

Research Activities is published three times a year by SWOV Institute for Road Safety Research in the Netherlands.

Contents:

Ten years of Sustainable Safety: considerably safer traffic ①

SWOV leader international study on 'Self-Explaining Roads' ②

A Different Way of Paying for Road Use: positive effect on road safety ③

Workshop on Scientific Research into Road Safety Management ④

The IRTAD Conference: the importance of data for road safety improvement ⑥

Real numbers of traffic injuries more accurate with MAIS ⑦

Publications ⑧



Ten years of Sustainable Safety: considerably safer traffic

In recent years, the development of the numbers of casualties and the fatality rate has decreased considerably in the Netherlands. Measures that emanate from or are in line with the Sustainable Safety vision have most probably made a sizeable contribution. A cost-benefit analysis of the measures that were taken also shows a positive result, even when pessimistic hypotheses concerning effects and costs are used. This is the conclusion in the recently published SWOV report *Ten years of Sustainable Safety*.

The first initiative towards the Dutch Sustainable Safety vision was taken in 1992 with the publication of the book *Towards a sustainably safe road traffic; National road safety assessment 1990-2010*. The actual implementation of Sustainable Safety started in 1998, after the Covenant Start-up Programme Sustainable Safety had been signed by the Dutch Ministry of Transport and the decentralized governments. What can we say now, ten years after the start, about the implementation of measures that emanate from

or agree with Sustainable Safety and about the safety effects they had?

Sustainable Safety vision

The purpose of the Sustainable Safety vision is to prevent crashes or to prevent the risk of serious injury where this is not (yet) possible. To do this, the human being with its limitations is used as a starting point. Initially the vision was based on three principles: functionality, homogeneity and recognizability. In 2005, two new principles were added in *Advancing Sustainable Safety*: forgivingness and state awareness.

Continued on page 2

Editorial

The results of ten years of Sustainable Safety, an account of the international SWOV workshop which was held in November, and the introduction of the Dutch version of road pricing are some of the topics in the December issue of Research Activities.

The door to safety swings on the hinges of common sense

Unknown

QUOTE

Infrastructure and legislation

In the period 1998-2007, many measures were taken that emanate from or are in line with the Sustainable Safety vision. In relation with infrastructure, it was decided in the Start-up Programme to construct 30 and 60km/h zones, to make priority regulations for main roads, to uniformize the priority regulations for roundabouts, and to introduce the 'moped on the carriage-way' measure. In addition, the Sustainable Safety principles functionality, homogeneity and recognizability were translated into guidelines for road design. To investigate to which extent the structure of the Dutch road network now conforms to these guidelines, a survey was held among all road authorities. The results from this survey indicate that an estimated 41,000 km of 30km/h road and well over 33,000 km of 60km/h road have been constructed during the last decade. This means that at present 70% of urban roads are 30km/h roads and 60% of rural secondary roads are 60km/h roads. Furthermore, essential recognizability characteristics have been applied to 75% of the access roads and to 40% of the rural distributor roads.

Enforcement and education

To improve enforcement, Regional Traffic Enforcement Teams have been set up which considerably intensified the enforcement of traffic behaviour during the period 1998-2007. The efficiency of the enforcement was also increased and there have been changes in regulations. Furthermore, enforcement was supported by public information campaigns to increase its effectiveness. Concerning education, agreements were made in the Start-up Programme about 'permanent traffic education'. This has resulted in a toolkit which describes a number of educational projects aimed at separate age-groups. In the area of public information, several parties increased their cooperation and the campaign calendar and central slogan 'That will bring you home' were introduced.

Vehicle safety

In the period 1998-2007, vehicle safety was also improved considerably, partly due to the introduction of EuroNCAP. Particularly the increased levels of penetration of electronic stability control (ESC), seatbelt reminders and airbags are responsible for an increase of vehicle safety. Although these measures cannot be attributed to Dutch policy, they are well in line with the Sustainable Safety vision.

Effects of measures

The construction of 30km/h and 60km/h roads are responsible for saving many casualties in the Netherlands. In 2008, these measures resulted in a reduction of more than 110 road deaths in comparison with the situation in 1998. Also, intensifying the enforcement efforts in combination with public information has been effective; it contributed to the increased wearing of seatbelts and a reduction of drink driving. These measures are estimated to have saved 55 and 65 road deaths respectively. The infrastructural measures as well as the intensifying of enforcement efforts in combination with public information are in line with the Sustainable Safety vision.

