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Contents:

Editorial

The update of the Dutch road safety vision had been translated into English and has been published under the title Advancing Sustainable Safety. You can read more about it in this issue of Research Activities. Other interesting articles are about the European research project PENDANT and the OECD research projects on Speed Management and on Young Drivers.

Advancing Sustainable Safety now available in English

Sustainable Safety, the vision that has been an important contribution to the successful Dutch road safety policy since 1992, has been updated and published under the title Advancing Sustainable Safety. This update is now integrally available in an English edition. On 3rd November the Dutch Minister of Transport Karla Peijs presented the first copies to her European colleagues at the EU Road Safety Conference in Verona, Italy. With this publication, SWOV wants to inspire the international road safety professionals with scientifically supported ideas of how they too can improve road safety in their countries.

The roads in the Netherlands are among the safest in the world. Since the mid 1990's the principles of the Sustainable Safety vision have been applied to road traffic in the Netherlands on a large scale. In spite of this top position, SWOV is of the opinion that much can still be done to make traffic even safer. Advancing Sustainable Safety provides ideas for successful future interventions.

The objective of Sustainable Safety is to prevent road crashes from happening, and where this is not feasible, to reduce the incidence of (severe) injury whenever possible. This can be achieved by a proactive and integral approach in which human

"Targeted road safety programmes are the best way to use public resources and reduce road deaths and injuries."

Martin Territt, Director of the European Commission Representation in Ireland

QUOTE

characteristics are used as the point of departure: a user-oriented system approach.

Improvements

The name Sustainable Safety is inspired by the UN Brundtland Commission on sustainable development: no longer do we wish to hand over a road traffic system to the next generation in which we tolerate that road transport inevitably leads to an epidemic of road deaths and injuries, as can be observed today.
Sustainable Safety has proven to be a successful way of lowering the number of road crash casualties and has certainly not lost its strength. However, past experience and a changing society were reason to update Sustainable Safety. The advanced Sustainable Safety vision places new emphases, explores new possibilities, and makes use of new social and technological developments.
Five principles, each of which uses 'man as the measure of all things' in both the physical and the psychological sense, are central to achieving this goal. Sustainable Safety combines scientific findings from several disciplines, both fundamental and applied, about the causes and the prevention of crashes.

Principles explained

Table 1 gives a compact survey of the Sustainable Safety principles, but below they are discussed in somewhat more detail.

Functionality: ideally, roads either serve the purpose of facilitating the traffic flow (through roads) or of providing access to a destination (access roads) These two road types are literally and figuratively connected by a third type (distributor roads). This subdivision in three road types creates a hierarchically structured road system.

Advancing Sustainable Safety has its own website: www.sustainablesafety.nl. Not only does the website give background information about Sustainable Safety and does it contain the full publication *Advancing Sustainable Safety* (pdf), it also provides access to the abbreviated version entitled *Advancing Sustainable Safety; the advanced vision in brief* (pdf).

Sustainable Safety principle	Description
Functionality of roads	Monofunctionality of roads, being either through roads, distributor roads, or access roads, in a hierarchically structured road network
Homogeneity of masses and/or speed and direction	Equality in speed, direction, and masses at medium and high speeds
Predictability of road course and road user behaviour by a recognizable road design	Road environment and road user behaviour that support road user expectations through consistency and continuity in road design
Forgivingness of the environment and of road users	Limitation of injury by a forgiving road environment and anticipation on road user behaviour
State awareness by the road user	Ability to assess one's task capability to handle the driving task

Table 1

Reducing the risk of severe injury due to man's physical vulnerability can be achieved by organizing the traffic in time and space in such a manner that there are no large differences in mass and speed between road users: there must be *homogeneity* between road users. This can be done by separating road users that have large differences in mass and speed. Also, the *physical forgivingness* of the road side environment, the exclusion of severe injury caused by crashing into a solid object, needs to be realized by constructing safe road shoulders.
Preventing unsafe acts is the most important way to prevent crashes. Road users should as much as possible perform their acts based on routine: this reduces the chance of serious errors while they also keep some control. This requires sufficient training, but the physical environment can also be of assistance by *recognizability* of road design and *predictability* of the road course. This results in more predictable road user behaviour, enables routine acts, and reduces the chance of errors.
Road users differ in the degree to which they are capable to perform their driving task. Their skills are both determined by their own competences and by their situation dependent state. This has resulted in the definition of the principle of *state awareness*. This principle entails that road users must be able to correctly judge their own task capability. This, for instance, will prevent crashes which are caused by overestimation of one's powers. The principle of state awareness is supplemented by what we have named *social forgivingness*. If the more capable road users anticipate on the actions of less capable road users and give some room for their mistakes, it will reduce the probability of dangerous actions turning into a crash.

