

Annual report 2006

Foreword

2006 was also a year in which SWOV has wanted its research to contribute to a greater road safety. Scientists, policy makers, and politicians again knew where to find us. For example, the former Minister of Transport, at the National Road Safety Congress, asked whether we could study if it was possible to lower the target for road deaths. This was a result of the second consecutive reduction of their numbers; 881 in 2005 and 817 in 2006, a decrease of 7%. In the autumn we published this study entitled '*The essence of the decline in the number of road deaths; Developments in 2004 and 2006, and new prognoses for 2010 and 2020*'. Our advice was that lowering the target was possible.

The National Mobility Council, a consultative body between the Ministry of Transport and other governments, resulted in the autumn of 2006 in a new maximum of 750 road deaths in 2010. What the decrease also brought to light was that there was a need to show road safety improvement by means of concrete data: infrastructure, traffic volumes, traffic behaviour, crash data, etc. It was also considered valuable to be able to compare similarities and differences in regional developments and to examine them more deeply. Although our advice with regard to the targets was positive, this did not mean that realisation was simple. We will have to do a lot to achieve the new targets.

2006 was the final year of our 2003-2006 research programme. Many studies were completed and their results are already available. For example, we now know more about which features make a road recognizable and predictable, what determines the credibility of a speed limit, which role emotions play, what the effectiveness of traffic education is, whether the shortest route can also be the safest, and how policy makers can use information in their decision making about new policy. Some subjects require more knowledge. These subjects get a sequence in the new research programme.

In this annual report we will elaborate further on a number of results. But we also invite you to search subjects that are relevant for your work on our website and then to talk to us about them. Look under *Research*, at *Fact sheets*, the *Knowledge base*, or at *Recent publications*. If the results give reason to make an enquiry, please let us know. This means that in future studies we can tune better to practical questions of your daily work.

We would also like to use this annual report to thank all those who have contributed to SWOV's work, in particular our own personnel. We would also like to thank the members of the Programme Advice Board, the Scientific Advice Board, and the Advice Groups for Road Safety Research, Road Safety Assessment, and Knowledge Management and Dissemination. We very much value your involvement in our activities and are sure that you have contributed to the quality of our work.

Here we would also like to thank Erik Glasius who is a member of our Board of Governors representing the Dutch Car Industry RAI. He retired in 2006. He has always shown a great deal of interest in SWOV's work. He was critically inquisitive, as his many questions showed.

Finally, in 2006 the grounds were laid for our 2007-2010 research programme. The subjects were agreed upon after lengthy consultation with many. What remains is our striving to reach the core of the road safety problem and thus provide solutions. These are solutions for which *Advancing Sustainable Safety* offers a great deal of inspiration. What have changed are the emphases that we make in the research themes. Together with you all we will again spend a lot of effort to further improve road safety in the Netherlands during the coming four years and, with it, achieve the target for 2010.

Pieter Jan Biesheuvel
Chairman

Fred Wegman
Director

Director's report

Programme 2003-2006 successfully completed

In 2006 the great majority of the SWOV 2003-2006 programme was completed successfully. That has resulted in a large number of publications. A number of activities were successfully completed during the first months of 2007. Good progress was also made in various international projects.

The 2003-2006 programme delivered results and products that can be useful to both the scientific world as road safety in practice. In the spring of 2007 we will complete our 2003-2006 programme. Because of SWOV's 45 years of existence, we will extensively study the scientific findings and their consequences for both science and the practical aspects of road safety. This will happen by organizing a congress to celebrate our 45th 'birthday' and presenting a bundle of results of the past four years.

Advancing Sustainable Safety

The regions form an important target group for the updated edition of *Advancing Sustainable Safety* which had been published in Dutch in late 2005. In the first half of 2006 we therefore organized four regional meetings to present the vision and, together with regional representatives, to discuss possible practical implementation. It became clear that such an implementation is not always simple. Because of this we started in 2006 with a series of new meetings with regional representatives, and the concrete plans have received an important place in the new four-year research programme.

The English translation was published in late 2006 in both a printed version as one that is available via our website entitled 'www.sustainablesafety.nl'. With this we hope to improve this vision's updated position internationally. At the EU road safety conference on 3rd November 2006 in Verona, Italy, the Dutch Minister of Transport presented the book to her European colleague ministers. She herself has also presented the book at various international congresses and meetings.

The National Road Safety Congress

In April 2006 the biannual National Road Safety Congress took place. As is usual, this congress was jointly organized by Royal Dutch Tourist Club ANWB and SWOV, with close cooperation and partial financing by the Ministry of Transport. The theme of the 2006 congress was *Together Safer! You achieve more with cooperation*. Slightly more than 400 road safety professionals from policy, research, and practice attended the congress.

Road safety in the Netherlands

As during many previous congresses, the minister announced the crash and casualty number for 2005. After the spectacular reduction in the number of road deaths in 2004 (19% fewer than in 2003), she announced a further decrease in 2005 of more than 7%. It's therefore going well with road safety in the Netherlands. The minister also wondered if these positive developments should have their consequences for the 2010- and 2020 targets for road deaths. The number of road deaths in 2005 (900 road deaths) had already been achieved.

In a reaction SWOV offered to examine why the number of road deaths had declined so suddenly and, based on this, to calculate what new, feasible targets were for 2010 and 2020 would be. This study entitled '*The essence of the decline in the number of road deaths; Developments in 2004 and 2006, and new prognoses for 2010 and 2020*' showed that much of the decline was very probably structural because of, among other things, a decrease in the large number of speeding offences, less drink driving, an increased seatbelt use, and less use of the moped. What made this sort of study very difficult was the lack of relevant data e.g. infrastructural road safety investments. It also explains why we only could indicate some of the causes of the decrease. This was directly responsible for SWOV spending more time on this problem and to argue for improvement proposals. According to SWOV, the expected future development makes it feasible to lower the targets to 750 road deaths in 2010 and 550 in 2020. In the meantime, the road safety target for 2010 has indeed been lowered to 750 road deaths.

International developments

Viewed from an international perspective, the Netherlands still occupies a top position in road safety research. According to the latest figures we have even climbed to the second position, just behind

Malta, with regard to the number of road deaths per 100,000 inhabitants. Other countries are also interested in the Dutch approach and experience. This is why SWOV is regularly invited to share its knowledge and vision with other countries. We also often receive requests from foreign institutes and organizations to come and visit us, sometimes with very concrete questions and sometimes with a more general purpose.

