SWOV RESEARCH ACTIVITIES 9

SWOV Institute for Road Safety Research

MARCH 1998

The Safety Effects of *Daytime Running Lights*

For the Commission of the European Communities the SWOV Institute for Road Safety Research has been carrying out a study into the safety effects of Daytime Running Lights (DRL). In this study the role of perception in accidents and the effects of the introduction of DRL have been reviewed together with 24 already existing evaluations of DRL. Additional statistical analysis and new techniques have been employed to produce the best estimates possible of the full effects of the introduction of DRL in the EU in terms of the saving of lives and reducing the costs of the road transport system.

DRL as a road safety measure is often difficult to understand for the road user because he or she knows that with sufficient attention every road user can be seen in daylight. Nevertheless, the research reviewed shows that visual perception in daytime traffic is far from perfect and it is worse in conditions of low ambient illumination.
In a striking example 8% of cars in an open field in broad daylight were not visible from relevant distances without the use of DRL. On shady roads or those with backgrounds which mask objects in the foreground, the visibility and contrast of cars in popular colours is greatly reduced.

It is known from in-depth accident studies that failing to see another road user in time (or at all) is a contributing factor in 50% of all daytime accidents and for daytime intersection accidents this increases to as much as 80%.

Validity of DRL effects debated

The psychological research reviewed shows that DRL does not only improve the visibility of motor vehicles in daytime, but also influences the timely peripheral perception of vehicles making conflicting movements. Moreover, cars with DRL are better identified as cars and their distances are estimated more safely compared to cars without DRL. All this contributes to the expectation that DRL has positive safety effects, especially in conditions of low ambient illumination. However until recently even road safety scientists ▸

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His main fields of interest are educational and learning psychology, traffic safety, mathematical psychology, multivariate analysis and social science methodology. Since 1989 he also lectures transport and traffic safety at the Delft University of Technology, Department of Civil Engineering.

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debated the validity of DRL effects in other conditions than in Nordic winter daylight.

New analyses

The scientific evidence for the safety effects of DRL in latitudes to the south of the Northern Scandinavian countries has only become available recently (Denmark, Hungary, Canada). Older DRL evaluations for southern regions mainly concerned DRL for company fleets in the USA, but results, though positive, were not statistically significant. New meta-analysis of the earlier and more recently available DRL studies, taken together, have now shown that DRL effects on the same latitudes as those applicable to Europe are statistically significant.

SWOV study

The SWOV study investigated for the first time the differences between national and company fleet DRL effects as well as the DRL effects on accidents and on casualties. Both are found to be statistically significant.

In this study all existing (24) independent DRL evaluations have been reviewed and/or re-analysed in order to obtain unbiased, and comparably defined, intrinsic DRL safety effects while estimating statistical uncertainties in an optimal way. Intrinsic DRL safety effects are defined as the effects of a change from 0% to 100% use of DRL by motor vehicles. The observed effects of DRL will differ, therefore, from the intrinsic effect when DRL usage is not zero at the start and/or not one hundred percent at the end of observations.

Curvilinear relation with the latitude

The intrinsic effects calculated in this study, cover nine countries and are combined into twelve national intrinsic DRL effects, five on multiple (multi vehicle) daytime accidents and seven on casualties in multiple daytime accidents. The result of this analysis is the establishment of statistically significant curvilinear relationships between latitude and national DRL effects with respect to both accidents and casualties. From the difference between these two relationships an estimate has been made for the relationship between latitude and DRL effects on fatalities in multiple daytime accidents. The figure displays these relationships and the 12 national intrinsic DRL effects.

The curvilinear natures of these relationships and the differences between them is explained by the lower ambient illumination levels at higher latitudes and the lower collision speeds in accidents with one or more DRL users.

Savings and costs associated with DRL

Based on the intrinsic DRL effects related to latitudes, estimates have been made for all the countries in the EU. The best estimation is that full DRL in the EU, corrected for the existing DRL usage (mainly in Finland, Sweden and Denmark), would prevent:

- *24.6% of fatalities in multiple daytime accidents;*
- *20.0% of casualties in multiple daytime accidents;*
- *12.4% multiple daytime accidents.*

Since only about 50% of all reported accidents in the EU occur when DRL effects apply, savings must be factored accordingly. Full application of DRL across all EU countries would, therefore, yield the annual prevention of:

- *5,500 fatalities;*
- *155,000 registered injured persons;*
- *740,000 registered accidents;*
- *1.9 million accidents involving insurance claims.*

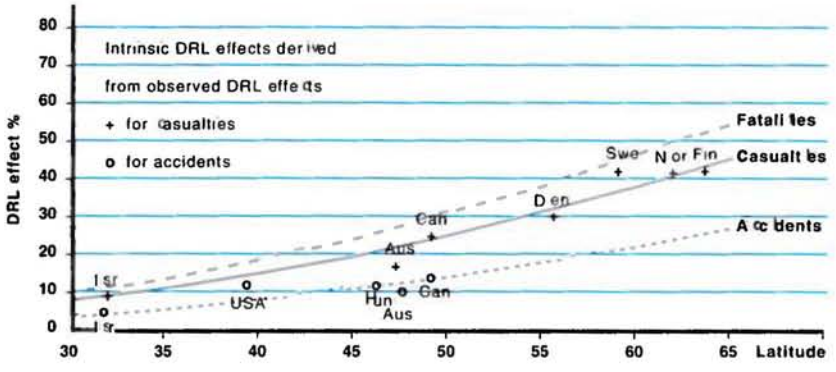
This relatively simple approach to the calculation of savings is possible because it is shown that there are no adverse effects of DRL on road users not directly involved in the change. Pedestrians benefit in the same way as car occupants and there is no change in the risk to motorcyclists (already using DRL).

Savings

The financial basis for calculating savings is taken from the recently adopted EU road safety programme which is based on an overall calculated saving of 1 million ECU per fatality saved.

However, accidents which can be prevented by DRL are relatively severe and simply using the average

Prediction curves for intrinsic DRL effects on (outcomes of) multiple daytime accidents



overall cost per fatality would exaggerate savings by about 13%. When corrected for this, the 1 million ECU per fatality prevented becomes 0.87 million ECU when applied to DRL. The total annual saving, therefore, is 0.87 million x 5,500 = 4.78 billion ECU.

Annual costs of automatic in-vehicle DRL

The annual economic costs of automatic in-vehicle DRL have also been researched and the additional annual costs are:

Fuel costs	*1.13 billion ECU*
Car costs	*0.08 billion ECU*
Bulb costs	*1.26 billion ECU*
Environmental costs	*0.18 billion ECU*
Annual economic costs	*2.65 billion ECU*

Using these figures the benefit/cost ratio for full DRL in the EU is:

4,78 billion ECU benefits
---------- = 1.80
2.65 billion ECU costs

Recommendations for action

1 Both the scale of potential saving of lives and the benefit/cost ratio demonstrated in this study indicate that the introduction of DRL across the whole EU is desirable and urgent.

2 On technical, practical and legal grounds it is recommended that compulsory DRL, when implemented in the EU, should be an automatic in-vehicle system that uses the existing low beam headlights (or special DR lamps in the long run). Introduction in this form is expected to be more readily accepted than a DRL obligation requiring behavioural changes by motorists.

3 The environmental costs, due to emissions of the 0.9% additional fuel needed for the light energy of DRL, are of importance. Environmental organisations have been against the introduction of the DRL obligation in Denmark and have influenced political decisions on DRL obligations in the Netherlands and Austria. In its conservative approach to benefit/cost calculations this study has identified a simple basis for the cost of environmental damage while ignoring the benefits provided by the savings. Past experience suggests that it would be wise to identify these benefits so that environmental arguments can be countered and the correct net effect of the introduction of DRL identified.

4 While it is very important that DRL safety effects are understood by policy makers, politicians and others with a professional interest, it is likely that public acceptance of compulsory DRL will require some form of social marketing of the policy in order to raise general awareness of the benefits of DRL. This should be a part of an implementation strategy to be developed. There will be additional costs associated with this recommendation but they will be 'start up' costs which can be set against the benefits over a period of time.