Violations

People not only make traffic unsafe by unintentional errors, but also by deliberate violations. Therefore, deliberate violations are also explicitly recognized as causes of crashes. When the traffic environment does not more or less automatically invite correct and safe behaviour, road users should comply with the rules from an inner motive. To improve rule acceptation, rules should be appropriate to the traffic environment and credible to road users, and people should be educated to accept the usefulness of rules. For those who still fail to obey the rules, the Sustainable Safety vision includes ways of enforcement with a fairly good chance of being caught when violating rules.

In order to make Advancing Sustainable Safety available worldwide, SWOV has created a special website: www.sustainablesafety.nl. The complete publication as well as a summary can be consulted at this website free of charge. Printed copies of the book and summary can also be ordered.

Stay informed

Subscribe to the SWOV newsletter

For some time now, SWOV has been publishing a monthly newsletter which is distributed by e-mail. The newsletter is intended to provide SWOV's relations with up-to-date and complete information about recently published reports and factsheets, new acquisitions in the SWOV library, and about conferences, meetings and colloquia. All information has a hyperlink which brings you directly to the detailed information on the website.
You can subscribe to the newsletter by using the hyperlink in the box in the bottom left corner of the English SWOV homepage, or by sending an e-mail to info@swov.nl.

Speeding: coherent policy necessary for improvement

In the fight against speeding a coherent, consistent policy will produce better results than a series of isolated measures. This is one of the recommendations in the OECD/ECMT report Speed Management.

Speed seems to have many positive effects, the most obvious being that it reduces the journey time and therefore improves mobility. On the other hand, speed could also have negative consequences for road safety, the environment, and the quality of life.

Speeding and road safety

Excessive speed, i.e. driving above the speed limit or driving within the limit but too fast for the conditions (inappropriate speed), is the number one road safety problem in many countries. Not only is speed a causation factor in around one third of fatal crashes, it also increases the severity of all crashes. At a higher impact speed, the forces that vehicle occupants must absorb in a crash increase with a power function. Occupant protection systems are effective at low and moderate impact speeds, but they cannot adequately protect vehicle occupants from these kinetic forces at high impact speeds. Speeding is a widespread social problem. Estimates in the Netherlands show that at any one time approximately 50% of drivers are exceeding the speed limits.

Reducing speeds will save fatalities. There is good experience available on how to quickly reduce the extent of speeding and thereby reduce current fatalities and injuries. Reduced speeding will also reduce the adverse environmental and social impacts associated with excessive speed, particularly in urban areas.

Coherent policy

An OECD/ECMT Joint Transport Research Centre working group studied speed hazards and speed management; SWOV's Ingrid van Schagen contributed to this study.

The working group concluded that a coherent, consistent policy, a well balanced set of measures which remain valid for a considerable period, will produce better results than a series of isolated measures. In developing a speed management package, the aim should be to obtain the right balance between the individual speed management measures. This package should include:

- targeted education and information to the public and policy makers about the problem of speeding;
- determining appropriate speeds for all types of roads. This also involves the review of existing speed limits;
- informing drivers of the current speed limit at all times;
- infrastructure improvements which are aimed at achieving safe, self-explaining roads;
- appropriate levels of traditional police enforcement and automatic speed control;
- development of vehicle engineering, such as collision avoidance systems and speed limiters.

New technologies

As new technologies become available progressively, new applications will provide a logical step forward in speed management. At present, Intelligent Speed Adaptation (ISA) applications are being actively researched and tested in many countries. This is done for informative (advisory) ISA, which principally displays the speed limit and warns the driver when he exceeds the speed limit, as well as for supportive (intervening) ISA, which largely prevents exceeding the speed limit.

To help secure the potential benefits of the ISA technologies, governments are encouraged, in cooperation with relevant partners, to develop interoperable digital speed limit databases.

And what happens in the Netherlands?

