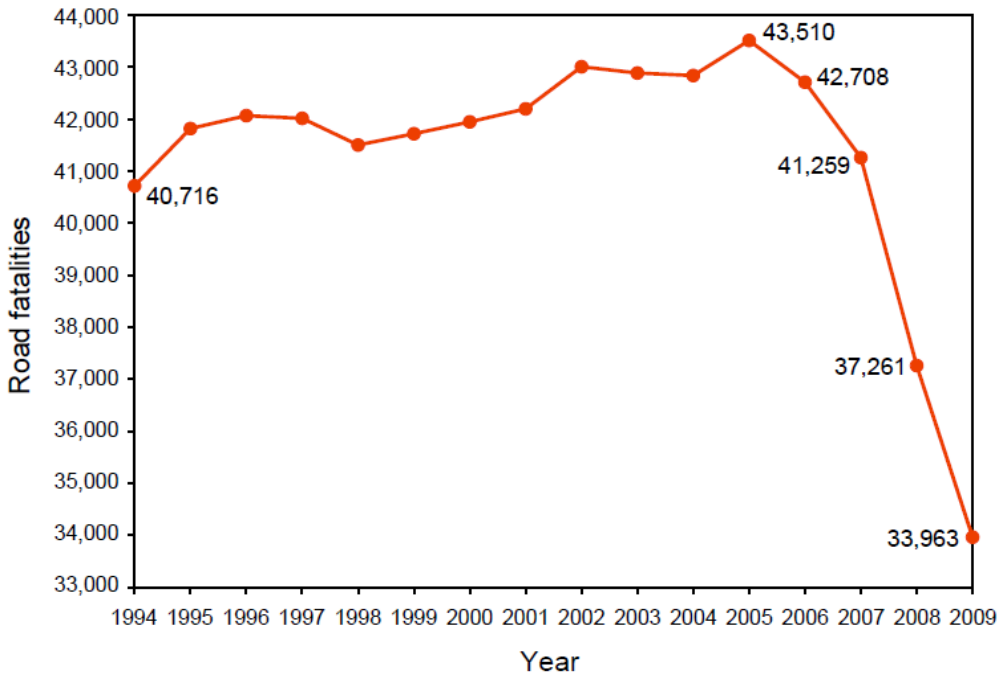

Figure 20. U.S. road fatalities reproduced from Sivak et al. 2010

Few will hesitate to attribute the decline to the many causal factors that changed during that economic downturn. It is not easy to be more specific. In 2009 Sivak concluded that: "The recent reductions in road fatalities have been more substantial than the reductions in the amount of driving", that."There are other reasons, in addition to the reductions in the amount of driving, for the decreases in road fatalities" and, that "The larger-than-expected fall in road fatalities is associated with the proportional decreases in rural driving and leisure driving." In their 2010 report Sivak and Schoettle attempt to identify the circumstances where the decrease in fatalities was especially large or small. This led them to list 21 circumstances and explanations. Thus, e.g., they list: decreased commuter travel during rush hours and leisure travel on interstates, but more leisure travel on local streets; more side airbags in side crashes; decreased speeds and more or better airbags in frontal crashes; reduced freight shipments by heavy trucks; increased motorcycle ownership by middle aged men etc.

There is a moral to Figure 20 and the following explanation. First, one has to keep in mind that there can be a pronounced downturn or an upturn in the time series of fatalities without it being caused by any new initiatives and interventions. Second, the shape and evolution of the time-series of fatalities depends on many factors. Third, when an attempt is made to estimate the effect of some initiatives, one must try to account for the effect of the autonomous change in all the other important factors that are seen to influence the evolution of the time series. Fourth, that this is very difficult to do and is, possible, beyond what we now know how to do.

Each section in this white paper shows figures of how fatalities and injuries decreased while exposure increased. These figures are followed by a description of the visions, targets, initiatives, and actions taken in each country. It is tempting to attribute the decline in fatalities and injuries to the actions taken. Doing so may not be fully justifiable.

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