The Safety Effect of Daytime Running Lights

A perspective on Daytime Running Lights (DRL) in the EU, the statistical re-analysis and a meta-analysis of 24 independent DRL evaluations as well as an investigation of possible policies on a DRL regulation in the EU

Matthijs Koornstra, Frits Bijleveld & Marjan Hagenzieker.
R-97-36 · 175 pp · Dfl · 50,-.
(in English)

Developing Urban Management And Safety

Together with other European road safety institutes, SWOV participates in the DUMAS project: 'Developing Urban Management and Safety', a project of the research programme of the Directorate General for Transport of the European Union. The Transport Research Laboratory in the UK is the co-ordinator of the DUMAS project. DUMAS will bring together the existing knowledge on the effects of safety measures with the planning and management of urban safety programmes currently in use in the EU. Nine countries are involved in the project: Austria, the Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, and the United Kingdom. Not only integration of measures into traffic safety schemes is of interest, but also the (local) policy and decision making process and the public acceptance. The project will follow on from earlier studies including the OECD report on 'Integrated Traffic Safety Management'.

The objective of DUMAS is to produce eventually a framework for the design and evaluation of urban safety initiatives. Its first stage has been devoted to preparing a state-of-the-art review on existing practice and experience in the field.

In view of this, nine national state-of-the-art reports were prepared by the consortium partners along the lines of a common framework as proposed by SWOV. An overview and analysis of these studies was prepared by SWOV.

The Dutch situation

SWOV published a report regarding the Dutch state-of-the-art in the field concerned. The central theme is the new direction which the government of the Netherlands has recently taken concerning its approach to road safety. This comes down to achieving a sustainably safe road traffic system in rural as well as urban districts. The most essential, but not the only, pillar in this approach is the bringing about of a sustainably safe road infrastructure.

The report starts with an analytical description of the size, nature and development of road safety in the Netherlands during recent years. Estimates are made, not only of the present day costs society pays for its road safety, but also of the benefits that can accrue if all the plans are completely realised. An analysis of the costs and benefits shows that the introduction of such an approach is certainly cost effective.

Next, an impression is given of the organisation and coordination of a road safety policy, in the widest sense of the word. A number of instruments are described which are available to the national and local governments. These enable them to keep their fingers on the pulse. The necessity for a new approach to achieve the policy goals is also substantiated. The developments within de urban infrastructures are placed in an historical perspective. The development is outlined of converting a fairly unstructured system into an infrastructure based on a sustainable road safety. This includes the variants in between.

Overview

The second SWOV-report offers an overview and an analysis of the national state-of-the-art reports of each of the nine countries involved in the project. The report addresses four subjects on which the partners were requested to gather information. These subjects are:

- *problem analysis and problem statement: what are the safety problems and how have they been stated ?*
- *policies: what policies and/or strategies are entailed and applied in dealing with such problems ?*
- *design and implementation: into what measures and/or tactics are such policies / strategies translated and how are such measures or schemes implemented in practice ?*
- *evaluation and monitoring: how are the safety effects of such measures assessed and monitored (product evaluation) and how is the urban safety initiative appraised (process evaluation) ?*

Policy and decision making

Knowledge on virtually all traffic safety management policies and specific measures turned out to be widespread among the countries in the study and applied in practice, albeit sometimes on a minor scale. So lack of knowledge as such cannot solely explain differences in accident records.

However, reviewing the national reports, the central role of policy and decision making became obvious. After all, it is at this level that problem solving is getting priority, legal embedding, funding and implementation, the 'top-down' raising of public awareness, etc. Adequate organisational structures are part of it. They play a key role in structuring and organising the co-operation of the many different partners to be involved in safety initiatives, in monitoring the processes, the information transfer, and so on.

Sharing interests and goal setting

The strategies of sharing interests and of goal setting turned out to be successful safety policies. At the same time they appeared to be effective in getting and, if necessary, keeping the traffic safety issue on the political agenda or priority list. In the sharing interests strategy, common goals of different policies are intended to be achieved by combined and attuned efforts. The forming of such coalitions was especially successful in alliances with environmental and well-being policies. In the goal setting strategy, the responsible authority commits itself to achieve a fixed traffic safety target within a certain period of time. The strategy turned out to be effective in achieving previously set targets. Indirectly, some other results of the strategy seem to be at least as important, for they will have a profound impact on future safety initiatives, in setting the scene and conditions for their

approach. The strategy requires, among others, long-range comprehensive action programmes, reliable organisational structures, monitoring procedures and information transfer. Importantly, the role and responsibilities of all actors involved also have to be established. Safety audits and safety impact assessment - in which the impact on road safety should, like the environmental impact, be systematically assessed at the decision stage - might be supportive to both aforementioned strategies.

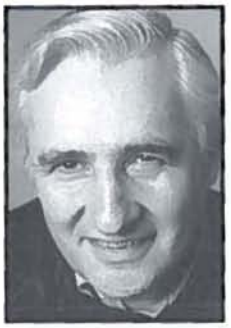
Old and new concepts

Some urban traffic safety concepts have been developed over time and have become generally accepted. In this context, the area-wide safety approach is of particular interest. The approach, being an integrated traffic safety management philosophy, embeds past beneficial experiences in the field of traffic safety, taking into account other local interests and related policies as well.

New developments regard the so called sustainably safe road traffic concept and the zero-vision approach.

The starting point of the sustainably safe concept is the principle that man is taken as the reference standard. The probability of accidents should be reduced in advance, by means of the infrastructural design. And where accidents still might occur, the process which determines the severity of these accidents should be influenced such that death and serious injury is virtually excluded.

In the zero-vision approach, it is essential that the traffic system has to be dimensioned in such a way that possible conflicts or incidents which might cause injury, never result in a pre-defined level of unacceptable loss of health to be exceeded.



Peter Wouters, 57 years old, studied Mathematics and Physics at the University of Amsterdam. He is a senior researcher employed by SWOV since 1969.

His main fields of interest are: manual control, man-machine systems, human factors engineering and system theory, integrated traffic safety management, specific (i.c. elderly and young) traffic participants, the safety of freight transport and advanced telematics in transport.

Evaluation

Evaluation studies of traffic safety schemes are rather scarce. Yet, evaluation is of importance for the sake of a scheme itself, as well as for the sake of future traffic safety initiatives. Reliable stated effects and information on it might encourage more widespread application. Studies of this kind do not necessarily have to focus on accident occurrence alone, but studying intermediate variables for instance might also be of value in appraising objectives of safety action, e.g. speed reduction, less through traffic, etc. The effectiveness of several of these traffic safety schemes have been reported. With regard to traffic calming measures, for instance, evaluation studies showed accident reductions between 15-80%.

Conclusions

In the final chapter of the report special attention has been given to what is seen as the crucial general outcome of this review: it is the question how can we elevate the exception - of only applying measures of proven effectiveness on an incidental scale - to the general rule. In that perspective, the individual outcomes of the review were considered once more and combined.

The conclusion can be drawn that the use of Urban Safety Management frameworks is understood but under used. These should be promoted on a national as well as a local level. The value of the DUMAS project is to point out how different national approaches to the issue allow the development of a fairly uniform framework which would assist in encouraging the changes in political decision making which will be required.

Urban road safety initiatives

State of the art on existing experience in the Netherlands

A.A. Vis.
D-97-11. 60 pp. Dfl. 22,50.
(in English)

Urban Safety Management in Europe

An overview of current practice in nine countries in the context of the DUMAS project

P.J.J. Wouters.
R-97-57. 46 pp. Dfl. 22,50.
(in English)

Adonis: a European exercise

Adonis stands for Analysis and Development of New Insights into Substitution of Short Car Trips by Cycling and Walking. The goals of ADONIS were to provide:

- **a comprehensive overview of best practice to encourage cycling and walking in cities;**
- **a detailed understanding of road users' travel behaviour and attitudes;**
- **new knowledge of behavioural factors in urban traffic accidents involving cyclists and pedestrians;**
- **a comprehensive overview with general recommendations and guidelines for urban decision makers regarding directions for efforts to promote walking and cycling instead of short trips in cities.**

Seven public and private European institutes and companies cooperated in attaining these goals.