There are a number of interesting developments in the Netherlands which are very much in line with the recommendations of the OECD/ECMT working group. Recently, the Dutch Minister of Transport announced a study and a pilot with intelligent dynamic speed limits on motorways, which respond not only to incidents and traffic volumes, but also to weather conditions. Furthermore, safe, credible, dynamic and enforceable speed limits are the topic of an interregional project that is being prepared in order to drastically reduce speed related accidents on interurban roads. And finally, Members of Parliament sent an invitation to different road safety and environmental organizations to produce an 'Action Plan' on the introduction of ISA in the Netherlands. This could be a valuable step towards ISA.

The website of the Joint Transport Research Centre http://www.cemt.org/JTRC offers an executive summary of the report entitled Speed Management. Here you can also order a copy of the report.

PhD projects at SWOV

PhD research is of the utmost importance for a scientific research institute like SWOV. PhD research contributes to a continuous high quality development and innovation of knowledge and understanding in the area of road safety. Last year an international evaluation committee judged SWOV's PhD programme to be very good, and recommended continuation.

At present SWOV stimulates its researchers to obtain a PhD and offers its employees the possibility to carry out their PhD research within a SWOV project. At present seven researchers are working on their theses.

Present research projects

The seven SWOV PhD-researchers work on a variety of subjects and expect to obtain their PhD in the SWOV research period 2007-2010. The PhD research is conducted in close cooperation with several Dutch universities. In the 2007-2010 research period, SWOV aims at offering PhD research possibilities for three more researchers.

Two of the current projects which facilitate PhD research are subprojects of the BAMADAS research programme *(Behavioural Analysis and Modelling for the Design and Implementation of Advanced Driver Assistance Systems)*. Nina Dragutinovic works on *Testing operational models and behavioural assumptions included in driving* and Maura Houtenbos's thesis will be entitled *Modelling Interaction Behaviour in Driving*. The BAMADAS project is carried out in cooperation with Delft University of Technology.

In the other projects Ragnhild Davidse studies *Elderly drivers,* Frits Bijleveld is occupied with *Time series model for road safety analyses* (see article elsewhere in this magazine), Charlotte Bax works on *Decision making processes in road safety policy,* Atze Dijkstra studies *Route choice in a road network*, and, finally, Saskia de Craen researches the *Development of driving experience in young, novice drivers*.

International contributions

SWOV research frequently finds its way to international conferences. In July, for example, Saskia de Craen, Maura Houtenbos, and Jolieke Mesken contributed to the International Congress of Applied Psychology in Athens. Jolieke Mesken organized a symposium at the conference about her PhD subject *Emotions in traffic* (see article on page 7) and Saskia de Craen and Maura Houtenbos presented their research (see *Frame 1*).

You can find more information about the SWOV research projects on the SWOV website www.swov.nl under Research.

SWOV contributions to the International Congress of Applied Psychology in Athens

The effects of driving experience on estimating safe driving speeds in situations on photo
Saskia de Craen presented the results of a study into the effects of driving experience on estimating safe driving speeds. This study makes use of photographs to measure the extent to which drivers adapt their speed to the complexity of the situation. The results showed that experienced drivers show better adaptation than novice drivers. This instrument is now being used in a two year longitudinal study into the driving behaviour of young, novice drivers.

Expectations on intersections: a study using two linked driving simulators
Maura Houtenbos presented her research into expectations on intersections. Usually just one single simulator is used in research in which the subject meets other road users whose behaviour follows earlier programmed instructions. This research which investigates interaction, however, made use of two linked simulators to look at the interactive behaviour between two drivers.

Frame 1

Young Drivers: The Road to Safety

OECD recommendations for reducing road deaths

Longer periods of accompanied driving, probationary periods, and tougher drink-driving limits are necessary to reduce the number of road deaths among young novice drivers. This is one of the conclusions in the OECD report entitled Young Drivers: The Road to Safety.

The report which was published by the OECD Joint Transport Research Centre and the European Conference of Ministers of Transport (ECMT) in September of this year, points to road crashes as the main cause of deaths among the 15-24 year olds in industrialized countries. SWOV's Divera Twisk chaired the international working group, and SWOV researchers Willem Vlakveld and Wim Wijnen also made contributions.