SWOV is furthermore a valued partner in international research projects. SWOV is especially very active at the EU level. In 2006 three new European research projects started in which SWOV is involved: DRUID about alcohol, drugs and medicines in traffic, PEPPER about traffic enforcement, and CAST about public information campaigns. SWOV finds such international cooperation very important. The knowledge that we gather there we can use to further improve road safety in the Netherlands. It also improves the scientific quality of our work. On the other hand we hope that our knowledge and experience contributes to road safety in countries with a shorter history of road safety improvement.

A look ahead

In January 2007 SWOV started with a new four-year programme. Although there are shifts in emphasis, the main direction and vision are the same. We are very confident that this SWOV programme, supported by the Programme Advice Board, the Scientific Advice Board, and the Support Groups, will contribute towards a further decrease in the number of road crash casualties in the Netherlands.

During the last few years, the Netherlands has got used to a decline in the annual number of road deaths. However, it is frivolous to assume that further decreases will occur automatically. There is every reason to support the Ministry of Transport in drawing up its intended Strategic Road Safety Plan. SWOV assumes that the results of our 2003-2006 programme will be used, and especially *Advancing Sustainable Safety* and our *Road Safety in the Netherlands 1950-2005* and the *Road Safety in 2020; Exposure, crashes, and policy outlooks*.

PhD of Matthijs Koornstra

The previous SWOV director Matthijs J. Koornstra received his PhD at Leiden University as Doctor in the Social Sciences. His thesis entitled *Changing choices: psychological relativity theory* contains an arithmetically formulated theory about how every individual psychophysically transforms the same objective space to individually different spaces for judgements or preferences. The theory is illustrated in a number of chapters by using specific road safety trends. Matthijs Koornstra was SWOV's director from 1986 to 1999.

Starting points and organization

SWOV is an inter-disciplinary and independent scientific institute that conducts research to improve road safety and, based on this, gives requested and uninvited advice. SWOV enjoys its reputation as a authoritative knowledge institute, both at home and abroad.

In research of aspects that promote road safety, the most important are the practical application possibilities of the research results. With this, SWOV strives to cover the whole field of road safety and adjacent policy areas in which this subject plays a role: health care, national health, spatial planning, mobility etc. The scientific quality of SWOV's research was in 2005 judged to be 'good' to 'very good' by the Quality Assurance Netherlands Universities (QANU) institute.

SWOV advises the government, parliament, and various governmental bodies. The publications are also of importance for the professional and managerial ranks in the public sector and social organizations, and for fellow researchers and research institutes. Our researchers use reports, our website, articles, papers, congress contributions, and interviews to spread their knowledge and contribute to public and social debates.

Four-year research programme 2003-2006

SWOV carries out its work within a four-year research programme. The programme contains research projects and knowledge dissemination.

The Road Safety Assessment Department has four projects about road safety developments that show what they have been up till now and how they will be in the future under various policy variants:

1. Road safety analyses
2. Road safety outlooks
3. Explorations of external influences
4. Knowledge and information systems.

The Road Safety Research Department, SWOV's other research pillar, works on ten research projects:

1. Road safety outlook
2. Infrastructure and road safety
3. Speed analysis, distribution, and road safety
4. Measures for speed control
5. Route choice on a road network
6. Recognizable layout and predictable behaviour
7. Novice drivers and driver training
8. Effects of education and campaigns
9. Optimal investments
10. Information use in decision making.

A separate place in the programme has been reserved for knowledge dissemination and knowledge management activities. The organigram provides an overview of SWOV's organization structure.

Practical and scientific relevance

The relevance of SWOV's research and knowledge dissemination activities are vouched for in various ways.

The **Programme Advice Board** discusses the subject choices in the programme and the progress of the activities, and advises the SWOV Board of Governors about it. It consists of representatives from ministries and interested parties.

The **Scientific Advice Board** advises the Board of Governors and the Director to increase the quality of SWOV's research and to promote its scientific importance. It aims with this at generic scientific questions in SWOV's research programme. The members represent various scientific disciplines that are important for SWOV's work.

The task of the **advice groups** is to give advice to SWOV researchers and the Programme Advice Board about the project and work plans at a more detailed level. The three advice groups deal with

Knowledge Management and Dissemination, Road Safety research, and Road Safety Assessment research.

The advice groups contain representatives of the state, provinces, municipalities, water boards, research institute, consultancy firms, universities, colleges of advance education, police, law courts, and interest groups.

Road Safety Research

Which factors influence road safety?

Road safety research was one of the two research programmes in SWOV's 2003-2006 research period. The results provide greater scientific knowledge about certain aspects of road safety. With this we want to gain insight into the factors that influence road safety, thus gaining greater insight into ways of improving it.

SWOV researchers are working on ten subjects. For some of these a connection has been looked for and found in projects subsidized by the European Union and the Dutch Transumo programme, by which SWOV could carry out extra activities. Below you will find an overview of these projects. You will find more information at www.swov.nl under Research, Publications in 'Research and knowledge dissemination 2006' (D-2007-1).

Road safety explorer

This project optimises and adapts for practical use the software instrument *Regional road safety explorer* (RRSE): the RRSE-GIS. With this, the costs of measure packages are compared with the effects on road safety and, ultimately, on mobility and the environment. An instrument that makes it possible to determine the Sustainably Safe level of infrastructure has also been developed within this project.

Infrastructure and road safety

This project aims to determine relations between traffic volumes, road infrastructure features, and road safety by using exposure and risk measuring units. To do this, data from three different test areas are being analyzed.

Speed analysis, distribution, and road safety

Speed is one of the core areas of current road safety problems. SWOV is studying the relation between speed, speed distribution, and road safety, as well as the credibility of optimal speed limits.

Measures for speed control

This project examines the possibilities of getting all drivers to obey the then applying speed limits within a period of ten years. To do this, two points of view are used: enforcement and surveillance in combination with campaigns, and new technologies on the roadside or in-vehicle.

Route choice on a road network

This project deals with the possibilities of influencing drivers' chosen route in such a way that is complies with the Sustainable Safety requirement that the quickest and the safest route are one and the same. Work will be particularly with micro simulations of route choice behaviour in various types of road networks.

Recognizable layout and predictable behaviour

Important starting points for Sustainably Safe roads are expressed in the core principles of functionality, homogeneity, and predictability. This project studies in which way the layout of a road and its environment can increase its recognition and thus the predictability of traffic behaviour.