As a component of this European project, a document has been prepared which comprises information about measures which are intended to stimulate cycling and walking so that the number of short car trips will possibly be reduced.

Measures being taking in the Netherlands, Belgium, Denmark and Spain were studied. The measures have been described and been put into a standardised format.
A collection of a great many descriptions is usually called a catalogue. Such a catalogue of measures is a substantial part of this document.

The document is intended for local traffic authorities, particularly for those who create designs for the construction or improvement of traffic facilities, and for those who wish to influence the use of these facilities.

T o n Hummel is 33 years old and studied Traffic Engineering and Human Geography. After his study he was employed by the Ministry of Transport and Public Works. Since 1997 he is a researcher at SWOV.

He is mainly involved in projects concerning the development of a sustainably safe road traffic system.

What is new about the catalogue?

For cycling measures, certain international catalogues have been published. For pedestrians, no European comprehensive work yet exists although some starts have been made in that direction. It seems as if cycling organisations can stand up for the interests of cyclists better than the pedestrian organisations can stand up for the interests of pedestrians. For this reason, cycling measures are often not only irrelevant to the needs of pedestrians but even unfavourable.

Developing a combined catalogue expresses a philosophy that emphasises the minimising of the use of measures that would negatively affect the 'other group', the ongoing considering of each group's interests, and the serving of each group's interests whenever possible.

A catalogue like this will never be really complete; other measures are conceivable, and there is more to report about each measure. The main purpose of this description of how to use the catalogue is to stimulate road authorities to prime the creative process intended to keep looking for good solutions.

Furthermore, it is assumed that only when people have good facilities will they use other means than the car for short trips. Naturally, just having good facilities is not enough; people have other reasons for taking the car instead of cycling or walking. Obviously, therefore, it is necessary to accompany this project with another one (WALCYNG) involved in developing a marketing strategy (based on the wishes and convictions of target groups) for developing communications intended to replace short car trips with cycling and walking.

Which measures are presented?

In general, two kinds of measures are presented: technical and non-technical measures which are friendly for pedestrians and cyclists. Examples of the first category are good cycle tracks and good crossing facilities. The second kind of measures concern rules and regulations, traffic signals, and public information and education. Addressed here are 71 technical measures and 31 non-technical measures.

Selection criteria

Important are the selection criteria:

1 *Comfort: is the solution attractive and does the solution make the trip shorter or faster?*
2 *Does the measure stimulate walking or cycling?*
3 *Is the measure cost effective?*
4 *Does it encourage safety and social safety? (Which must not be endangered in any case.)*

Which measures are not presented?

This document assumes that a municipality has already allowed some space for cyclists and pedestrians in its city planning or restructuring, and that decisions have already been made in regard to the locations for new cycle and pedestrian routes. Once this has been established, individual measures such as the ones presented here can be considered.

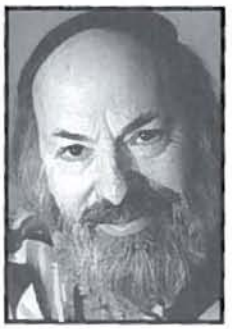
The same applies to public transport facilities. Walking and cycling are often used to cover the distances previous and subsequent to the routes covered by public transport. The document is limited to the covering of these supplementary distances. Furthermore, effective public transport does not usually contribute to a shift from use of the car to cycling and walking. On the contrary, much public transport replaces bicycle and walking trips.

What is included?

Each description of a measure is accompanied by illustrations: photos, design, diagrams of a lay-out, or other road elements, as well as illustrations of public information material. Infrastructural measures are sometimes provided with dimensions as well.

Next, the advantages and disadvantages of the measures in terms of comfort, costs, safety, and social safety are described in as much detail as possible. Also discussed are the advantages and disadvantages for road users other than pedestrians and cyclists. If possible, a cost estimate is provided.

Covered and locked bicycle safe in the Dutch city of Utrecht



A a d

Vis, 59 years old, has been working at SWOV as a researcher for more than 30 years. Earlier, he was involved in research concerning safety barriers, submerging vehicles and the influence of the use of alcohol, medicines and drugs on traffic safety.

Recently, he carried out research on street lighting, traffic calming and infrastructural aspects and the safety of motor riders.

Finally, the names of publications or organisations are listed as sources for more information.

Laws and regulations

Some of the four countries have special regulations in force for pedestrian and cyclist facilities, a fact which has consequences for the use of the document. One example is how the Netherlands strives to give cyclists broad cycle tracks. This measure is partially determined by the fact that in the Netherlands cyclists are allowed to ride side by side. It is always important, therefore, to involve the regulations in a certain country when choosing measures. In addition to the national laws and regulations, there are also European regulations (the Vienna Agreement and the Geneva Convention). Not every country has ratified these agreements, and every country can also apply the rules in its own way.

Classifications of the measures

Road authorities can have many different questions when wanting to take measures to encourage cycling and walking. They may wonder which regulations will provide the strongest motivation to cut back on short car trips, or they may wonder

what can be improved in regard to the infrastructure.

In the first case, classifying the measures according to the their level of firmness - from very strong to very weak - is necessary. In the second case, making a distinction between infrastructure and non-infrastructure is most useful. And, obviously, both questions can be posed simultaneously. Classifying according to both criteria at once is handiest.

In this set of directions, several possible classification criteria will be applied to the measures while always implying a different presentation of the question. Although the classification used in the document may be the most obvious one, it is certainly not the only one possible. For this reason, various systems of selection will be offered.

Best practice to promote cycling and walking

SWOV Institute for Road Safety Research, the Netherlands. Ingeniería de Tráfico S.L. (INTRA), Spain. Langzaam Verkeer VZW, Belgium. Danish Road Directorate, Technical University of Denmark (DTU), Denmark. 300 pp. Dfl. 75, -.

Aggressive behaviour in traffic

This report gives an account of the findings of a study into aggression in traffic. The study was commissioned by the Dutch Ministry of Transport. It begins with a description of activities in the Netherlands in the field of traffic aggression. The report then defines the term traffic aggression more precisely, using the relevant Dutch research material, international research and the conclusions of an expert meeting on aggression in traffic. The meeting which was held on 12 August 1997 was hosted by the Royal Dutch Touring Organisation ANWB. Further, an attempt is made to estimate the relevance of the traffic aggression phenomenon to road safety. Finally, possible approaches to prevention of traffic aggression are formulated.

A simple analysis of newspaper reports shows that excessively aggressive acts (road rage) are relatively uncommon. This is also confirmed by the more extensive American research. The degree of social disquiet about the phenomenon is probably partly determined by media coverage.

Types of aggression

Traffic surveys and socio-psychological literature distinguish two types of aggression:

1 *affective aggression, whereby there is an intent to cause damage or whereby a threat to cause damage is made, prompted by a feeling of anger at perceived injustice;*
2 *instrumental aggression, whereby the aggressor attempts to gain psychological or material advantage and thus reckons on causing harm to others. Anger is not at the root of this.*

Affective aggression

Nothing is known about the extent of affective aggression, but its potential consequences are considered to be serious. Excesses can probably be placed at the extremes of the aggression scale. Causes are to be found within the sphere of emotion theory: the aggressor becomes angry because of disadvantage to which he has been put by someone who is also seen to be able to prevent such disadvantage. Further, moods play a role as do personality traits. Prevention could be geared towards the prevention of intentionally harmful actions and behaviour, and the aggressor's learning how to control anger.

Instrumental aggression

Instrumental aggression is thought to be widespread. Many conscious violations are committed with the

P e t e r Levelt, 55 years old, studied Psychology at the University of Amsterdam. He carried out research on children and media. He obtained his doctorate in 1981 with a thesis on the subject: what children can learn from television.

For ten years he was head research and one of the editors of the television program Sesame Street. Since 1986 Peter works at SWOV and his main topic is traffic behaviour.

intent of harming others or to deliberately place others in danger. The consequences for road safety also appear considerable. Causes are to be found in personality traits and attitudes, and in situational factors. Moods can also be a factor here. Prevention overlaps with the prevention of a number of traffic violations, such as speeding offences and driving under the influence of alcohol. Attitude theory provides handholds for an appropriate approach.

