



CONTENTS

THE ROAD SAFETY TARGETS OF THE	
DUTCH NATIONAL TRAFFIC AND	
TRANSPORT PLAN ARE ACHIEVABLE	1
ECONOMIC EVALUATION OF ROAD	
SAFETY MEASURES	3
THE VALUE OF STATISTICAL LIFE IN	
ROAD SAFETY	4
The road safety situation in	
THE NETHERLANDS	6
THE COSTS OF ROAD SAFETY IN	
THE NETHERLANDS	7
MEMORANDUM OF UNDERSTANDING	
CSIR-SWOV	7
SWOV PUBLICATIONS	
COLODUON	-

## The road safety targets of the Dutch National Traffic and Transport Plan **are achievable**

ABOUT 300 FEWER DEATHS IN 2010 AND A DECREASE IN THE NUMBER OF IN-PATIENTS BY 4,600. ARE THESE ROAD SAFETY TARGETS IN THE RECENTLY PROPOSED DUTCH NATIONAL TRAFFIC AND TRANSPORT PLAN (NVVP) ACHIEVABLE? WHICH RESULTS CAN BE EXPECTED FROM THE (PACKAGES OF) SEPARATE MEASURES? AND WHAT DOES IT ALL COST?

The Dutch Ministry of Transport asked SWOV to calculate the effects of the NVVP measures, to be able to judge the achievability of the road safety targets in the Netherlands. The calculations appear to be positive (SWOV report D-2000-9). SWOV research shows that the measures suggested could reduce the number of road victims by a quarter Furthermore, the measures can for a large part be financed from existing budgets.

New road safety policy The draft NVVP, which wa Srecently presented by the Dutch Minister of Transport is the successor to the Second Transport Structure Plan of 1989. In the



new traffic and transport plans to 2010, the continuation of the second phase of "Sustainably Safe" has been included. The NVVP still aims at achieving the target set in 1986 for the year 2010: a maximum of 750 deaths and 14,000 in-patients.

The table below shows the progress made in road safety in the period from 1986 to 1998. Related to the new base year of 1998, this target means there must be a further reduction of 30% deaths and 25% in-patients. It appears that the 2010 target for in-patients (-25%) is more ambitious than the target for deaths (-30%) when taking into account the casualty reduction during the period 1986-1998.

### Reduction percentages of road victims in the Nether and 5.

	Deaths	In-patients
Development in 1986-1998	-30.2%	16.9%
Still to achieve in 1998-2010	-29.6%	-24.7%

The SWOV Sustainably Safe approach served as a starting point for calculating the various measures. Four Categories of measures were therefore distinguished, that is infrastructure, behaviour, vehicles, and intelligent transport systems (ITS). When performing the calculations, as much use a 5 possible was made of known (research) data, such as knowledge on the effects of measures in general and the extent to which, and the speed in which, they are carried out. Where necessary, the data was supplemented by a "best guess".

The study consists of two parts (SWOV reports D-2000-91 and D-2000-91).

In the first part, the effect of each measure separately was totalled to calc date their combined effect on the national casualty reduction. The second part examined the costs and cost-effectiveness of each measure. These were calculated to examine the costs of the total package of measures. Calculating the costs of the measures involved close cooperation with the Transport Research Centre of the Ministry of Transport, The Ministry's Road Construction Division, the Inter-Provincial Consultation, and a consultancy firm.

### Measures, effects, and costs

In order to prevent overestimation of the total effect of the measures on the national casualty reduction, the over apping effects of a number of measures were taken into account. The effect estimation of the total package of measures is a reduction of more than 300 deaths and 4,500 in patients by 2010. These measures are based on the "Sustainably Safe" vision SWOV views the sustainably safe policy, and especially the plan for a second phase, as the pivot for policy during the next de cennium. A strong central management is recommended to ensure that the differences - or even conflicts in the decentralized realisation of this policy, will not be too great. SWOV also asks that attention be paid to communicating the ideas behind "Sustainably Safe" to the road users. The acceptance of impeding measures will be greater when road users realise that they receive a better quality of life

in exchange for the introduction of, and adherence to such measures.

The cost-effectiveness ratio (C E ratio), that expresses the costs per victim (deaths or in patients) saved, has been used as indicator in ranking the measures by efficiency. It was established that there were large differences in the C-E ratios of the various measures.