Novice drivers and driver training

Young, novice motorists have a more than three times greater death and injury rate. The central issues in this project are to understand, measure, and influence the extent to which a young motorist is capable of tuning the difficulty of the driving task and all traffic dangers to his/her own driving skill.

Effects of education and campaigns

This project studies the effects of different types of traffic education, and the costs and benefits that go with them. It will deliver clues to an effective and efficient education policy.

Information use in road safety decision making

The project consists of two parts. The first part, *Cooperation during decision making*, aims at the influence of cooperation during the decision making about the construction of 60 km/hour zones. The

second part, *Weighing up of all road safety interests*, deals with, in the decision making about investments in the construction and maintenance of roads, road safety interests besides those of accessibility, the environment, and spatial planning.

Optimal investments

This project concentrates on the further development of practical, usable standard methods for carrying out cost-benefit and cost-effective analyses of various road safety measures. This project also includes a study of the utility of the Quality Adjusted Life Years (QALY) method for road safety issues.

Transumo

The Dutch research programme Transumo (Transition to Sustainable Mobility) has as goal to make a large step forwards in achieving a sustainable transport system that meets the high requirements of pollution, accessibility, and safety. The programme is divided into a number of projects. The *Area-orientated integrally safer* project is being carried out with SWOV in charge. SWOV also contributes to the *Intelligent vehicles* and *Advanced traffic management* projects. *More information can be found at www.transumo.nl.*

Example of a project within Road Safety Research

Traffic education systematically assessed for the first time

Traffic education is a frequently used to promote road safety. However, relatively little is known about its effects and effectiveness. A number of Provincial Road Safety Boards requested SWOV to study the effects of eleven education projects. The study was entitled *Effects of Traffic Education*. In this project, education refers to all activities aimed at improving knowledge, motivation, and skills.

Self-reported behaviour

As a measure of traffic education's effectiveness the researchers chose as safe behaviour what road users self reported. To do this the researchers made their questions as concrete and specific possible, such as: "Have you during the last month [often / a few times / never] had to walk back to the pavement because the cars approached you quicker than you first thought?". Besides their self-reported behaviour, the researchers also enquired after changes in knowledge, insight, awareness, attitude, and social judgements; these are known as 'behaviour determinants'.

Method

The study consisted of a before-measurement, followed by an intervention viz. an education programme. The after-measurement took place about a month after the intervention. A control group was also used. All participants were individually examined to see if changes had occurred between the before- and after-measurements.

Results

Not one programme had a negative effect. In more than half the programmes there had been a small but significant improvement in self-reported behaviour as a result of the education project. This 'modest' effect can be explained by the short duration of the projects and because they had been studied in isolation from other measures. The effects of traffic education are greater when education lasts longer and is combined with other measures e.g. police enforcement. This corresponds to the structural and programmatic traffic education approach that the Provincial Road Safety Boards want.

Materials

It is desirable and necessary to assess all future education programmes. It provides insight into what works and how to improve programmes. The Effects of Traffic Education project gave an initial impetus to a systematic and manageable assessment method. With this, SWOV provides the materials for an effective and efficient education policy.

The complete report entitled '*When is education effective? Systematic evaluation of education projects*', (R-2006-28) is available at www.swov.nl.

Example of a project within Road Safety Research

More credible speed limits are possible

The faster the speed the greater the risk of a crash, and the greater its severity. In order to encourage the road user to obey the speed limit, SWOV introduced the term 'credible speed limit'. The assumption here is that road users abide by the speed limit better if they experience it as being credible. But which factors influence the credibility of speed limits? And what can road authorities do to make their speed limits more credible?

Questionnaire

The study concentrated on 80 km/hour roads. Five hundred motorists filled in a questionnaire in which, by means of photos, they could indicate which speed limit was safe for such a road and how fast they themselves would like to drive. The speed limits stated by the subjects served as indicator of a credible speed limit. Their driving behaviour was then studied using a driving simulator in situations with credible and not credible limits.

Differences

There are clear differences between road users' preferred speed, which drivers regard as being safe, and the speed limit that applies there. In some situations drivers want to drive faster than allowed; in other situations they think that the speed limit is too fast. Thus speed limits are not as credible for everybody always.

Characteristics

The extent of credibility is related to road features and road user characteristics. A credible speed limit depends directly on features such as there being bends, vegetation, buildings, and road width. The driving simulator tests confirmed this result as well as SWOV's assumption that road users obey a speed limit better if they find it credible. The speed limit that a road user experiences as credible also depends on age and the willingness to take risks.

Conclusion

SWOV concludes that it is certainly possible to make speed limits more credible for everybody. This can be done by adapting the road environment to the limit, or the other way round, by adapting the limit to the road environment. The results of the studies and additional literature study have been used to draw up a checklist with which road authorities can judge the speed limits on their own roads. The checklist will be elaborated in the new 2007-2010 research programme for use in a software application.

The complete report entitled 'Speed and speed management; Summary of the most important findings from the speeding projects in SWOV's 2003-2006 research programme' (R-2006-13) is available at www.swov.nl.

Road Safety Assessment Research

Is road safety predictable?

Commencing in the 2003-2006 research programme, SWOV began with a new research activity: road safety assessment. This activity leads to road safety assessments, road safety outlooks, and exploration of external influences. Researchers analyze the numbers of road deaths and injured over longer periods in the past, and social developments are judged on their road safety effect. Road safety assessment research also pays attention to developing a vision.

Below you will find an overview of the projects in 2006.

You will find more information at www.swov.nl under Research, Publications in 'Research and knowledge dissemination 2006' (D-2007-1).

Road safety outlooks

A road safety outlook examines possible future developments and their expected road safety effects. The starting point is the important expected development in exposure or distance travelled. Then there is the expected effect of current and intended policy of this exposure to the dangers of travelling. From these developments SWOV estimates the future numbers of road deaths and injured.

Model development

This project is aimed at developing models with explanatory variables for a number of selected high risk groups: moped-car crashes, pedestrian-car crashes, etc.

Exploration of external influences

This project examines which influences in other policy areas have recent and future road safety effects. Such insight is necessary for a proactive road safety approach.

Road safety analyses

This project results in annual analyses and long term analyses. Annual analyses deal with the most recent developments and compare them with long term trends. Long term analyses describe trends and look for explanations by using data on road safety measures and social developments. The results of these analyses provide a better understanding of factors that influence road safety developments and they form a basis for explorations.