Attributed aggression

Experts currently consider another factor to be even more relevant: people are irritated by the aggressive behaviour of others. This concerns attributed aggression which by no means always involves objective-aggressive acts. The same factors that apply in the case of affective aggression apply here. However, the emphasis here lies more on the subjective perception of intentional damage by others. Therefore the emphasis in preventative action lies on changing these attributions and the promotion of an ability to see others' point of view.

In various countries ranking tables of acts which are seen to be aggressive have been developed. Here, the degree to which an act is seen to be aggressive does not correspond exactly to the degree to which it is experienced as annoying, nor to the degree to which one reacts aggressively oneself.

Recommendations

It has been established that good theoretical frameworks exist for studying aggression in traffic but that some gaps exist in knowledge concerning the extent of, and motives for, the various forms of aggression and concerning the relevance for road safety.

It is proposed that an aggression meter be developed, to begin with attributed aggression. This will then fill the gaps in existing knowledge, answer the social question of whether aggression is increasing and will serve to evaluate preventative measures.

Aggressive behaviour in traffic

Opinions, state of the art and recommendations

Dr. P.B.M. Levelt.
R-97-45. 147 pp. Dfl. 45,-.
(in Dutch)

Road safety developments in the Netherlands

In the Netherlands, as in many other countries, the number of fatalities is well-known, but the real number of hospitalised road traffic victims is not. The degree of completeness of the police reporting for this group in the Netherlands is yearly roughly estimated; it has gone down from about 80% twenty years ago to 60% by now. The Ministry of Transport and Public Works wishes to arrive at a new approach for registering data concerning road traffic accidents to be able to determine the actual extent of road safety. This new approach is being elaborated in more detail by the collaborative efforts of the ministry itself, Statistics Netherlands (CBS) and SWOV. Within this context estimates of the real numbers of road casualties are published officially.

SWOV was commissioned to develop and apply a method to determine the actual number of casualties. Two separate categories were to be estimated: hospital admissions, and injured persons who reported themselves for treatment in the hospital's Accident and Emergency Care Department.

Ragnhild Davidse is 26 years old. She studied Psychology at the Leyden University. After her study she was employed by the Centre for Science and Technology Studies at the Leyden University. Since 1996 she is a researcher at SWOV.

A main part of her task concerns the analysis of developments in road safety. Other activities concern the Road Safety Information System and data management.

Hospital admissions

To make an estimate of the hospital admissions, a comparison has been made between the records in two well-established databanks: the databank of police reported traffic casualties, which is the official Dutch databank for traffic accidents and the National Patient Register from SIG Health Care Information. The first one covers only road casualties, but more than hospitalised ones; the second one covers only hospitalised patients, but more than road casualties. The first one is incomplete, the second almost complete. However, it is not possible to earmark all road casualties in the second database. The first one has only scarce information about the injuries, the second has only scarce information about the accident.

Therefore the information of the two databanks was combined by matching the individual records and procedures have been developed that can effectively be used to estimate the total number of hospitalised road casualties. It was found that the total number of hospital admissions resulting from road traffic accidents occurring in the Netherlands was:

- *in 1994 19,840*
- *in 1995 20,000*
- *in 1996 19,420*

Injured persons requiring hospital emergency care

Determining the actual extent of injuries requiring hospital emergency care was based on the source file known as VIPORS (Road Traffic Accidents in the Private Accident Registration System) containing data from 1994 through 1996. Based on a sample of 13 hospitals, national data were obtained by multiplying the sample outcomes with certain factors.

The total number of injured persons requiring hospital emergency care as a result of road traffic accidents occurring in the Netherlands was:

- *in 1994 99,200*
- *in 1995 102,500*
- *in 1996 91,200*

Situation in 1996

These new estimates were used in another report, that presents an analysis of the general developments in road safety in the Netherlands, with a special focus on the year 1996. The number of road deaths in 1996 was 1,180. This number dropped considerably in comparison to the figures for 1995, when 1,334 people died in traffic, thus indicating the first decrease in the number of deaths since 1991. This would seem to be an encouraging development especially when considering the unfortunately high number of road deaths in 1995. However, it cannot be concluded yet that these figures actually indicate a positive development in road safety on Dutch roads. The main explanation for the relatively fewer number of deaths in 1996 was the cold winter during that year, rather than structural factors such as effective road safety measures or a reduction in mobility growth.

The largely incidental character of the decrease in the number of fatalities means that additional policy efforts will still be needed for the target set for the year 2000: 25% fewer casualties than for the year 1985. This is the main conclusion

drawn in this report, following a thorough analysis of the available figures concerning 1985 through 1996 road casualties in combination with explanatory factors such as the figures concerning exposure data.

Peter Polak, 57 years old, studied Physics at the University of Amsterdam, culminating in a PhD in 1973.

He is a senior researcher employed by SWOV since 1975. His main fields of interest are methodology, mathematical models and data reduction: the representation of complex results by simple concepts.

population, number of vehicles on the road, etc.

High risk groups

This report also examines the nature of the road hazards. Absolute numbers of road casualties and risk figures were related to significant subdivisions such as the transport mode and the age of the person operating the vehicle. It is known that mopeds are linked to extremely high risks. This applies not any longer, however, just to the chance of being admitted to hospital. In recent years, the chance of dying in a traffic accident has also been the highest for moped riders. The main users of this transport mode (young people aged 15 through 17) also make up one of the most risk-filled age groups participating in traffic. People aged 18 through 24 as well as those 65 and older are also considered to be of high risk. The first group mostly due to problems associated with young motorists, and the second group due to their higher degree of physical vulnerability.

Spearheads

National priorities have been put on a selected number of spearheads. Some of them are discussed.

The effect of alcohol in traffic is still a cause for concern. According to police reports, the number of traffic deaths as a result of alcohol accidents increased in 1996. According to SWOV, however, these figures are not so much due to more people drinking alcohol and then participating in traffic, as they are the result of the fact that the police have been checking more often to see if alcohol use was involved in fatal accidents. The combination of drinking and driving is chiefly a problem involving young male motorists. Although drivers aged 18 through 24 do not drink as much as middle-aged men, the degree to which these younger drivers are involved in alcohol-related accidents is extremely high.

The use of safety belts and the large-scaled violation of speed limits also deserve continuing attention. Seat belt use has remained the same for years, and speed limits are being violated to a great extent on almost all types of road. There are signs that the police are increasing their enforcement efforts, particularly when it comes to a more intensive control of speed limit violations. A more wide spread effort using automated control techniques in combination with information campaigns, however, will be needed to achieve a lasting effect throughout the country.

Finally, the road safety on Dutch roads was put into perspective by comparisons with figures for other causes of death, with the situation in other countries, and with other modes of transport. Special attention was given to the costs resulting from the lack of road safety.

Ton

Blokpoel is 54 years old. Since 1966 he is employed by SWOV. First as a statistical analyst, later he grow into an expert on the analysis of road safety figures.

He advises his colleagues at SWOV on how to use which data for their research. He is also involved in the development and marketing of the Road Safety Information System.

The determination of the total number of hospitalised traffic victims by comparison of police and hospital reports

Dr. P.H. Polak & S. Oppe.
D-97-21. 14 pp. Dfl. 15,-.
(in English)

Road safety in the Netherlands during the years 1985-1996

An analysis of the developments

R.J. Davidse (ed.).
D-97-16. 68 pp. Dfl. 25,-.
(in Dutch)

Estimating the actual extent of road safety from 1994 through 1996

Incremental method and results for hospital admissions and injured persons treated in hospital emergency departments

L.T.B. van Kampen, Dr. P.H. Polak, A. Blokpoel & J.M.J. Bos.
R-97-41. 78 pp. Dfl. 25,-.
(in Dutch)

Annual analysis of VIPORS for 1996

Final reporting about the results of registering road traffic victims at hospital emergency departments

J.P.M. Tromp, L.T.B. van Kampen & A. Blokpoel.
R-97-50. 69 pp. Dfl. 25,-.
(in Dutch)

Assessment of the comprehensiveness and representativeness of VIPORS over the year 1996

A study to evaluate the representativeness and comprehensiveness of data gathered at hospital emergency departments in 1996 in order to estimate the total amount of casualties requiring emergency treatment

L.T.B. van Kampen.
R-97-51. 54 pp. Dfl. 22,50.
(In Dutch)

A further step towards a sustainably *safe traffic* system

Road safety policy in the Netherlands aims to achieve a sustainably safe road traffic system: a system in which the road infrastructure has been adapted to the limitations of human capacity through proper road design. It is meant to be a system in which vehicles are technically equipped to simplify driving and to give all possible protection to vulnerable human being. Furthermore, it is a system in which road users have been properly educated, informed, and where necessary deterred from undesirable or dangerous behaviour. Man should be the reference standard and road safety problems should be tackled at its roots: a pro-active approach.