Vehicle safety has also improved, but the majority of these improvements are the result of European policy and initiatives from the vehicle manufacturers. In 2007, ESC and airbags saved an estimated 10 and more than 30 road deaths compared to the situation in 1998. Seatbelt reminders have contributed to the increase in seatbelt use which, as was mentioned earlier, saved an estimated 55 road deaths in 2007.

Many more measures have been taken, but unfortunately it has proved to be impossible to make estimates of their effects.

Total effects and cost-effectiveness

The decreases in numbers of casualties and fatality rate (number of road deaths per distance travelled) show that Sustainable Safety has been successful. In the Netherlands, the rates of decline for the number of road deaths and for the fatality rate were more than twice as high as in the preced-

ing decade (1988-1997). The positive result is not equally clear from the analysis of data concerning in-patients.

To get an idea of the combined effect of all these measures, the number of road deaths in 2007 was compared to the expected numbers of road deaths for 'continuation of present policy' and for 'maintaining the status quo'. For the first scenario (continuation of present policy) the hypothesis was used that a past trend like decrease of the risk will continue. For the second scenario (maintaining the status quo) we assumed that the risk does not change. In 2007, there were almost 300 (registered) road deaths less than were expected if it had been business as usual. Compared to the situation that could be expected in 2007 if the status quo had been maintained, there would have been 400 fewer road deaths in that year.

A cost-benefit analysis was made of all measures since 1998 to which these 400 road deaths saved could be attributed. The benefit-cost ratio of this set of measures appeared to be very positive (almost 4). Furthermore, a sensitivity analysis was made using pessimistic hypotheses about (higher) costs and (lower) benefits; also for these hypotheses the benefit-cost ratio is higher than 1.

Reports

The SWOV study into the effects of Sustainable Safety has resulted in two reports: *Ten years of Sustainable Safety* and *How sustainably safe have Dutch roads been equipped?* The latter report contains the results of the survey that was held among road authorities early 2009 and is still to be published. In the near future a book with a concise and less technical description of the effects of Sustainable Safety will also be published. All publications are in the Dutch language, but the reports also have an English summary. ◆

All SWOV publications can be consulted and downloaded at www.swov.nl.

SWOV leader international study on 'Self-Explaining Roads'

ERA-NET Road is a network of several European road authorities active in the European Research Arena. This initiative is supported in the EC 7th Framework Programme. Many countries realized that they were commissioning research in similar areas and that it would therefore be profitable to join research efforts and budgets. In 2009 an ERA-NET Road call 'Safety at the heart of road design' was put out. The common goal of these international projects is to achieve road safety improvement by putting the concepts Self-Explaining Roads and Forgiving Roadsides into practice. The emphasis is on road safety solu-

tions that are developed collectively and that give a leading role to the limitations of the human being. Out of sixteen proposals five projects were awarded.

SWOV will lead two of the five projects: RISMET (Road Infrastructure Safety Management Evaluation Tools) and ERASER (Evaluations to Realise a common Approach to Self-Explaining European Roads). RISMET, which started in October of this year, is among other things, involved in the development of road safety instruments which will make it easy to identify unsafe or possibly unsafe

locations in the road network. The countries that participate in RISMET besides the Netherlands are Germany, Portugal, Norway, the United Kingdom, and Austria. ERASER, which will begin early 2010, will focus on the development of practical guidelines for road authorities which are based on existing fundamental knowledge about self-explaining roads. In ERASER, the participating countries are the Netherlands, Germany, Austria, the United Kingdom and Sweden. Both projects have a duration of two years. ◆

For more information: www.eranetroad.org.

A Different Way of Paying for Road Use: positive effect on road safety

In November of this year, the Dutch Government decided to introduce a Dutch version of road pricing called 'A Different way of Paying for Road Use'. SWOV has investigated which road safety effects are to be expected of paying for the use of a car instead of paying for its ownership.