Knowledge and information systems

Much SWOV research depends on the availability of high quality data. Collecting and making this accessible in various SWOV knowledge and information systems is a continuous activity. These systems are an essential information source for both our own researchers as well as for external professionals. The activities in this project are data management, relation management, and technical management of the data collection. The starting points are being up to date and customer orientated.

Example of a project within Road Safety Assessment research

An overview of 55 years of road safety

Within the Road Safety Analyses project, '*55 years of road safety assessment in the Netherlands 1950-2005: the peak conquered*' was published. This study shows the developments of road deaths and in-patient numbers, subdivided by transport mode, road types, and other characteristics. What are also discussed are the factors that have influenced this. The assessment is a time document that summarizes current knowledge about developments and effects. This means that it provides scientific links for future road safety policy.

Correct data

Making a road safety assessment is not possible without well defined and registered data. The SWOV researchers based the numbers of road deaths on official data from the Central Bureau of Statistics. To determine the numbers of in-patients we compared the police data with the hospital registration. What the researchers also did was compare the trends in road deaths and injured with the exposure development.

Analysis methods

In order to visualize the road safety developments, the researchers used various analysis methods, among which were calculating ratios and time series analysis. Calculating ratios involves dividing the number of casualties by, for example, the kilometres travelled. Time series analysis compared various development trends.

Casualty reduction

It is not easy to answer the question about which past factors contributed to the reduction. That is why the exposure/distance travelled growth offered the best links. A number of examples were elaborated in the assessment. Many other influences and measures have also had a positive influence on the reduction of crash casualties e.g. seatbelt wearing and the alcohol law.

Results

Some of the most important developments from the assessment were:

- The death rate per kilometre travelled has fallen since 1985 by an average of 4-5% a year for pedestrians, cyclists, and car occupants.
- During the last 10 years the crash rate especially among the elderly has decreased for all modes of transport except the motorcycle.
- Because of the large increase in the number of cars, the number of road deaths among motorists dominates road safety policy.
- Among road deaths men are over-represented.
- The number of pedestrian deaths has decreased, especially among children.
- The number of single vehicle car crashes, i.e. crashes not involving any other road users, has for years hardly decreased, whereas other crash types involving cars have.
- Single vehicle crashes with cyclists, including those between cyclists, determine to a great extent the total number of in-patients. This crash type has increased during the last few years.

The complete publication entitled '*The peak conquered; Road safety assessment in the Netherlands 1950-2005*' is available at www.swov.nl.

Example of a project within Road Safety Assessment research

Are a lot fewer casualties in 2020 a realistic policy target?

Within the road safety outlooks project *Road Safety in 2020; Exposure, crashes, and policy outlooks* was published. In this, SWOV estimated the numbers of casualties expected in 2010 and in 2020. SWOV researchers also examined which contribution new measures could make in achieving or lowering the road safety targets for 2020. Using the results of this study, the government can formulate realistic road safety targets and can adjust policy.

Exposure scenarios

This SWOV outline used the study entitled *Welfare, Prosperity and Quality of the Living Environment* that has visualised how Dutch society will develop until 2040. The study defines four general macroeconomic scenarios. With these four scenarios as basis, the ministry's Transport Research Centre has produced prognoses about mobility/exposure. The exposure development is an important determinant in the future numbers of traffic casualties.

Calculation

For all exposure scenarios, SWOV researchers calculated the expected numbers of road deaths and in-patients for 2020. Then they judged the feasibility of the road safety targets, as are found in the *Mobility Paper* for the scenarios with the largest and smallest growth in exposure.

Prognosis

For the prognosis of the number of road casualties in 2020, we first examined what would happen if the current policy was continued unaltered i.e. without new measures; the baseline prognosis. This showed that the feasibility of the targets, a maximum of 580 road deaths and 12.250 in-patients in 2020, was extremely unlikely.

New measures

It was then calculated which extra contribution was expected from a number of intended new measures e.g. accompanied driving from 17 years old or the expected extra investment of € 300 million for dangerous state and provincial trunk roads. If these measures were carried out between now and 2020, there would be a further decrease in the annual number of road deaths, although these new measures were only expected to achieve a modest decrease.

Within reach

The conclusion is that there are various reasons to alter the 2020 targets. SWOV argues that based on the starting points of SWOV's road safety vision of *Advancing Sustainable Safety*, it would develop an additional package of measures. Further elaboration is needed to be able to determine the quantitative effects of these measures. However, previous effect calculations show that substantial casualty 'savings' are possible.

The complete report entitled *Road Safety in 2020; Exposure, crashes, and policy outlooks* (R-2006-27) is available at www.swov.nl.

PhD research

Which answer hides behind the question?

In 2006, eight SWOV researchers were working on their PhD theses. The QANU assessment commission judged this part of SWOV's programme very positively. The study entitled *Emotions in traffic* resulted in one of our researchers being awarded his PhD. We expect that three of the eight will have completed their theses in 2007, and that the other four will be ready in 2008 or 2009. You will find here a list of their subjects.

Information use in road safety decision making

The subject studied here is how the decisiveness of road safety policy is influenced by cooperation during the decision making, and the presence or absence of public support. An examination is also being made of how cost-benefit information can improve the decision making about infrastructural investments.

Time series models for road safety analyses

In this study develops risk models that fit the specific requirements of statistically reliable road safety research.

Novice drivers and driver training

What does a young motorist learn from his/her traffic experience and how do they lead to changes in attitude and driving behaviour? This project uses a monitoring study and a practical study.

The elderly in traffic

How can the driving task of the elderly be improved, for example turning left? Which infrastructural features of intersections are related with crashes involving the elderly turning left and which driver assistance systems can achieve safer driving behaviour?

Route choice on a road network

Which possibilities are there to influence a driver's route choice in such a way that the chosen route fits Sustainable Safety, and the quickest route and the safest route are one and the same?

Emotions in traffic

Under which circumstances do emotions occur in traffic, and which influence do emotions have on traffic behaviour?

Modelling the interaction behaviour of drivers

In this study a descriptive model of interaction behaviour in traffic situations in which the behaviour of a number of motorists can be observed.

Drivers in interaction with supporting systems

Behavioural changes can have both positive and a negative road safety effects. This study aims to better visualise the relation between the various types of ADAS (Advanced Driver Assistance Systems) and behaviour change.