The study shows that it should be possible to finance the NVVP measures from existing budgets of Road Authorities and other actors. However, there appear to be bottlenecks in a) the restructing and redesigning of the provincial road network, and b) goods transport measures, which will almost entirely have to be paid by the transport companies. Probably additional financial measures are needed to eliminate these bottlenecks, and for achieving the necessary involvement for carrying out "Sustainably Safe Phase 2". This also happened during the "Start-up Programme Sustainably Safe".

The results of this study permit them to be added to a future measure catalogue. The research carried out can also serve as a basis for further planning of the second phase of "Sustainably Safe".



# Economic evaluation of road safety measures

SCIENTIFIC ECONOMIC METHODS MAY HELP GOVERNMENTS TO REACH DECISIONS ON HOW TO IMPROVE ROAD SAFETY AS EFFICIENTLY AS POSSIBLE. SWOV RECENTLY MADE AN INVENTORY OF THESE METHODS, AT THE REQUEST OF THE EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT (D-2000-16E).



The level of traffic safety in Europe has (been) improved considerably over the last decades Nonetheless, most governments are still strongly committed to further improve the national traffic safety level. Many possible measures or packages of measures are available, while monetary resources are limited. The use of scientific economic methods may help decision makers to decide on 1) whether interventions are needed at all, 2) what the total governmental budget for safety policy should be, and 3) what the optimal package of measures could be. given the budget.

There are in principal two economic evaluation tools available to assess the efficiency of measures when governments decide to intervene in the field of taffic safety. They are social cost-benefit analysis (CBA) and cost-effectiveness analy 9 5(CEA). The first method, CBA, can be used both for determining the opt mum budget and for drawing up an optimal package of measures. The second method, CEA, is suited only for this latter purpose, given the budget. In addition to a CBA or a CEA, it is recommended to carry out two other analyses. Firstly, an analysis of redistribution of costs and benefits will show who will be affected by the advantages and disadvantages of the measures. Thus, aspects of justice On be considered in decision making. Sec andly . a sensitivity analysis will show the robustness of the estimated effect 5.

To apply CBA, detailed information is needed for quantifying all the effect s

and assigning monetary value to each of them. This information is not always available, which makes the CBA method of limited use. Especially where ranking of projects within a given budget is concerned, CEA may be applied in combination with non-monetary methods, such as the goals achievement matrix (GAM) and the scorecard. The GAM is a multi-criteria method. relating effects of various alternatives to a number of stated social objectives. The scorecard method is a presentation tool used to facilitate the comparison of various alternatives by showing several aspects of these alternatives, supplied with ranking numbers.

Though CBA and CEA are accepted methods, further research is still needed to expand their possibilities. Priority should be given to:

- direct effects of safety measures on safety,
- side effects of safety measures on mobility and environment,
- indirect effects of education and enforcement on traffic safety,
- assessment methods for 'quality of life'.

Finally, it should be dear that the ultimate decision regarding traffic and road safety measure salways falls



to those who bear political and administrative responsibility. These decision may be based on other leg timate considerations than suggested by the outcome of economic evaluation studies.

# The value of statistical life in road safety

Accident costs are an important part of the costs of traffic and transport. An evaluation of accident costs can help in allocating road safety budgets more efficiently and rationally. The costs of fatal accidents are, however, difficult to calculate, as much of the damage done by fatalities is 'immaterial'. Still, it is important to assign monetary value to fatalities to be able to include this most harmful accident type in the evaluation of accident costs. Some valuation methods, estimated values and factors that affect these estimates are presented in this article.



Assigning monetary value to a fatality requires the economic valuation of a so-called *statistical* life. It is essential to be aware of the fact that *not* the life of a specific *individual* is to be valuated, but one life in a large population. The value of a statistical life (VOSL) in road safety is therefore the value of the saving of one life in a large population of road users, i.e. the value of a reduction in fatality risk.

### Valuation

The VOSL can be estimated by determining how much people are willing to pay for a reduction in the fatality risk. For example, a large group of individuals are on average willing to pay 25 Euro for a risk reduction from 7 to 4 fatalities in a population of 100,000. Then the estimated VOSL would be 0.8 million Euro ([25/3]\*100,000). Thus, the willingness to pay (WTP) method is based on individual preferences. These preferences can be determined by stated or revealed preference methods. A stated preference method uses a questionnaire. In this, the respondents are asked how much they are willing to pay for certain goods (such as a reduction in the fatality risk). A revealed preference method estimates the value of the good by relating it to goods on the market. For example, the price of an airbag can be related to the risks on a fatal accident with and without an airbag. The value of the reduction in fatality risk can thus be calculated.