Casualties

One tenth of all road users in the OECD countries are under the age of 25, but they constitute a quarter of all road deaths. Moreover, studies in the United States and the Netherlands have shown that in these countries, for every 10 road deaths among young drivers, another 13 passengers or other road users are killed in accidents which involve a young driver. Young men are the most dangerous drivers and have a three times higher death rate than young female drivers.

Recommendations

Based on the research results, the OECD recommends improving the road safety of young drivers by:

- obliging young drivers, in addition to their driving lessons, to practice driving accompanied by an experienced driver before they take their practical driving test. When Sweden in 1993 lowered the minimum age for accompanied driving from 17½ to 16, while keeping the driving licence age at 18, the average number of hours spent driving before passing the driving test increased from 45 to 120, and the number of crashes in which young novice drivers were involved decreased by 40% within two years.
- setting the maximum BAC of novice drivers to 0.2 g/l. This is lower than the 0.5 g/l that applies in most European countries. The reason for this is that the young are more sensitive to the effects of alcohol than older drivers.
- imposing probationary periods on young drivers during which they can lose their licence and/or have to undergo further training if they break the rules of the road. If drivers are penalised on

a system of demerit points, the threshold for removing the licence should be set lower for novice drivers.
- applying strict enforcement of traffic regulations to all drivers, with special emphasis on the offences most committed by young drivers: not wearing a seatbelt, driving under the influence of alcohol and/or drugs, and speeding.
- placing a stronger emphasis in the driver training on becoming a safe driver, rather than only on passing the driving test.
- exploring the possibilities of new technologies, such as the black box, to trace the cause of a crash, and the smart key that prevents starting the engine under certain conditions.

The Netherlands has already introduced a demerit point system for young novice drivers and set the maximum BAC for this group at 0.2 g/l. A graduated license is a possibility to further reduce the number of young road deaths. Telematics, which as yet is insufficiently used, presents the possibility of introducing a graduated driving licence without making it too big a burden for police enforcement.

The website of the Joint Transport Research Centre http://www.cemt.org/JTRC offers an executive summary of the report entitled Young Drivers: The Road to Safety. Here you can also order a copy of the report.

PENDANT: study on in-depth accident data completed

The collection of more in-depth accident data at a European level is necessary to make reliable analyses possible of developments in vehicle technology and crash protection. This is one of the main conclusions of European project PENDANT, Pan-European Coordinated Accident and Injury Databases.

On September 29th 2006, the results of PENDANT were presented to the public. At the same time the PENDANT project, which started in 2003, officially came to an end. For almost four years 13 partners and several subcontractors from eight different EU countries have worked together to, among other things, develop crash investigation tools and a standardized database system for data entry and combined analysis.

Technological development

Vehicle design and crash protection have experienced a very fast technological development over the past ten years. Analysis of accident data can establish the effectiveness of safety systems and provide useful information for the next generation to be developed. Thus, international crash data needs to be available which includes information on newer vehicles. Such data can improve the efficiency and speed of feedback to designers and manufacturers of safety systems.

PENDANT objectives

To make the use of international data for in-depth analysis possible, PENDANT divided its tasks over three workpackages.
The first workpackage aimed at the development of accident investigation tools and procedures and worked on harmonization of crash reconstruction, estimation methods, and assessment techniques. Using in-depth crash data, it also worked on the development and harmonisation of methods to predict the casualty reductions new technologies can achieve. This workpackage resulted in an extensive description of accident

investigation methods and in a a public database of EuroNCAP crash tests.

The second workpackage, which was clearly the heart of the project, aimed to:
- update data collection protocols for injury causation, development of accident causation data specification;
- develop a system to investigate the causes of injuries based on the STAIRS methodology in eight countries;
- develop a standardised database system to facilitate data entry and combined analysis without individual case records crossing national boundaries;
  - investigate approximately 1100 accidents involving injured car occupants and compile the data into the database;
  - analyse the composite database and identify priorities for future European regulatory and other action.

This workpackage succesfully designed the international crash database, filled it with the initial 1100 records with data from eight European countries, and tested it by making the first extensive analyses.
The third workpackage worked on the comparison and analysis of data from hospital registration systems. The results were an analysis based on hospital data from three different countries, an analysis based on linked data (hospital to police) from these countries, and descriptions of the linking procedures and their results.

Results

The initial analyses of the in-depth data in the international database were made on a variety of topics, among which pedestrian crashes, rollover crashes and rear end collisions. The analyses showed differences between countries, but also came up with new findings about similarities in all countries from which data was used.