Example of a PhD thesis

The role of emotions in traffic

Humans experience four main emotions: happiness, fear, anger, and sorrow. Which traffic conditions incite these emotions and to what extent do they influence driving behaviour? The psychologist Jolieke Mesken tried to answer these questions during her PhD thesis at Groningen University together with SWOV.

Experiments

Mesken's study consisted of a literature study, a questionnaire, two experiments, and an on-the-road study. The experiments with a group of irritated subjects, a happy group, and a neutral control group did not provide any notable differences. This was probably because all participants enjoyed the experiment in a driving simulator.

Angry

The on-the-road study provided more results. For 50 minutes the subjects drove along a route, during which they were monitored by a heartbeat meter and were observed and interviewed by Mesken. This showed that during a trip they were nervous or anxious an average of three times an hour and angry twice an hour. Anger is especially annoying because people pay less attention. On the other hand, nervousness due to, for example, poor vision results in the opposite, driver pays more attention.

Irritated by others

The most frequent emotions while driving are irritation and nervousness. People become nervous if they cannot control the situation themselves, and they get angry or irritated if there is somebody else who they can blame. Problems occur because people make incorrect estimates, e.g. because other road users do something different than they expected. For example, they do not get angry because of a tailback or detour as such, but because of the behaviour of other road users in these situations.

Recommendations

Mesken made a number of recommendations as a result of her study. Social and communication skills should be included in driver training. Making traffic situations clear and predictable results in less irritation. Communication that is clear and in time about, for example detours because of roadworks, will positively influence the effectiveness of these measures. Enforcement should not aim at general ideas such as aggressive road behaviour, but at specific behaviour. For example, road users are irritated with speed limits if they are not credible. A 50 km/hour limit on a dual carriageway and cycle tracks are not understood by car drivers. In such a case, road authorities should clarify why people may not drive faster than 50 km/hour.

The complete thesis entitled 'Determinants and consequences of drivers' emotions' is available at www.swov.nl.

Advisory research

Requests from at home and abroad

Every day requests reach SWOV about all aspects of road safety. These requests often come from municipalities, provinces, ministries, firms of consultants, fellow research institutes, inhabitant groups, etc. SWOV is also regularly requested from abroad to give an expert advice. A number of examples are:

Transport Research Centre

SWOV gave advice about updating road safety costs in 2002 and 2003 and the consequences of this for human costs. We also gave advice about a report on the consequences of extra long and heavy lorries. The Department of Public Works (of the Ministry of Transport) and a building contractor combination requested SWOV to further interpret guidelines for roadworks.

The Hague Municipality

The municipality's audit office asked SWOV to advise it about various phases of an assessment study of the municipality's current road safety policy.

Flanders Road Safety Support Base

SWOV regularly advises the Belgian province of Flanders. In 2006 a report on the seatbelt campaign in Antwerp was provided with comments. SWOV also carried out a road safety analysis in Flanders for the new policy plan for the coming years.

International advices

SWOV publishes ever more in scientific, peer reviewed, journals. The opposite is also true that SWOV, more frequently than in the past, is requested to review scientific articles, for example by *Accident Analysis and Prevention*. The contribution that SWOV made for the scientific assessment of the Monash University Accident Research Centre (MUARC) in Australia and its membership of organising commissions of international congresses, such as the *Fit to drive* congress that will take place in Vienna in 2007.

International and national working groups

In the Netherlands SWOV is represented in among others:

- the Advice Board of Traffic Safety Organization
- the Advice Board of the Traffic Science and Traffic Engineering educations of the Post Graduate Education institute;
- the Alcohol and Traffic Platform;
- the Consultancy Bodies for Personal Transport of the Ministry of Transport;
- the College of Experts for the Driving Test Organization;
- the Commission for Fitness to Drive with Dementia.

At the international level, SWOV is represented in e.g.:

- the Steering Committee of the Joint OECD/ECMT Transport Research Centre;
- the Operational Committee of IRTAD;
- the Board of FERSI;
- the PIARC Technical Committee on Road Safety;
- the Transportation Safety Management Committee of the Transportation Research Board;
- the ETSC Steering Committee Performance Indicators;
- the Commission de expertos para el estudio de la problematica de los jovenes y la seguridad vial (Spanish expert group about the young and road safety).

Example of a project within Advisory research

A better look at the field of vision problem

The blind spot of lorries is a well known problem. In spite of the obligatory introduction of the blind spot mirror and blind spot cameras, the number of road deaths has again reached the level of before the introduction. SWOV supports the Ministry of Transport's demonstration project and is studying which additional measures are necessary to improve driver field of vision and reduce blind spot crashes.

Crash location

The SWOV study entitled *Problem of lorries turning right* shows that most collisions of lorries against cyclists are located at the corner of the right-hand front of the lorry. However, the blind spot mirrors and cameras were aimed at the area to the right of the lorry. As of January 1st 2007 all new lorries have to be equipped with an extra front mirror or camera so that the area to the right of the front is visible.

Pattern

Besides information about the collision point, the SWOV study also provided information about the course of these crashes. The study showed that there is a pattern: the cyclist going straight on takes right-of-way but does not always get it. In addition, in most of the crashes involving lorries turning right, they accelerate after standing still. Apparently, a lorry driver in a stationary lorry sees less of cyclists beside or in front of the vehicle.

Demonstration project

For a year long, from June 2006, the Ministry of Transport is testing front mirrors and cameras in lorries. One hundred and fifty lorries either get a mirror or a camera system. The results are meant to show how both systems work in practice and how drivers use them. This information helps to determine how mirrors and cameras should be mounted in new lorries. The conclusion will also be used in deciding whether existing lorries should also be equipped with such systems.

Additional measures

Besides measures to improve the field of vision, SWOV recommends in its study to also take measures that eliminate or reduce the danger of lorries turning right. Among other things, SWOV recommends positioning mirrors at intersections, to give information to cyclists, and install larger front and side windows in lorries.

The complete report entitled ' Problem of lorries turning right; An analysis based on crashes in 2003 and the new European guidelines beginning in 2007' (R-2006-2) is available at www.swov.nl.

Example of a project within Advisory research

Is paying per kilometre good for road safety?

The plan to make motorists pay per kilometre has already resulted in a great deal of discussion. This also applies to road safety. The *Pay Differently for Mobility* national platform concluded that the decrease in the number of kilometres driven as a result of road pricing would more or less equal the decrease in casualties. However, SWOV is of the opinion that this subject needs more analysis and therefore recommends a study of the road safety effects of the various ways of paying.