In recent time the SWOV Institute for Road Safety Research has carried out various research projects in order to advise the Dutch Government and other key stakeholders how to design and how to achieve such a sustainably safe traffic system.

A few recent projects are mentioned below. For more information please ask for the complete list of SWOV research on a sustainably safe traffic system.

Functional requirements for design criteria

The concept of sustainably safe road transport comes down to the removal of all function combinations by making roads and streets mono-functional. Multi-functionality leads to contradictory design requirements and also to higher risks. Based on existing knowledge functional requirements for design criteria have been developed by SWOV for a sustainably safe traffic system:

- *create residential areas as large as possible;*
- *every trip as long as possible over the safest type of roads;*
- *make trips as short as possible;*
- *combine short and safe;*
- *prevent search behaviour for destinations;*
- *make road types recognisable;*
- *reduce and uniform design characteristics;*
- *prevent conflicts between on-coming traffic;*
- *prevent conflicts between crossing traffic;*
- *separate different transport modes;*
- *reduce speed where conflicts could occur;*
- *prevent obstacles alongside a road.*

Recently these functional requirements have been made operational in provisional guidelines, compiled by a working party of the Netherlands Centre for Research and Contract Standardization in Civil and Traffic Engineering CROW.

Testing the sustainability of the road network in West Zeeland Flanders

Road safety in the Province of Zeeland and especially in the region known as West Zeeland Flanders (WZV), is poorer in several respects than in other places in the Netherlands. The regional road authorities selected the WZV area as the site for introducing a sustainably safe traffic system. The Ministry of Transport and Public Works then designated this project as a demonstration project. Among other things, this means that a monitoring system will be used for meticulously following the developments within this geographic area. SWOV has developed this system and compiled various strategies for carrying it out.

Testing

One element of this monitoring is the testing of measures in the area of road infrastructure against the design principles for sustainably safe road networks. The strategy proposed for this testing was worked out in more detail to create a design for the testing. The testing must answer three questions.

- *Does the design of the road network conform to the design principles for sustainably safe road networks?*
- *Does the behaviour of road users change as a result of applying the design principles for sustainably safe road networks?*
- *Does behaviour change in accordance with the line of reasoning relating to the design and use of principles for sustainably safe road networks?*

Functionality, homogeneity and predictability

The design of this study consists of three parts: functionality of the road network, homogeneity of traffic and predictability of traffic circumstances.

Functionality involves the intended use of the road network. This will be tested beforehand with models calculated to show the effects of the various traffic measures on traffic distribution over the network, and afterwards with counts, surveys and measurements that will establish the actual situation.

Homogeneity involves the circumstances, such as differences in speed and dimensions, under which the various types of traffic (pedestrian, vehicular, bicycles, etc.) are combined. Testing this occurs beforehand by evaluating the planned rules and possibilities for behaviour, and afterward by perceiving the actual traffic situations.

Predictability is recommended to be established by means of field test, use of a driving simulator, video and photo studies, each of which will establish different combinations of different aspects of behaviour. These aspects of behaviour are: identifying road types and situations, identifying limitations in one's own behaviour, predicting situations and behaviour, controlling of encounters / limited effort, and limited variation in behaviour/agreement with desired behaviour.

All activities for testing will be focused on an itinerary in this region which includes all types of sustainably safe roads but could be applied elsewhere as well.

Road safety impact assessment in the Westland Region

The Westland Road Safety Project was launched in 1994. It was a project conceived to enable the realisation of policy goals in the area of road safety for the years 2000 and 2010. As part of this project, SWOV drew up a road safety impact assessment for the road network in the Westland region. The Westland region is that part of Holland south of The Hague. The study was financed by the Dutch Province of South Holland and subsidised by the Association of Dutch Insurers.

The aim of this study was to calculate the safety effects and costs for three different scenarios in the year 2010. These scenarios are a reference scenario, as well as three sustainably safe scenarios known as the max, min and mix scenarios. The last one is based on the min scenario, adding three new road sections. A functional classification of roads was developed for each of the scenarios.

Outcomes

The differences between the outcomes of the three sustainably safe scenarios were not very great. For all scenarios, the traffic on most of the roads appeared to increase considerably in relationship to the 1993 situation. Traffic flow decreased on some roads, depending on the chosen scenario. The only scenario yielding results sufficient to meet the criteria set by the policy goals (40% fewer injuries than in 1986) was the max scenario. This scenario was estimated to yield 42% fewer casualties as a direct result of making modifications in the infrastructure. The min scenario would yield 32% fewer casualties, while the mix scenario would yield 38% fewer casualties when compared with the 1986 situation. In comparison to the trend scenario (536 casualties annually), traffic hazards would be almost or largely cut in half.

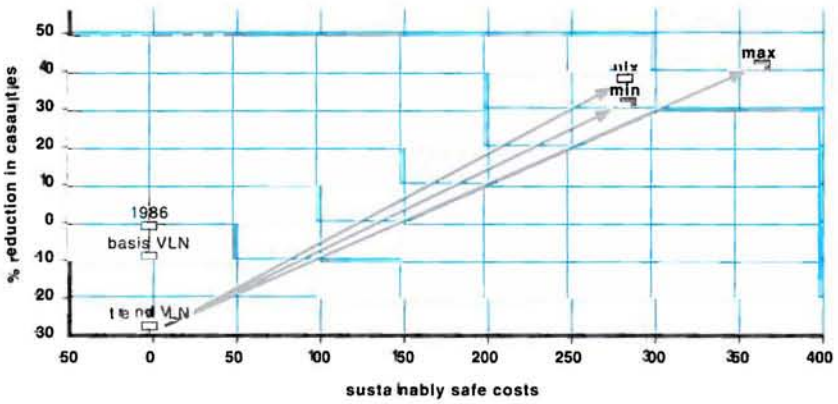
Theo Janssen is 52 years old. Since 1972, after he completed his study Civil Engineering at the Delft University of Technology, he is employed by SWOV.

The research projects he is involved in, are the field of road infrastructure, especially the categorisation of roads and road safety measures. Since 1991 he is research manager of the department Technical Sciences.

Mix scenario most cost effective

The costs accompanying the three sustainably safe measures were estimated by the regional road authorities to be 365 million guilders for the max scenario and 285 million guilders for both of the other scenarios, excluding the costs for constructing the three new road sections included in the mix scenario. When the reduction in the numbers of casualties was weighed against the investment costs, it appeared that the mix scenario would be the most cost effective.

Result of investments in a sustainably safe system



Sustainably safe traffic system and accessibility: a pilot project for the Central Netherlands

This study which was carried out with a Dutch firm of consulting engineers, DHV Environment and Infrastructure compares two kinds of road networks for the same region: one network developed in the traditional manner and another network satisfying the basic conditions for a sustainably safe road traffic system. The comparison deals with issues such as road safety, accessibility, traffic flow, and various environmental aspects such as noise and the emission of harmful substances. The reason for this comparison can be found in the sometimes uttered hypothesis that a sustainably safe network can have adverse effects on accessibility, on traffic flow and could have detrimental environmental effects.

To assess the quality of the two network versions, calculations were made using a traffic forecasting model. Such a model produces traffic flow data and speeds per road section. The data generated was used to score the two networks according to a number of criteria.