What does PENDANT mean for the Netherlands?

For the Netherlands/SWOV the Pendant study brought the opportunity for both TNO and SWOV to gather in-depth accident data based on the same international criteria. This data could next be analyzed further using the international Pendant database.
PENDANT also made it possible to study the crash test data from EuroNCAP in detail.
Finally it gave SWOV international experience in linking hospital data to police data. This method is now being used in the SafetyNet project.

All information about Pendant is available on the website www.vsi.tugraz.at/pendant/. The results of the crash tests can be found on www.crashtestdb.com/home/main.php.

Fewer road deaths in the Netherlands in 2004 and 2005: no coincidence

The strong decrease in road deaths in the Netherlands during the last two years was not coincidental. Fewer speeding offences, less drink-driving, more seatbelt use, and fewer mopeds made a contribution. This is SWOV's conclusion in its recent report entitled *The essence of the decrease in the number of road death in 2004 and 2005.*

Coincidence or trend?

At the Dutch National Road Safety Congress in April 2006, the Dutch Minister of Transport, Karla Peijs, announced that the number of road deaths had decreased for the second year in succession: in 2004 it went down from 1088 to 881, and in 2005 there was a further decrease from 881 to 817. For each year, this is approximately 175 road deaths below the long term average. SWOV investigated whether this strong decrease was a matter of coincidence or whether it was the beginning of a new trend. To find the solution, SWOV looked at two types of possible explanations: external factors and road safety measures, and the behavioural changes resulting from them.

External factors

As we studied the external factors such as demographic developments, developments in mobility/exposure, and the vehicle sales and total numbers, we observed that the sale of mopeds had decreased strongly in 2004. The average sale of new mopeds had decreased from 30,000 over 2002-2003 to 20,000 over 2004-2005. Analysis has shown that the changes in sales figures and numbers of road deaths are significantly related. It is still unknown whether there is a direct causal relationship. It is possibly the 'beginners effect' which plays an important role. After all, new sales are only a small proportion of the total number of vehicles.

Improved infrastructure

SWOV also examined the possible effects of changes in road design, safer vehicles, and new traffic laws on the number of road deaths. All these efforts are likely to have had a positive road safety effect. In order to really show this effect, it is necessary to know for each year which, and how many, infrastructural improvements were carried out. Only then can any relation between road adaptations and decreases in road deaths be established. Unfortunately there is no national database which contains information about such infrastructural adaptations.

As vehicle safety developments are usually very gradual, it is not reasonable to expect that they suddenly resulted in the large decrease in road deaths in 2004 and 2005.

Road safety measures: extra benefit from behavioural changes

SWOV researchers studied the contribution of road safety measures like traffic regulations, infrastructure, enforcement, and campaigns to this sudden extra decrease in road deaths. Although a number of these did show tendencies, only speeding, drink-driving, and seatbelt use had a quantitative effect.

In the last year, the decrease in the number of serious speeding offences saved approximately 15 deaths. The same number was also saved by a reduction of the number of drivers who had slightly exceeded the alcohol limit. During the last few years more motorists and car passengers wore a seatbelt. In 2005 90% of all car occupants wore a seatbelt, whereas it was only 75% in the late 1990s. This has saved approximately 10 deaths.

SWOV report R-2006-4, ' The essence of the decrease in the number of road death in 2004 and 2005' contains more information about the decrease of the number of road deaths in The Netherlands. The report is in Dutch, but has an English summary. It can be consulted and downloaded from the SWOV website under Research, Publications.

Target for 2010 sharpened to a maximum of 750 road deaths in the Netherlands

The Dutch Minister of Transport Karla Peijs, together with representatives of all tiers of government, has sharpened the road safety target for 2010: the maximum number of traffic deaths is not allowed to exceed 750. An analysis of recent road safety developments carried out by SWOV, entitled *The essence of the decrease in the number of road deaths*, was used to support the decision to lower the road safety target for the Netherlands.

The report, which SWOV offered to the Minister in August of this year, gives a prognosis for the number of road deaths in 2010 and 2020. In 2010 the number of road deaths will be between 680 and 810. In 2020 it will be between 470 and 630 road deaths. Therefore SWOV finds a target of 750 fatalities in 2010 and 550 in 2020 realistic.