From the 1970's onwards, many studies have tried to estimate the VOSL in road safety using stated and revealed preference methods. Such studies were carried out in different countries and in different years, and have resulted in a wide range of estimates. The estimates of a statistical life value show vast differences, going all the way from 150,000 up to 30 million 1996 US dollars.

## Factors affecting VOSL estimates

Researchers at the Vrije Universiteit Amsterdam studied literature on the economic valuation of statistical life in road safety. They collected the results from 25 different studies and analysed them using statistical methods. They used this 'meta-analysis' to determine whether there are factors that systematically affect the estimates of the value of life. Some of their results are presented in this article. The full results are reported in a discussion paper of the Tinbergen Institute, institute of economic research.

From the studies, 71 VOSL estimates in road safety were collected, together with the characteristics of these studies. On the basis of this database, a descriptive analysis and meta-analyses were carried out. The descriptive analysis confirmed that the VOSL estimates show large differences. A more intriguing result was that some of the highest stated preference estimates of the VOSL are over 1,000 times the Gross Domestic Product (GDP) per head of population of that country. This means that people would under certain conditions be will hg to pay more for increased safety than their available budgets would ever allow !

Meta-analysis was carried out to determine whether the large differences in the 71 VOSL estimates could be explained by a number of 'standard explanations' from literature. Among these are, for example, the GDP per head of population and the fatal accident rates of the countries concerned, and in the year of data collection. Standard explanations also involve expectations that stated preference studies yield higher estimates than revealed preference studies. An d studies that value safety as a private good are expected to present higher estimates than studies valuing safety as a public good. The result of this meta-analysis was that these, and some other 'standard' variables hardly have any, or no explanatory power. In other words: other explanations than the standard ones should explain the large variety found in VOSL estimates.

### Initial fatality risk In stated preference studies, questionnaires present the fatality risk



to the respondent, as well as the reduced fatality risk after an investment in road safety. Literature indicates that the VOSL is affected by this presented initial risk level and the reduction of this risk as the result of a safety



improvement. It can be expected that the WTP increases with increasing size of the risk reduction. In other words: the more 'difference it makes', the more money people are willing to pay. It can also be expected that the WTP for a given reduction in fatality risk increases with increasing level of the initial risk. In other words: the higher the initial fatality risk, the more money people are willing to pay for a given reduction in this fatality risk. Vice versa: the lower the initial risk level, the lower the WTP for a given reduction (see figure).

The abovementioned theory has not been used in the existing literature to explain the large variance in VOSL estimates, presumably because the initial risk levels are already very small. It is typically assumed that in this low range of initial risks, the exact risk level does not affect anymore the amount of money people are willing to pay for a given risk reduction; this amount is constant. This can also be seen in the figure.

Nonetheless, the researchers at the Vrije Universiteit Amsterdam tested whether the initial risk levels and the risk decline in several studies could explain the variance in VOSL estimates. It can be concluded from this meta-analysis that the VOSL does indeed depend on the initial risk level and the risk decline. In other words: people really do take the risk levels mentioned in the questionnaires into account.

### To conclude

It can be concluded that a statistical life does not have one, common value, not even from this theoretical, economical perspective. The VOSL will be different in different situations. The value depends, among other things, on the initial level of the fatality risk, and on the risk reduction considered. These variables have a far better explanatory power than more general background variables such as GDP per head of population.

In the Netherlands, the VOSL has until now been estimated by means of the 'human capital method'. The economic criticism on this method is that it is not based on individual preferences. An empirical follow-up of the research project will be conducted by researchers of the Vrije Universiteit Amsterdam and SWOV. The results are expected to be values of a statistical life for the Netherlands, which will be estimated by making use of individual preferences.



The willingness to pay for a given reduction in fatality risk as a function of the initial risk levels (in 1996 U.S. dollars, logarithmic scale).

> The full discussion paper (number 00-089/3) can be downloaded from http://www.tinbergen.nl.