Mobility and road safety

The amount drivers are to pay per kilometre travelled according to the plans will be determined by different factors. In the first place the driver pays for vehicle use instead of vehicle ownership. Furthermore, the place and time of a journey will be a contributing factor in road pricing. For example, a journey during the rush hour on congestion-prone roads will be more expensive than a journey outside the rush hour on less busy roads. Another determining factor is formed by the environmental characteristics of a vehicle; clean cars pay less. 'A Different way of Paying for Road Use' is not only expected to lead to fewer vehicle kilometres, but also to these vehicle kilometres being travelled at different times and locations. In addition, the kilometres that are not travelled by car will be replaced by kilometres travelled with other transport modes. These types of changes in the extent and the type of mobility could have a road safety effect. Therefore SWOV carried out a study of the road safety effects of 'A Different way of Paying for Road Use'.

Variants

'A Different way of Paying for Road Use' makes the ownership of a car cheaper, but the actual use becomes more expensive as a consequence of the payment per kilometre driven. It is not yet clear how this will exactly be realized. Many different variants are possible and in each of these



variants the vehicle road tax will be abolished and replaced by a basic kilometre rate. This basic kilometre rate in its turn differentiates between fuel types and vehicle mass. All variants that were studied are expected to have a positive road safety effect due to a general reduction in vehicle kilometres. In 2020, the investigated variants of 'A Different way of Paying for Road Use' are expected to have resulted in a decrease in mobility of 6 to 10% and a decrease in the number of traffic fatalities of 4 to 7% as opposed to a situation without 'A Different way of Paying for Road Use'. In absolute numbers this is an annual saving of 20 to 40 fatalities. Our calculations show that the highest reduction can be achieved by using the 'A Different way of Paying for Road Use' variant in which the purchasing tax is abolished completely and is replaced by the highest kilometre rate.

Rush hour rate

In addition, the introduction of a so-called rush hour rate is a subject of discussion. A rush hour rate involves an added charge for kilometres travelled during the rush hour on congestion-prone roads. Also in this case different variants are possible. All these variants are expected to result in a small further reduction of mobility and a small reduction of traffic fatalities. Only the 'area charge' variant is expected to have greater effects. An area charge would be introduced during the rush hour around the major cities, irrespective of the traffic flow, and will be operational on both the main roads and the secondary road network. This variant will therefore have a greater mobility effect on the relatively dangerous secondary road network and in urban areas. In the densely populated

coastal region Randstad, where an area charge is most likely, this will probably result in an extra saving of approximately five traffic deaths per year.

Young novice drivers

At present, there are no reasons to expect that 'A Different way of Paying for Road Use' has specific negative mobility effects, and will therefore affect the safety of young drivers. Just like for older drivers, their vehicle ownership will increase slightly and their vehicle use will go down. The net effect on the number of vehicle kilometres is unknown, but consulted experts expect it to be limited. However, special attention for this issue will remain important when 'A Different way of Paying for Road Use' is introduced. In relation with the relatively high crash and fatality rates of young drivers, a small change in mobility may already have an important safety effect.

Conclusion

All in all, the SWOV study brings us to the conclusion that 'A Different way of Paying for Road Use' will have a positive road safety effect. Depending on the chosen variant SWOV expects 20 to 40 traffic fatalities to be saved annually. The maximum reduction could be achieved by using the variant in which the purchasing tax is abolished and an area charge during the rush hour is introduced for the Randstad region. ◀▶

More details can be found in SWOV report R-2009-2 'Road safety effects of the introduction of 'A Different way of Paying for Road Use'. The report is in Dutch, but it has an English summary. It can be consulted and downloaded on www.swov.nl.



Workshop on Scientific Research into Road Safety Management

In the area of road safety there is a growing interest in research on road safety management issues. The complex nature of this type of research combined with the observation that scientific journals pay limited attention to this type of research was reason for SWOV to take the initiative for an international workshop on Scientific Research into Road Safety Management.

The organization of the workshop, which was held on November 16 and 17, was in the hands of SWOV, supported by a Scientific Committee consisting of Richard Allsop, Shalom Hakkert and Andrew Hale, as well as SWOV researchers Marjan Hagenzieker and Paul Wesemann. The committee was chaired by SWOV's managing director Fred Wegman. The workshop was attended by approximately fifty road safety experts from around the world.