Minister Peijs said that she was 'very pleased' with the report. In a letter to the Dutch parliament she announced she would put the sharpening of the target on the agenda for the National Mobility Council. This council, in which the Minister meets with representatives of provinces, regions, municipalities, and water boards to discuss traffic and transport policy and its realization, has met and agreed with the sharpening of the target.

Dutch Minister of Transport Karla Peijs receives the SWOV report

SWOV-rapport R-2006-4 'The essence of the decrease in the number of road deaths' is published on de SWOV website www.swov.nl under Recent publications. The report is in Dutch, but it has an English summary.

Emotions in traffic
PhD for Jolieke Mesken

Which are the aspects in the interaction between person and task environment that elicit emotion, and which are the consequences of emotions for driving-related performance and road safety? These are the central questions in Jolieke Mesken's PhD-thesis *Determinants and consequences of drivers' emotions*.

On 30 November 2006, SWOV researcher Jolieke Mesken obtained a PhD in Behavioural and Social Sciences at the University of Groningen on her study into emotions in traffic. Mesken carried out a literature study, a questionnaire study, two experimental studies and an on-the-road study to answer the research questions.

Studies

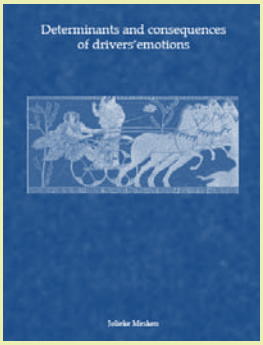
The questionnaire study asked drivers to report their most likely emotions and reactions to each scenario.
The experimental studies used three groups of drivers: one group that was subjected to induction of positive emotion, one that was subjected to a negative emotion, and a control group. Each group was asked to evaluate a number of video fragments of following distances in terms of risk perception, optimism bias, illusion of control, and behaviour intention twice. In this study the differences between experimental and control groups were rather small.
Finally participants were asked for an on-the-road study, in which they drove an instrumented car. This study showed anxiety to be the most frequently occurring emotion, followed by anger and happiness.

Causes and frequency

The studies showed that emotions manifest themselves when important goals are blocked or advanced. The main goals in traffic are flow and safety. Obstruction of the traffic in combination with the presence of another road user usually causes anger. Safety, however, which is mainly due to the situation, usually causes nervousness. Positive emotions are not very frequent, but if they occur, they mostly are not related to the presence of other road users. It is considered normal if others show positive behaviour. Nervousness occurs most frequently with 2.6 times in a 50 minute trip, followed by anger with 1.5 times, and joy with 1.0 times per trip.

Effects

In general, positive emotions are related to positive reactions, and negative emotions are related to negative reactions. However, negative emotions that are caused by a situation, and not by a person, lead to positive reactions.



It also became clear that nervousness goes together with an increased heart rate, and also with an increased perceived risk. Drivers who report anger drive faster on certain road sections than drivers who don't. The video experiment showed that watching the following distances more than once, changed the judgement: the second time the brief following distances were judged to be riskier than they were the first time.

Conclusions and recommendations

Based on the results of the study, Jolieke Mesken has formulated a number of recommendations with respect to training and education, infrastructure and enforcement.

Training and education
Social and communicative skills should be part of the driver training as much as motor skills and cognitive skills.

Infrastructure
As emotions usually manifest themselves in interactions between road users, measures taken to reduce congestion will not be effective in preventing anger. It is better to make the traffic system predictable, as the Sustainable Safety vision also advocates, and to minimize the number of interactions between road users.

Enforcement
Enforcement should not aim at a general concept like 'aggressive road behaviour', but more at specific types of behaviour which are known to increase risk. An example is speeding: present research indicates that drivers are irritated by the speed limits in two situations. This happens when the reason for a (lowered) limit is unclear, and also when the relation between the speed reduction and road safety is unclear. There should be better communication about the reasons for speed limits and their relation to road safety in order to improve the credibility of the limit, and consequently, the number of violations.

Jolieke Mesken's thesis ' Determinants and consequences of drivers' emotions' is the first publication in a series of SWOV PhD studies. The thesis can be consulted and downloaded from the SWOV website www.swov.nl under Research, Publications.

Colophon

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Recent SWOV publications on time series analysis

An important issue in road traffic safety research is the need for the quantitative analysis and modelling of developments in road traffic safety, by taking into account the main risk factors that have short and long term effects on road traffic safety.