# The road safety situation in the Netherlands

THE NETHERLANDS IS STILL ONE OF THE SAFEST COUNTRIES IN EUROPE. HOWEVER, THE RECENTLY PUBLISHED ANNUAL ANALYSIS FOR 1999 SHOWS THAT THE ROAD SAFETY IMPROVEMENTS IN THE NETHERLANDS IN THE 1990'S LAG BEHIND THOSE IN MOST OF THE OTHER EU COUNTRIES. THAT IS WHY, IN ORDER TO ACHIEVE A FURTHER IMPROVEMENT, AN INCREASED POLICY EFFECTIVENESS IS NECESSARY. ONLY THEN CAN THE NATIONAL ROAD SAFETY TARGETS FOR 2010 BE ACHIEVED.

The SWOV analysis of road safety developments is published every year. It describes the size and nature of road safety in the Netherlands, as well as developments in road safety. The 1999 analysis (D-2000-15) discusses trends, backgrounds, and explanations Of accident and casualty rates. It al 50 makes prognoses for the developments up to 2010, the target year. Spe Cal attention is paid to high risk traffic behaviour and the safety developments of a number of specific high risk groups-The most important results are given briefly below.

A first conclusion is that the number of victim's continues to decrease, even though the number of motor vehicle kilometres travelled continues to increase, it can therefore be said that, in general, there is a positive development in road safety in the Netherlands. The death rate, per kilometre travelled, also continues to decrease. However, there is still much room left for improvement. Each year, there are nearly 1,200 road deaths and nearly 20,000 in-patients. In addition, over 200,000 are treated in Accident and Emergency hospital departments or by general practitioner 5 (doctors). This number also includes victims who need a long time to recover.

Furthermore, the number of annual road deaths is decreasing slower than before, and, since the early 1990's, the number of in patients has not decreased at all. Of the five safest countries in Europe, the Netherlands even has the smallest decrease in the number of road deaths. This means that the road safety development can be improved considerably; even if it is a relatively safe country.

Prognoses of kilometres travelled and risk developments show that the national in-patient target (40 percent less than in 1986) will certainly not be achieved if the pace of improvement is the same as the last ten years. The target for road deaths (50 percent less than in 1986) can be achieved if at least the same decrease in death rate as in the past decades is achieved. This will not happen automatically, but it is not altogether impossible either.

SWOV regards the formulation of so-called performance indicators (targets) for high-risk traffic behaviours, and monitoring their developments, as an important instrument for achieving a further reduction in the number of road accident casualties in the Netherland 5. There can be separate performance indicators for drunk driving, speeding. and the use of seatbelts and other safety devices. Like general, national target 5, such performance indicators can stimulate and guide the way in which available resources are used as effectively as possible. They can aim at the most relevant 'high-risk behaviours'. high-risk groups, and high-risk traffic situations.

Moreover, measures should be taken for categories of road users that have relatively high numbers of victims. Travelling must become, and remain, safer for mopedists and light-mopedists, cyclists, and older car drivers. The large share of lorries in the numbers of fatal road accidents must also be reduced-

SWOV is convinced that further, permanent road safety improvements in the Netherlands are feasible. To achieve this, the above-mentioned areas need extra measures, their own targets, and policy attention. They must fit within the framework of the sustainably-safe approach, and be based on the ever-increasing scientific knowledge and insight.

# The costs of road safety in the Netherlands

RECENTLY, SWOV HAS CALCULATED NEW FIGURES FOR ROAD SAFETY COSTS IN THE NETHERLANDS (SWOV REPORT D-2000-17). SWOV HAD PREVIOUSLY CALCULATED THESE COSTS FOR 1993.

In the calculation of the new figures, cost data for 1997 were used. These were provided by the Transport Research Centre of the Ministry of Transport. Furthermore, SWOV used a number of new methods for calculating costs. To make the data comparable, a number of figures for 1993 were recalculated using these new methods.



The total road safety costs for 1997 were 16.8 billion Dutch guilders, which is approximately 15% more than the costs for 1993. This increase in costs is larger than the 9% increase in the cost of living in the period 1993-1997.