Method

Based on what information there is, SWOV has looked at the various implementation variations of *Pay Differently for Mobility*. Choosing a particular variation to pay can have a large road safety effect. SWOV wanted to express this effect in the number of casualties saved. This can be calculated by multiplying the number of kilometres travelled by the crash rate of those kilometres.

Results

The available data was insufficient to reliably calculate the road safety effect. SWOV did arrive at a number of findings and points of interest.

- Pricing kilometres can result in motorists choosing the moped or bicycle for short distances; the crash rates of both of these are higher than for the car. This would make traffic less safe and require extra investments for moped riders and cyclists in a sustainably safe infrastructure.
- Motorists can swap over to a motorcycle with substantial road safety consequences.
- The traffic will possibly shift from the main road network to the lower order network. In that case extra money is needed to make the lower order roads safer for a greater traffic volume.
- In its road safety analysis, the national platform made no distinction between cars and lorries. This distinction can be important, especially in those paying variations in which heavy traffic pays more. This can be either safer or less safe depending on the chosen variation and conditions.
- Young motorists are a group with high crash rates. Paying per kilometre makes car possession cheaper, resulting in more of the young being able to afford one. Car use, however, becomes more expensive, and this can lead to fewer kilometres being driven by young motorists. This can also be either safer or less safe depending on the chosen variation and conditions.

It is certain that paying per kilometre will have a road safety effect. A more refined method and more specific data are needed to be able to calculate whether the effects will be positive or negative.

International research

What can we learn from each other?

SWOV strives to also conduct project-financed research for the European Union. A precondition for this is that such projects fit in our research themes, knowledge management, or knowledge dissemination. With this international cooperation, SWOV strives to broaden its research and increase its quality and efficiency. 2006 was also a year in which we participated in a large number of mainly European Union (EU) projects. Below you will find a list of these projects in alphabetical order.

Alcohol interlock

The research team is studying the psychological, sociological, behavioural, and practical influence of alcohol programmes on various target groups. The project is preparations of a large scale quantitative study that precedes the judicial implementation.

CAST

The goal of the EU Campaigns and Awareness-Raising Strategies in Traffic Safety (CAST) project is to develop aids to establish the added value of mass media campaigns in combination with other measures such as police surveillance or infrastructural adaptations. The project team is developing a manual for effective mass media campaigns and a manual for assessment studies.

DRUID

In 2005, the first preparations took place for a new EU project about alcohol, drugs, and medicines called DRUG (Driving under the Influence of Drugs, Alcohol, and Medicines. This is a large scale project in which nearly 40 partners from about 15 European countries will participate during the coming years.

HUMANIST

The Human Centred Design for Information Society Technologies (HUMANIST) is an EU 'network of excellence' whose purpose it is that researchers and research institutes exchange knowledge to form an EU knowledge network. The project aims at the possible applications of new technological developments in traffic. Its point of view is to as well as possible fit the wishes and needs, possibilities and impossibilities of the human being. *You can find more information at www.noehumanist.org.*

IN-SAFETY

The Infrastructure and Safety (IN-SAFETY) project aims at promoting two road design principles with planners and designers. These are 'forgiving roads' and 'self-explaining roads'. 'Forgiving' is the design principle that makes it possible for drivers to correct wrong manoeuvres in time.' Self-explaining' means that drivers recognize an unsafe traffic situation and react to it correctly in time. *You can find more information at www.insafety-eu.org.*

PENDANT

This Pan-European Coordinated Accident and Injury Databases (PENDANT) should lead to two new European databases: an in-depth crash database and one with hospital data about traffic casualties. These databases will give a better picture of the causes of crashes and injury. *You can find more information at www.vsi.tugraz.at/pendant.*

PEPPER

This project is about police enforcement. SWOV is mainly concerned with a meta-analysis of the effects of police enforcement on crashes. Initially we pay attention to the enforcement of speed, alcohol, and seatbelt wearing. We will carry out a literature study of what is known about speed enforcement to draw up a coding list to be able to store the data of various studies in a comparable way.

PREVENT

This project, which is called PREVENT (Develop a training programme to improve work zone safety) consists of various international institutes working together on an education programme in which

knowledge about safety at road works is distributed to relevant target groups, such as road workers and driving instructors. *You can find more information at www.hit.certh.gr/prevent.*

RiPcoRD-iSEREST

The project entitled 'Road Infrastructure Safety Protection – Core-Research and Development for Road Safety in Europe and Increasing Safety and Reliability of Secondary Roads for a Sustainable Safe Surface Transport' (RIPCoRD-ISEREST) has as goal to develop 'best practice' instruments and guidelines for infrastructural road safety measures. *You can find more information at www.ripcord-iserest.com.*

SafetyNet

In this project, 22 European institutes are developing an information system to assist road safety. Within SafetyNet, SWOV is the leader of two of the seven project parts: Safety Performance Indicators and the development of the European Road Safety Information System. *You can find more information at <http://safetynet.swov.nl>.*

SUPREME

This project, the Summary and Publication of Best Practices in Road Safety in the Member States (SUPREME) makes an inventory of good practice examples of road safety measures in 25 EU member countries plus Norway and Switzerland, and exchanges it with them. *You can find more information at www.kfv.at/supreme/objectives.php.*

Example of a project within international research

Young motorists on their road to safety

Road crashes are the main cause of death of 15-24 year olds in industrialized countries. This was shown by the OECD (Organisation for Economic Co-operation and Development) report *Young drivers: the road to safety*. A SWOV researcher was chairman of the international working group.

Casualties

One in ten of the road users in the OECD countries is younger than 25, but they make up a quarter of all road deaths. What is more, studies show that in the Netherlands, for every ten killed young drivers in a crash in which a young driver is involved, there are also thirteen killed passengers or other road users.

Telematics

The OECD report indicates possibilities of telematics applications that have not yet received a lot of attention in the Netherlands. For example, a smart car key can ensure that during the first period after passing the driving test, young drivers are not allowed to drive during weekend nights. And a black box that continuously compares the speed of the car with the speed limit makes it possible to continuously keep an eye on the behaviour of novice drivers.