Results

The overall results showed no adverse effects on mobility or accessibility, and for some aspects, the effects were actually positive.

When using a sustainably safe design for the network, road safety is considerably enhanced. The minimum gain is nearly 5%. The term minimum is used because only the effect of the differences in traffic distribution over the network was examined, and not the effects of a sustainably safe design. It has already been estimated that with the complete package of sustainably safe measures, a reduction of 60 to 80% in the number of casualties can be attained in the long run.

Accessibility was measured in two ways. The number of vehicle hours driven was examined; combined with the number of vehicle kilometres, this gives an indication of the overall traffic speed on road sections. Furthermore, the number of vehicle hours lost at junctions was examined; this gave an idea of the traffic flow at junctions.

The number of vehicle hours driven was somewhat higher in the sustainably safe version. This can be explained by the fact that the number of vehicle kilometres driven in this version is slightly higher. The number of vehicle hours lost at junctions was lower in the sustainably safe version. This was caused mainly by the beneficial effect of the roundabouts on traffic flow at the junctions between the access roads.

As far as noise was concerned, no quantitative data relating to the number of homes adversely affected by noise was obtained. Maps indicate where the noise levels increase or decrease by more than 3 dB(A). From this it appears that extra attention should be given to access roads inside urban areas.

The harmful effects on air quality were calculated using three parameters: fuel consumption, nitrogen oxides emissions and CO_2 emissions. The differences between the two versions were marginal.

Functional requirements for the categorisation of roads

A first step towards the development of guidelines for a categorisation of sustainably safe roads

S.T.M.C. Janssen.
R-97-34. 30 pp. Dfl. 17,50.
(In Dutch)

Testing the sustainability of the road network in West Zeeland Flanders

A. Dijkstra, P.C. Noordzij & C.M. Gundy.
R-97-29. 83 pp. Dfl. 35,-.
(in Dutch)

Implementing Sustainably Safe Measures in the Westland Region

A study into the approach, costs and safety effects of a sustainably safe infrastructure for three scenarios

R-97-46. 129 pp. Dfl. 65,-.
(in Dutch)

Sustainably safe traffic system and accessibility: a pilot project for the Central Netherlands

Final report

F. Poppe.
R-97-40. 46 pp. Dfl. 40,-.
(in Dutch)

SWOV PUBLICATIONS

New list of SWOV Publications available

The SWOV Public Relations Department has made a new list of the publications which are written in English, German or French. The list contains titles of reports, papers and articles published in 1985-1997. The number of the publication is R 98-2. The price is Dfl. 22.50. If you want to receive a copy of this list, please send a letter or telefax to Sandra Rietveld and ask for an order form. We also have a list of all 1997 publications, including the ones written in Dutch. Its number is R 98-3 and it costs Dfl. 17.50.

A sustainably safe traffic and transport system: déjà-vu in urban planning?

This paper deals with the question of how to reconcile urban development with traffic structure, traffic flows and transport modes. A distinction is drawn between the so-called pan-urban projects and those within individual residential areas. A sketch of developments and trends is given, designed to examine whether the knowledge and insight attained in days gone by is being applied, whether the urban traffic system can ever be controlled in all its facets and if pan-urban concepts have a chance of success anyway. It is examined how these concepts relate to the most modern of the pan-urban concepts: the sustainably safe traffic and transport system.

The question of how to reconcile urban development with traffic structure, traffic flows and transport modes is by no means a new one. The trends in thinking on the subject, varying from traffic free through reduced traffic to everything out of the way for the car, still fail to converge towards any ideal or optimal situation. Various concepts have been propounded and perhaps even adopted for a period. They then disappear only to reappear - sometimes years later - possibly in modified form.

One example would be the urban underground railway. Thirty years ago this was considered unacceptable in the Netherlands because of the large-scale demolition of residential property, now it would seem that the idea is once again viable.

Mistakes of the past are repeated

Whether there is any sort of collective learning process for the trends described here would seem very doubtful. The mistakes of the past are repeated at every new emergence - consider the current planning trend to give residential streets the original old-fashioned look, with tong straight roads and cars parked on both sides.

That this particular design leads to diminished road safety has been proven by many studies conducted in the days before the introduction of the Dutch wooncrf en the 30km/h zones. A number of common points link the various designs and structures.

Firstly, they are mostly confined in their concept to fulfilling one or two purposes or aims, (such as the accessibility of the inner city or the liveability, i.e. amenity of an area).

Secondly, they come into existence only with the greatest of difficulty (given the resistance of those they affect).

Thirdly, they disappear, sometimes after but a short time. An example would be the residential area scheme which was attempted in the Dutch borough of Rijswijk, (with the help of millions of guilders of government subsidies), and which disappeared only fifteen years later when the area was returned to its previous layout.

The town as a laboratory

At the town and city level, urban development and traffic planning involves using the town as a permanent laboratory, in which theoretical considerations concerning the optimum traffic structure are given little chance, or serve merely as a background, in order that a common thread through practice and policy be maintained. There are towns which, in executing their traffic policy (or at least a part of it), manage to maintain that common thread for years. However, the thread is thin and its strength seems to depend entirely upon the individuals charged with the execution of the policy. Of course, it is the urban local authority whose responsibility it is to give form and substance to the traffic policy but whether the powers that be will ever emerge from the laboratory stage remains to be seen.

National government attempts to influence traffic policy at local level by subsidising projects and by promoting the exchange of knowledge and expertise. This influence has either a very rigid form, (as in the Rijswijk case, where the residents

Atze Dijkstra is 43 years old. He studied Civil Engineering at the Delft University of Technology. As from 1983 he was researcher at SWOV, commissioned with mainly infrastructural projects. From 1992 till 1996 he worked as a researcher at the OTB Research Institute for Policy Sciences and Technology of the Delft University of Technology.

Since 1996 he works for SWOV again as a project manager and he is working on the following subjects: bicycle facilities, sustainably safe traffic and transport system, roads in rural areas, main roads in urban areas, and traffic calming.

had the residential area scheme foist upon them), or a much too loose form, as in the case of a subsidised plan for a new residential estate between Utrecht and Vleuten-De Meern, which was replaced by the local authority with a plan which, from the point of view of traffic aims, was exactly the opposite.

Compromises

An urban traffic system unites many functions and must score on many points in order to fulfil the overall set requirements. A system which scores well on one point will probably score badly on another. For example, a tunnel for cyclists may score well on road safety but will score rather badly on social safety.

The traffic system of an urban area remains a framework of compromises and sub-standard solutions. If one aspect is placed to the fore and an attempt is made to have this aspect reflected in all the different functions, the character of the whole framework is adversely affected. The trick is to find the right combination of aspects and functions for each situation. This mix is not necessarily the most logical or rational solution, nor is it the ideal solution as derived from theory, but is the solution that will meet with the least resistance.

Urban and pan-urban projects

In this paper the author draws a distinction between concepts which are devised and executed across complete urban areas (the so-called pan-urban projects) and those within individual residential areas. Urban development projects are usually confined to the latter, residential area, level. Modifications to the traffic structure are more often than not of a pan-urban nature, because traffic is not confined to one small area of a city, but tends to diverge across the whole road network.

Next, a sketch of developments and trends is presented from influential books and reports dating from the early post-war years (or in some cases even earlier). This review of the old masters is designed to examine whether

- *the knowledge and insight attained in days gone by is being applied;*
- *the urban traffic system can ever be controlled in all its facets;*
- *pan-urban concepts have a chance of success anyway.*

This sketch does not pretend to be complete. It does, however, give a good picture of the most important developments. It is also examined how these concepts relate to the most modern of the pan-urban concepts: the sustainably safe traffic and transport system. A question to be raised here is whether this concept in fact introduces anything new. Using a fully worked-through example, the possible application of old knowledge to this latest concept is shown.

A sustainably safe traffic and transport system: déjà-vu in urban planning?