These risk factors include exposure to risk (e.g., motor vehicle kilometers), transitory factors (e.g., weather conditions, calendar effects), and safety performance indicators (e.g., seatbelt use, drink driving, speed). As the term 'developments' implies, the analysis of such data poses special challenges to researchers due to the fact that the observations concern repeated measurements over time and therefore often do not satisfy the usual assumption of independence. Failure to properly handle these issues may easily lead to incorrect conclusions from the monitoring, explanation, and forecasting of developments in road traffic safety.

Expertise network

In the aftermath of the European COST Action 329, in 1999 an international expertise network was formed called the International Co-operation on Time Series Analysis (ICTSA), consisting of researchers from road safety institutes and universities located in Australia (Monash University), France (INRETS), Belgium (BIVV/IBSR and IMOB - Hasselt University), Poland (Gdansk University of Technology), Austria (KfV), Switzerland (Swiss Council for Accident Prevention BFU), and the Netherlands (SWOV). The purpose of ICTSA is for its members to exchange know-how and expertise on ongoing developments in the field of time series analysis of road safety data.
Two-day meetings of the ICTSA are held twice a year, during which members have the opportunity to present and discuss their road traffic safety research using time series analysis. The small scale of these meetings allows for an in-depth, thorough and fruitful exchange of ideas and experiences concerning the application of time series analysis to traffic safety research.

Publications

The participation of SWOV researchers in this expertise network - combined with research projects at SWOV involving the analysis of Dutch road safety developments - has recently resulted in a number of publications on time series analysis. The first publication by Bijleveld investigates statistical issues involved in the simultaneous analysis of accident related outcomes of the road traffic process, and was published in Accident Analysis and Prevention. The following two publications are two SWOV reports by Bijleveld and Commandeur called *The basic evaluation model* and *Test modelling single accidents with the basic evaluation model*. Finally, the Tinbergen Institute published a Discussion Paper by Bijleveld, Commandeur, Gould (Monash University) and Koopman (Vrije Universiteit Amsterdam) which presents a new method for the simultaneous analysis of developments in safety, exposure and risk based on the so-called state space methodology for time series analysis. In the first half of 2007 an introductory text book by Commandeur and Koopman on time series analysis by state space methods is also expected to be published as the first in a new series of books by Oxford University Press entitled 'Practical Econometrics' designed to make the latest econometric techniques accessible to practitioners as well as to academics and students.

The two SWOV reports 'The basic evaluation model' (R-2006-2) and 'Test modelling single accidents with the basic evaluation model' (R-2006-3), can be consulted and downloaded from the SWOV-website.

Publications on time series analysis

Bijleveld, F.D. (2005). The covariance between the number of accidents and the number of victims in multivariate analysis of accident related outcomes. Accident Analysis and Prevention, 37, p. 591-600.

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Commandeur, J.J.F. & Koopman, S.J. An introduction to state space time series analysis. Ac-cepted for publication by Oxford University Press.

Publications

Most SWOV reports are written in Dutch but they all include an English summary. Below is a selection of reports that have recently been published by SWOV. Records of all SWOV reports that were published from 1980 onward can be found on our website (www.swov.nl). Reports that were published in or after the year 2000 can be downloaded free of charge.

The essence of the decrease in the number of road deaths; Developments in 2004 and 2005, and new prognoses for 2010 and 2020

H.L. Stipdonk, dr. L.T. Aarts, C.C. Schoon & P. Wesemann. R-2006-4. 68+8 pp. € 12.50 (in Dutch with an English summary).

In 2004 there was a sudden, sharp, extra drop in the number of road deaths compared to this downward trend. In 2005 there was a further decrease. This analysis aims to describe and explain this strong decrease, and, with a view to a possible adjustment of the road safety targets, determine the consequences for the number of road deaths in 2010 and 2020.

Speed management: enforcement and new technologies

Fred Wegman & Charles Goldenbeld. R-2006-5. 29 pp. € 8.75 (in English).
This paper reviews the scientific evidence about the effects of modern speed enforcement methods and discusses some new technologies for speed management and their potential impact on crashes.

Fact sheets:

- The elderly and Intelligent Transport Systems (ITS)
- Content and assessment of traffic education programmes
- The road safety of motorway tunnels

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