Recommendations

Based on the study's results, the OECD recommends improving the road safety of young drivers by:

- obliging young drivers to increase their driving experience before taking their practical exam through accompanied driving with an experienced driver;
- setting the maximum blood alcohol content for novice drivers at 0,2 g/l. At the moment, in most European countries, this limit is 0,5 g/l;
- introducing a test period in which young drivers can lose their driving licence and/or undergo additional training. Within a demerit points system, the threshold for losing the driving licence should be lower for young drivers;
- strict enforcement of the traffic rules, with the emphasis on offences that are the most common among young drivers i.e. not wearing a seatbelt, drink-driving of alcohol and/or drugs, and speeding;
- putting the emphasis in the driver training on producing safe drivers, and less emphasis on just passing the exam;
- exploring the possibilities of new technologies such as the black box to trace the cause of a crash and the smart key that prevents a car's engine igniting under particular circumstances.

The report 'What is the meaning of the 'Young drivers: the road to safety' report for the Netherlands?

Example of a project within international research

Studies of new technology bundled

Scientific behavioural knowledge about the interaction between road users and modern in-vehicle technology is spread worldwide among a large number of institutes. To change all this, in 2003 the European HUMANIST Network of Excellence began, in which SWOV is also participating. HUMANIST is the acronym of: HUMAN centred design for Information Society Technologies. The network is partially financed by the European Commission.

New technology

At this moment in time, communication technology for use in cars is constantly expanding. We expect that modern technology can play an important role in regulating mobility/exposure and improving road safety. In order to effectively apply modern technology it is essential to take the wishes and needs of road users into account. We need to anticipate the physical and cognitive conditions of motorists and any undesirable effects on their driving behaviour. That is why the contribution of behavioural scientists in designing new technology is essential.

Exchanging knowledge

HUMANIST brings the most important European research institutes together who are working on the new technology and infrastructure of what is known as 'human centered design'. The starting point of human centered design is that man is the measure of all things. The HUMANIST network is aimed at exchanging researchers, employing PhD and post doc graduates, the mutual use of each other's research facilities, and an exchange of knowledge.

Results

Within the HUMANIST framework of knowledge exchange, SWOV has contributed to three subjects:

- in the field of 'credible speed limits' in relation to intelligent speed assistance (ISA), an innovative system of speed management that in time will be applied throughout the European Union;
- about the possibilities of using a driving simulator in driver training;
- about the position of the elderly in relation to new technology, especially at high risk road locations such as intersections.

HUMANIST will be completed in 2007. More information is available on the special project website www.noehumanist.org.

Knowledge management

What is known about a subject?

Not all aspects of road safety are explicitly studied in the projects of a four-year research programme. In order to have up to date information about as many aspects as possible, SWOV in its programme segment knowledge management follows as many developments possible and reports them in literature studies and fact sheets.

All literature studies and fact sheets can be seen integrally at www.swov.nl under Research.

Literature studies

Literature studies provide an overview of national and international research about a particular subject that has been published. They contain well considered conclusions and, where necessary, signal knowledge gaps. In 2006, SWOV published a literature study about the many aspects that are connected to the safety of motorized/powered two-wheelers. We also examined is the positioning of vehicles within Sustainable Safety.

The complete report 'Powered two-wheelers and road safety; Inventory and positioning in Sustainable Safety' (R-2006-24) is available at www.swov.nl

Fact Sheets

In the current research programme SWOV began making fact sheets about all sorts of road safety subjects. The fact sheets are a brief, accessible form of the most important information about a subject. They are available in English as well as Dutch. In 2006 we produced many new fact sheets. We now present two of them.

Example of a fact sheet within knowledge management

Concentration problems behind the wheel

Drivers' concentration problems have a negative influence on driving ability. When drivers are absent minded it may for instance cause longer reaction times, less adequate observation of the environment, and late and sudden braking. This may endanger their own safety and that of other road users.

The size of the problem

Concentration problems can be caused by drivers having something else on their minds such as: phoning, distraction e.g. by a striking billboard alongside the road, fatigue, or lack of concentration e.g. daydreaming. In America research is being done to determine the size of concentration problems. After a crash, they examine if distraction played a role. A hundred cars have also been equipped with cameras that are aimed at both the driver as the road environment. Meters register the vehicle's performance and the driver's condition.

Apparatus

A lot of research is being done on apparatus that warns the driver if he/she is getting tired. This apparatus is getting better but is still far from perfect. It measures the consequences of fatigue such as swerving, speeding, and eyes blinking. Such apparatus could also be used in the future to warn drivers about concentration problems from a lack of intensity i.e. the extent to which body and mind are mobilized to perform tasks. Warning drivers about their thoughts straying is probably not possible.

Measures

At the moment there are few concrete measures available that deal with concentration problems while driving. What is possible is to warn drivers not to drive if they 'can't keep their minds on the job'. Loss of concentration because of a low intensity, without being fatigued, can be prevented by making the driving task more interesting by, for example, introducing variations along a long, straight road. Rumble strips can also be a solution.

Research

Just how large concentration problems are is difficult to establish. United States research suggests that 7% of crashes are partly caused by concentration problems, without the driving doing other things and without being fatigued. However, a lot more epidemiological research is necessary to make a valid estimate.

The complete fact sheet 'Concentration problems behind the wheel' is available at www.swov.nl.

Example of a fact sheet within knowledge management

RSA and RSI test the safety of roads

Road safety audits (RSA) and road safety inspections (RSI) are not yet being used on a large scale in the Netherlands. But these instruments that result from the Sustainably Safe start-up programme can contribute to road safety.

RSA

An RSA tests the design of new roads or the reconstruction of an existing road. An RSA is preventative: even before the infrastructure has been constructed, an RSA signals any potential problems and makes suggestions for improving. The audit underlines the importance of safety as an explicit criterion in road design and layout, and guarantees that all measures have been considered to reduce design problems. An RSA can be used by the road authority, together with the designers who develop traffic plans and an audit team that actually carries out the audit.

RSI

An RSI tests the safety of existing roads. Inspectors use an RSI to regularly and systematically visually control various faults, usually by means of checklists. The road authority is also involved in an RSI. There is no standard method for carrying out an RSI.

Experience

An RSA has been carried out in various project phases in seven provinces in the Netherlands. The users found the audit useful as a second opinion and a good instrument to determine how far the ultimate plans diverge from the original starting points. Expense can be a problem. An RSI is mainly used if a stretch of road has a high crash rate. In the EU RIPCoRD-ISEREST project they are attempting to standardize the RSI approach in Europe.