Contribution to the conference 'Traffic safety on two continents', Lisbon, Portugal, September 22-24, 1997

Atze Dijkstra.
D-97-12 . 20 pp. Dfl. 15,- .
(in English)

4th World Conference on Injury Prevention and Control

Building partnerships for safety promotion and injury prevention

The Fourth World Conference on Injury Prevention and Control will stress the need for building an international community for injury control management and for sharing rich experiences in the different countries and regions all over the world.
It will encompass a rich variety of knowledge and experience in the various sectors concerned, such as:

- control of road traffic injury;
- safety at work;
- home and leisure safety;
- prevention of sports injury;
- prevention of interpersonal and self-inflicted violence.

It will pinpoint the divergences as well as the similarities in these sectors in the respective regions of the globe in terms of the need for control programmes, the approach in injury control, the techniques applied and achievements made in closing the gap between research and intervention. The conference is an initiative of the World Health Organisation and its Collaborating Centres for Safety Promotion and Injury Control.

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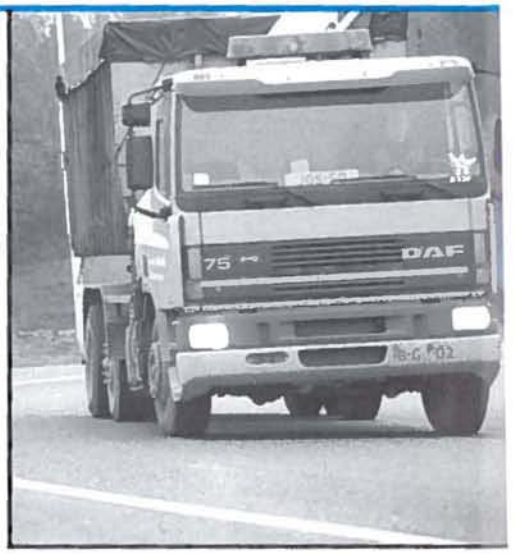
How to order SWOV Publications

SWOV carries out research concerning road safety. Our main client is the Dutch Ministry of Transport. Therefore, most SWOV reports are written in Dutch. In these reports, normally an English summary is incorporated. Sometimes however when research is carried out for the EU or other international bodies reports are written in English. SWOV researchers also participate in international conferences, workshops and seminars and contribute to international journals. These contributions are normally written in English, sometimes in German or French. Some of those are published by SWOV. In this magazine the newly published reports are mentioned and a summary of the contents is given. The complete reports can be obtained by asking for a SWOV order form, completing it and sending it to Sandra Rietveld of the Public Relations Department of SWOV. The price of each report (in Dutch guilders) is mentioned in this magazine, 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.

SWOV REPORTS IN BRIEF



Review of modelling of road casualties in the Netherlands

Max Cameron (Monash University Accident Research Centre, Australia). D-97-18. 31 pp. Dfl. 17,50 (in English)

The SWOV Institute for Road Safety Research in the Netherlands invited Max Cameron of the Monash University in Australia to undertake a review of existing and potential new activities at SWOV aimed at modelling time-series of road casualties (deaths and injuries) and casualty accidents. The review covers the following areas:

- *Macroscopic models of traffic and traffic safety. Recent work at SWOV has attempted to apply the general models to disaggregated sub-groups of total road casualties in the Netherlands. Current work is experimenting with structural state space models for traffic growth and casualty risk per kilometre in each sub-group, with a view to combining these into a comprehensive total model of the situation.*
- *Explanatory models of road casualty trends. The macroscopic models used by SWOV to date, do not offer much explanation for trends in road casualties, apart from the contribution of traffic growth. It is considered that SWOV should be in a position to explain the relative contribution of the various road safety programmes and other socio-economic factors to road casualty trends in the Netherlands, especially after each of the years 2000 and 2010 since the Dutch government has plans for substantial reductions in road casualties over the periods leading up to these years.*
- *Recommendations for further work by SWOV. During the review a number of directions of profitable research are commenced, but tempered by the availability of data, especially in the area of explanatory models. Recommendations for continuation of this research, or other potentially profitable directions, are included in the review.*

Overturning by lorries

A review of the literature, subsidised by the Association of Dutch Insurers J.P.M. Tromp R-97-30. 31 pp. Dfl. 120,- (in Dutch)

This study looks how often lorries overturn, what the causes for this are, and what measures can be taken to prevent overturning. The research is based principally on literature from Western Europe and the USA.

In Europe, overturning occurs in 3% to 10% of all accidents involving lorries. In the transport of hazardous substances, approximately one third of the accidents entails overturning, a great number of these involving articulated lorries. In the United States, overturning occurs in 4 to 9% of all accidents involving lorries (including accidents with only material damage). Overturning occurs also in one third of single vehicle accidents with lorries, and in 15% of the fatal accidents with lorries. Overturning is a contributing factor in 60% of the fatalities resulting from accidents involving lorries.

The literature reporting the mechanical reasons for the overturning of lorries shows that most of these cases involve lorries with a high centre of gravity (when fully loaded) which then either take curves at high speeds or must swerve suddenly. Problems also increase if a vehicle is articulated, has a large wind surface and has an inadequately tuned brake system.

The measures that can be taken to prevent the overturning of lorries or that protect the driver in case of an

accident, can be described as follows:

- *impose a limitation on traffic during times when gusts of winds are higher than 17 to 20 m/s;*
- *indicate a safe speed at which lorry drivers can take curves;*
- *install automatic three point type seat belts in lorries, with all anchorages located on the seat;*
- *create a minimal survival space for the lorry driver by building sturdier cabs which are designed to protect the driver in case of overturning;*
- *introduce valves and other similar devices within the encasement of the tank lorries (to prevent the outflow of hazardous substances in case of accidents);*
- *provide lorries with hoist points or crane hooks to simplify salvaging operations following overturning;*
- *use premium differentiation and compulsory excess to stimulate hauliers to use vehicles less susceptible to overturning;*
- *vehicles susceptible to overturning could possibly be excluded from insurance coverage during high winds.*

Use of safety devices in 1997

Seat belts, children restraint systems and head rests in passenger cars and seat belts in vans
J.A.G. Mulder
R-97-32, 140 pp. Dfl. 40,-.
(in Dutch)

Since 1968, SWOV frequently conducts surveys on the presence and use of seat belts. Over the years these surveys were extended to the use of seat belts on the back seats, to children restraint systems and to the proper adjustment of the head rests. The 1997 study incorporates a new element: the presence and use of seat belt by drivers and front seat passengers of vans. Seat belt wearing is for this group is compulsory since 1992. Data were gathered in actual traffic by observations at traffic lights on several types of roads on one hand and by setting up an inquiry into a part of the observed drivers and passengers.

The study showed that 70% of the drivers and 75% of the front seat passengers in the Netherlands is wearing the seat belt.
These percentages did not actually change for the last couple of years. The use of seat belts by back seat passengers has raised considerably. About 41% is wearing a seat belt. This is more than shortly after the introduction of the seat belt law for back seat passengers in 1992. At that time less than 30% was wearing a seat belt in the back of the car.

The use of seat belts by drivers of vans is still a problem: if there is a seat belt in the car, only 42% of the drivers is wearing it. The use of children restraint systems is high (about 95%) and has even increased to a certain extent. The proper use of head rests is worsening.

SWOV has recommended again to use a combination of information and enforcement campaigns to make the public realise that the proper use of seat belts is in favour of their own safety. It is calculated that some 60 of the annual 1.180 road deaths in 1996 could still have been alive if 90% of the drivers and passengers in the Netherlands would have been wearing their seat belt.

Safety effects of in-car telematics: a checklist

Determining possible adverse effects of telematic systems on the driving task
T. Heijer.
R-97-43, 20 pp. Dfl. 15,-.
(in English)

The overall aim of this research is to provide policy makers with a well-based tool to assess the safety effects of existing and new telematic systems in road vehicles. The project must result in a set of guidelines and methods to identify potential safety hazards that single or multiple applications of these ATT systems may produce. The safety effects of single Advanced Transport Telematics (ATT) systems, also called ITS (Intelligent Transportation Systems) have been investigated in a number of theoretical studies and a series of experiments.