Main Groups	1993 costs (recalculated)	1997 costs	
Medical costs	440	511	
Production loss (gross)	4,346	5,397	-
Material damage costs	3,211	3,580	
Settlement costs	1,280	1,410	
Sub-total	9,277	10,898	
Congestion costs	55	220	
Immaterial damage	5.2.42	5.670	
Total	14,674	16,788	

The total material and immaterial road safety costs for 1993 and 1997. All figures are in millions of Dutch guilders, and are expressed in current prices. (1 Dutch guilder= 0.454 Euro)

## Memorandum of Understanding CSIR-SWOV

Mr-P-Hendricks (right), director of Tranportek South Africa and SWOV managing director Mr.F. Wegman (left) have signed a Mem Gandum of Understanding on the 30<sup>st</sup> of November 2000 in Pretoria, South Africa

With this Memorandum of Understand ing ,both partners recognize the advantages to be gained by cooperation in the performance of research projects and in transferring technologies. Tranportek is the Division for Roads and Transport Technology of the Council for Scientific and Erdustrial Research (CSER) seated in Pretoria, South Africa.



## **Publications**

Most SWOV reports are written in Dutch but include an English summary. Below is a selection of reports that have recently been published by SWOV. Reports can be obtained by completing the SWOV order form that can either be found on the website, or that can be sent to you by Patrick Rugebregt of the Department of Information and Communication (Patrick.Rugebregt@swov.nl). The price of each report (in Dutch guilders) is mentioned in the following list, as well as the language in which the report is written. Reports can be paid by credit card. For bank transfers, we will charge an extra Dfl. 15, - per transfer. After SWOV has received your payment, the reports will be sent to you by mail. Records of all SWOV reports that were published from 1995 onward can be found on our website (www.swov.nl).

### Road safety audit testing period

A qua litative evaluation of seven test audits for improving their content and procedures. I van Schagen -D-2 000-7.32 pp. Dfl. 20, -(in Dutch).

### A road safety analy \$ 5 **G** t he preliminary National Traffic and Transport Plan

Summary of establishing the effects, costs and co % effectiveness of measures a)med at meeting the target<sup>5</sup> for the year 2010. C. Scho <sup>o</sup>n, P. Wesemann & R. Roszbach -D-2000-9.40 pp. Dfl. 20, -(in Dutch).

### Economic evaluation of road safety measures

Contribution to the 117 "EC MT Round Table, 26 and 27 Oct db & 2000, Paris. P. Wesemann . D 2000 -16E . 40 pp .Dfl . 20r .

Frequency and causes of single vehicle cyclist accidents An accident analysis ba ed on a survey of cyclist victims. C. Sch ogn & A. Blokpoel R-2000-20. 33 pp. Dfl. 20,- (in Dutch).

### The road Safety in the Netherlands up to 1999

Analy 9 sof the size, nature, and developments. I. van Schagen (ed.). D- 2000-15. 89 pp .Dfl. 30,- (in Dutch).

### Rev'ew of road safety projects in Peru

Evaluation of project proposals establishing a medium and long-term road safety strategy. M. Koornstra. R-2000-22. 58 pp -Dfl. 22,50.

The costs of road hazard in the Netherlands in 1997 P.Wesemann .D-2000-17. 30 pp. Dfl. 17,50 (in Dutch).



### Colophon

RESEARCH ACTIVITIES is a magazine on road safety research, published three times a year by the SWOV Institute for Road Safety Research in the Netherlands. Research Activities contains summaries of research projects carried out by SWOV and by others.

Editorial committee:	Nicole de Bree, Ragnhild Davidse,
	Boudewijn van Kampen, Marijke Tros
Editor:	Marijke Tros
Photographs:	Jan van der Sluis;
	Paul Voorham, Voorburg
Realisation:	Slee Communicatie, www.slee.nl

#### Publisher

SWOV Institute for Road Safety Research PO Box 1090, 2260 BB Leidschendam, The Netherlands

т	+ 31703209323
F	+ 31 703201261
E	swov@swov.nl
1	www.swov.nl

Free copies are available from the publisher. Please send subscription requests and address changes to SWOV

Copyright No part of this publication may be reproduced in any form, by print, photoprint, microfilm or any other means without the prior written permission from the SWOV Institute for Road Safety Research

The articles in this magazine can (for own use only) be found on our website: www swov nl

55N. 1380 703X

#### SWOV Institute for Raod Safety Research

PO Box 1090 2260 BB Leidschendam Duindoorn 32 2262 AR Leidschendam The Netherlands T + 31 70320932

F	+ 31 703201261
E	swov@swov.nl

|--|