Utility

In other countries the RSAs have already proven their value. The audits in the Netherlands also showed that they contribute to road safety. In spite of this, audits are rarely used in the Netherlands. The demand for audits should be encouraged, for example by making the RSA a quality brand name and a managerially anchor it in the form of subsidy, precondition, or obligation. An RSI also contributes to road safety, but it is necessary to draw up a standard procedure.

The complete fact sheet 'Road safety audit and road safety inspection' is available at www.swov.nl.

Knowledge dissemination

SWOV makes itself heard

In addition to research, an important SWOV task is knowledge dissemination. The 2003-2006 period was characterized by making knowledge dissemination more effective and more efficient. In this way SWOV supplies the knowledge needs of media, professionals, and private individuals better.

External communication and press contacts

Road safety is a 'hot item' in the media. In 2006 SWOV gave many interviews, explanation about current events, and background information. 80 to 90 press articles referred to SWOV. Professionals and individuals also knew their way to SWOV.

Knowledge markets and congresses

During last year SWOV was involved in various knowledge markets and congresses. Together with the Royal Dutch Tourist Club ANWB, SWOV organized its biennial National Road Safety Congress; the theme of which was *Together Safer! You achieve more with cooperation*. 405 people attended the varied programme. We also organized four regional meetings to explain *Advancing Sustainable Safety*. Finally we had our stand at the biennial Intertraffic trade fair which was visited 500 times.

Relations

In 2006 SWOV relation management was redesigned. Our efforts are more systematic to build up a good relationship with organizations that are important for our work. Sharing information is now quicker, so that we can go along with current developments. We had many useful contacts that lead to good cooperation.

Educational activities

Last year SWOV unfolded various educative activities: we again arranged lectures about road safety and contributed to various courses. We also participated in consultation with lecturers in scientific and trade institutes for further education. A large number of students did work placement or carried out a graduation project here. There was also a great deal of internal interest in education so that more SWOV researchers will soon be qualified to be visiting lecturers or participate in making international research results better known.

Colloquiums and publications

Thirteen colloquiums were held here last year to inform colleagues about new knowledge or to ask them their opinion. We had about fifty publications including Research Activities and our journal in Dutch.

Website

Both our Dutch and English websites (www.swov.nl) underwent a metamorphosis. The new style and layout went towards meeting the wishes to locate fact sheets, knowledge base, data, and library quicker.

Library and documentation

The SWOV library is the most specialized road safety library in the Netherlands. The collection consisted in 2006 of more than 117,500 titles. The number of journal subscriptions is about 275. We also dealt with 3,650 requests for literature.

SWOV knowledge and positions

In important purpose of knowledge dissemination is to ensure that SWOV's knowledge and positions are used in road safety decision making themes in the Netherlands and beyond. Ministry of Transport spokespersons regularly use SWOV knowledge. In 2006 a discussion note was made to initiate the development of a clear SWOV vision on the use of research knowledge.

Example of an activity within Knowledge dissemination

Together safer!

In April SWOV, together with the ANWB, organized the biennial National Road Safety Congress (NRSC) 2006 in Rotterdam. This was supported and partially financed by the Ministry of Transport. About 400 people attended this 14^e edition.

Plenary

The theme *Together Safer! You achieve more with cooperation* was openly supported by three opening speakers during the morning plenary session.

The Minister of Transport started by announcing the newest, positive road safety data over the previous year i.e. 2005. She emphasized the importance of cooperation of organizations and governments to further reduce the numbers. According to her, special attention was needed to influence driving behaviour by, for example, ISA and an alcolock.

Mr. van Woerkom, head of the ANWB, emphasized in his presentation the importance of a good design of the road safety infrastructure. He argued especially for a consistent, sustainably safe layout of 30 km/hour zones. Furthermore, he emphasized the importance of a safety judgement of roads according to EuroRAP (European Road Assessment Programme).

Fred Wegman, SWOV's director, dealt in his speech with the newest road safety data that the minister had just announced. Using a number of scenarios, he talked about the new targets for 2010 en 2020.

Discussions

The morning session was closed with two stage discussions lead by the day's chairman Mr. Maartens. In the first discussion the Minister of Transport, the alderman for traffic of Utrecht municipality, and the executive for infrastructure and public transport of the province of Gelderland their opinions about three *policy* propositions. In the second stage discussion, the following participated: the head of the Zeeland police region, the chairman of Traffic Safety Association, and the alderman for traffic of Dordrecht municipality. They reacted to three propositions about *implementation*.

Although the propositions on their own provoked sufficient discussion, Mr. Maartens stirred up the discussion by his stimulating remarks.

Exchanging

During the various congress intervals one could visit the knowledge market with various stands and about twenty posters. The visitors encountered the many different initiatives that supported the importance of cooperation.

During the afternoon there were thirty different presentations on the workshop programme. Their subjects were very varied, from *Education* to *New initiatives* and from *Integral traffic policy* to *Lorry and delivery van traffic*.

Prize-giving

At the end of the day the prize for the 'Best contribution NRSC 2006' was awarded. There were actually two prizes: one for the best poster presentation and one for the best workshop presentation. The poster presentation prize went to Lelystad municipality for its poster about the *Safe Traffic Meeting Place*. The prize for the best workshop presentation was awarded to the Frisian Provincial Road Safety Board for its presentation about the digital road crash registration.

All speeches, presentations, and posters are available at the website www.nvvc-congres.nl.

Composition of Board of Governors and external advisory bodies in 2006

Board of Governors

P.J. Biesheuvel (chairman)
Ms. J. Blankers
P. Janssen
H.J. van der Steenhoven
G. van Woerkom

Dutch Car Industry RAI
On the recommendation of the employees council
Royal Dutch Tourist Association ANWB

Programme Advice Board

J. Barkhof (chairman)
W.H.B van Dunné
J. de Geus
J.F. Jeekel
H.H. Kok
W.G. de Raad
Ms. W.A.A. Schrover
J. Spee
W. Wessels

Traffic Safety Association
Municipality of Waalwijk
Transport Research Centre
Province of Utrecht
Province of Flevoland
Transport Operators Association
Bureau of Traffic Enforcement
Regional Road Safety Board Amsterdam

Scientific Advice Board

J. Godthelp (chairman)
Prof. K.A. Brookhuis
Prof. I.A. Hansen
Prof. R.E.C.M. van der Heijden
Prof. C.C. Koopmans
Prof. G.P. van Wee

TNO Human Factors Research Institute
Groningen University/Delft University
Delft University
Radboud University
VU University Amsterdam
Delft University