The general setup of this project contains the following stages:

- *A checklist is defined that summarises available knowledge on known safety effects and diagnoses which part or function of a given ITS device may prove unsafe or doubtful.*
- *The definition of standard procedures for laboratory testing to produce a verdict on the ITS device or parts of the device for which the checklist was inconclusive.*
- *The third step determines if and what modifications of the ITS application will be necessary.*

However, the overall results of the project so far show that existing knowledge still only provides fragmented knowledge and not a clear, comprehensive picture. Therefore, as long as this situation remains, the second step of the scheme (laboratory testing) should be complemented by another possible testing method: full field testing.

A first concept of the checklist was introduced. This checklist mainly considers overload and underload as sources of possible adverse effects of ITS and also the possible effects of interference of two systems that operate simultaneously.

An attempt was made to reorder this checklist according to the aspects of visual, mental and physical task load and also to assemble basic material necessary to extend the checklist with aspects of

counterproductive behavioural adaptation. To that end, an expert meeting was organised to obtain directives on which way to go with counterproductive behavioural adaptation. The results of this meeting were twofold:

- *a structuring matrix, based upon characteristics of ITS applications and characteristics of the traffic environment;*
- *a list of psychological mechanisms relevant to behavioural adaptation.*

Subsequently, it has been attempted to interpret relations between the items of the latter list with the aid of a general model: the model of situation awareness. According to this model it is concluded that schemata (models of the relation between surrounding phenomena), scripts ('automated' sequences of actions) and the ways these are generated or changed, play an important role in behavioural adaptation. The paper concludes with a recommendation for a three-step procedure to obtain a checklist on counterproductive behavioural adaptation:

- *analyse the contents of schemata and scripts and determine common characteristics;*
- *determine which characteristics are indispensable for safe driving behaviour;*
- *determine which of the characteristics may be influenced by ITS applications and in which way.*

The safety of light motor scooters

P.C. Noordzij.
R-97-47. 14 pp. Dfl. 15,-.
(in Dutch)

This report examines how the safety of motor scooters can be estimated and considers which conditions should be placed on the use of motor scooters in terms of safety.

The Netherlands is maintaining the European guideline for a driving licence in which no distinction is made between motorcycles or scooters. This guideline does, however, offer the possibility of introducing a separate driving license for light motorcycles for persons 16 years of age and older. Every country can determine whether it will permit the driving of a light motorcycle with a car driving license and whether additional limitations may be imposed.

Based on the literature and the experiences gained in other countries, letting people under the age of eighteen drive light motorcycles and/or motor scooters is concluded as being undesirable. Those with a licence to drive a car should take an additional course in riding a light motorcycle or scooter and to gain experience in riding these light motorcycles and scooters.

An example of economic costs and benefits resulting from damage-prevention measures

Calculations of costs and benefits of safety measures as part of a damage-prevention policy of companies engaged in the road transport of freight
J.E. Lindeijer, S.A. Rienstra & P. Rietveld.
R-97-42. 84 pp. Dfl. 25,-.
(in Dutch)

SWOV carried out a study into likely damage-prevention measures being taken in the haulage industry. The study was based on interviews, a survey, a literature search and an accident analysis. It was found out that it was not possible to make standard calculations of the economic costs and benefits of likely measures which can be deemed representative for all the companies in this sector.

The costs and benefits appear to be too dependent on specific business characteristics such as the type of transport, sort of cargo, company culture, size of the company, availability of a company's own haulier or carrier, willingness of the management to carry out an active damage-prevention policy, number of damages, and market volume. This study was therefore confined to the elaboration of example calculations for certain ideally typical companies of various sizes and with various assumed company cultures that then resulted in working out a method of calculating costs and benefits. Based on these examples the following general conclusions were drawn to the useful effect produced by the measures:

- *larger companies in particular could still gain large economic benefits by implementing and active damage prevention policy. This would also result in a reduction of lorries involved in accidents, a benefit which would also improve road safety in general;*
- *additional benefits to trade and industry resulting from an active damage-prevention policy could be:*
  - *a more pleasant working atmosphere at the company, this could lead to greater involvement and motivation and lower rate of absenteeism;*
  - *an improvement in the company's image;*
  - *a decrease in the number of injury and fatal accidents involving lorries;*
  - *a savings on maintenance costs (e.g. tire wear);*
  - *a savings on fuel.*

Perception of motorcycles

A literature search
P.C. Noordzij.
R-97-48. 18 pp. Dfl. 17,50.
(in Dutch)

This report provides results of a literature search into the perception of motorcycles. The literature concerns accidents as well as field

tests and lab tests. This information provides sufficient indications to show that perceiving motorcycles is more difficult than perceiving cars. The impression also exists that the failure to perceive motorcycles is partially due to the fact that motorists attach little importance to the (possible) presence of motorcycles.

The daytime visibility of motorcycles can be improved by the use of lighting, but there is still a small group of motorcyclists who are not yet doing this. Other possibilities for making motorcycles more conspicuous are limited. Recognising a motorcycle as being a motorcycle from a short distance away is no problem during the daytime. Recognising them at night can be improved if the motorcycle is equipped with retroflecting material that emphasises the contour of the motorcycle. It is recommended that when developing plans for providing motorcyclists and motorists with information (on how to improve the perception of motorcycles), account is taken of the possibility for using yellow light for better recognition of the motorcycle (during the day and at night).

Literature search into vehicle safety barriers at the H4 level

A literature search into safety barriers tested at the H4 level to the first and second standards of the prEN 1317
W.H.M. van de Pol.
R-97-49. 80 pp. Dfl. 25,-.
(in Dutch)

The Civil Engineering Division of the Department of Public Works has made a design for a new type of safety barrier. This barrier was specially designed for very heavy vehicles. SWOV was asked to make an inventory of the literature of full-scale tests at the H4 level. This means collisions with the barrier at a speed of 65 km/h with heavy vehicles such as lorries and articulated lorries with a mass of 30 or 38 tons and with a passenger car of 900 kg at a speed of 100 km/h.

Not many full-scale tests at the H4 level have yet been carried out according to the first and second standards of the prEN 1317. For this reason, only a few H4 tests are mentioned in the literature.
In addition to these H4 tests, the literature also mentions full-scale tests that have been carried out with heavy vehicles which do not specifically meet the criteria for the H4 level. These tests deviate from the H4 tests listed in the first and second standards of the prEN 1317 in that they involve vehicles with a different mass and a somewhat different collision speed and/or collision angle. In spite of the fact that these tests are somewhat unlike those at the H4 level, they are included here to supplement the limited number of tests at H4 level found in the literature. For inclusion, however, the collision energy had to be of the same level.

From the research, the following conclusions were drawn:

- *Heavy vehicle safety barriers can be made of either steel or concrete. Examples of constructions made of both these materials were found that satisfy the desired H4 level.*
- *For a fixed construction, concrete is to be preferred over material for small widths.*
- *For more rigid constructions, steel is to be preferred over material for greater widths.*
- *The available heavy vehicle safety barriers are higher than current constructions. Vehicle safety barriers with a height of about 1.3 metres appear to provide good results. With a height of about 1.0 metre, vehicle roll-overs (overturning) still occur.*
- *Constructions that are 1.3 metres and taller have a positive effect on arresting cargoes.*
- *The damage suffered from collisions involving a steel construction appears to be much greater than damage suffered from collisions involving concrete safety barriers.*
- *The available vehicle safety barriers intended for embankments differ from those for bridges and viaducts. The safety barriers for embankments are not as massive in design as those for bridges because in the case of embankments there is a greater room for deflection.*
- *It appears possible that the ASI values for passenger cars during a collision with a heavy vehicle safety barrier are below the highest permitted value of 1.4.*

COLOPHON

SWOV Research Activities is a magazine on road safety research, published twice a year by the SWOV Institute for Road Safety Research in the Netherlands.

SWOV Research Activities contains summaries of research projects carried out by SWOV.

Editor: Anita van der Vorst

Photographs: Paul Voorham, Aad Vis, Studio Verkoren

Design and lay out: Additief vormgeving en reclame, Zoetermeer

Print: Drukkerij Bestenzet, Zoetermeer

Publisher: SWOV Institute for Road Safety Research
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Free copies are available from the publisher. Please send subscriptions and address changes to the publisher.

ISSN: 1380-703X