Need for research on policymaking

In recent decades, a growing interest in, and an increasing wealth of information coming from, road safety research, has become apparent. This research does indeed increase our knowledge and understanding and is certainly necessary. However, additional work is required to translate these findings into effective policymaking, but for several reasons this type of research is very complicated in nature. It is not easy to assess the safety impacts of policies using standard methodologies which also meet the requirements for sound scientific research. At the same time, we welcome positive interests from policy makers and designers of road safety programmes in so-called ex-ante and ex-post evaluation. One of the reasons behind the increasing interests is that a growing number of countries are using quantitative targets for policymaking, and as a consequence, have an explicit wish to monitor their progress over the years.

Presentations

The workshop centered around nine invited presentations which were based on written manuscripts. The relatively small number of 50 participants allowed for active interaction between all participants and ensured that high quality discussions could be held. The workshop consisted of three sessions which were divided over the two days.

Opening statements

Referring to the city of Haarlem's history, SWOV's managing director Fred Wegman opened the meeting at the Philharmonie in Haarlem.



Then Jean-Paul Repussard (Road Safety Unit, DG TREN) talked about the workshop from the European Community perspective. He pointed out that the EU-target for 2010 will probably not be met: a 50% reduction in fatalities in 2010 as compared to 2001. He was, however, confident that the presentations of this workshop would be of help to the European Commission's preparations for a new target to be set for 2020.

Next Tony Bliss (Global Road Safety Facility, World Bank) informed the audience of a recently released WHO report on road safety in developing countries, in which it is examined how experience in high income countries can be of use to low and middle income countries. He looked at road safety from a management perspective. Which type of road safety management produced the results in successful countries? We should not only focus on what works, but also on what makes it work (e.g. laws). He also held a plea for innovations like the Safe System Approach to achieve reductions of fatalities and serious injuries.

Session 1

The first session, which was chaired by Richard Allsop of University College London, focused on predicting road safety developments.

Jeremy Broughton presented work on monitoring national casualty trends in Great Britain since 2000, when new casualty reduction targets for 2010 were set. Preparations included forecasting the number of casualties that might be expected in 2010, conditional upon predictions about how the volume of road travel by the various transport modes might change and the type of new road safety measures that the Government might introduce.

Bruce Corben presented an elaborate new approach used in the State of Western Australia (WA) to support the development of its new strategy, 'Towards Zero', addressing the 12-year period from 2008 to 2020. The approach is

based on scientific insights and proven solutions. The 'Towards Zero' strategy is based on Australasia's Safe System vision, which was derived from the best elements of the Swedish Vision Zero and the Dutch Sustainable Safety vision. It explicitly involved a community consultation process aimed at acceptance by the community, the stakeholders and the government.

In the third presentation of this session Henk Stipdonk discussed how to estimate the expected number of casualties in a chosen future year. He presented the development of a new forecasting method using many disaggregations. It is conjectured that properly disaggregated forecasts will have smaller prognosis confidence intervals.

The recent diverging trends of the number of fatalities and the number of killed or seriously injured in several countries was discussed.

In his summary, Richard Allsop noted the acceptance of a three step approach: what will happen to crash rates; what will happen to mobility and how can policy affect this? He also singled out issues surrounding wide confidence intervals which should not worry decision makers by stating that there is always a best estimate whatever wide the range of uncertainty. Allsop concluded by paraphrasing the motto of the town of Haarlem "vicit vim virtus" into "statistical soundness overcomes brute-force number crunching".

Session 2

The second session was about evaluating road safety measures and programmes and was chaired by Shalom Hakkert of Technion, the Israel Institute of Technology.

In their presentation, Jean Chapelon and Sylvain Lasarre gave an insight into the old and new organisation of road safety management in France. The focus of the new organisation is on a science based policy. He also described the

extensive information system and the road safety data that are collected in his country. Interesting empirical findings mentioned in this presentation were the noticeable drop in fatalities in recent years as well as the apparent relation between urbanisation and road safety. The latter was derived from the departmental comparison of road risk. In particular the unique monthly updated road safety status drew attention.

The contribution that was presented by Peter Holló (and prepared in collaboration with Vojtech Eksler from CDV, Tszech Republic, and Joanna Zukowska from Gdansk University of Technology, Poland) focussed on the past development of road safety in central European countries. In Hungary, changes in speed limits did contribute to this development. In Poland, a drop in the number of fatalities was related to developments in the gross national product. This relationship was the topic of further discussions, in other sessions as well. It also stirred a further discussion on the need for collecting data on further (e.g. structural) indicators for use in road safety research.

In his presentation Tony Sze (prepared in collaboration with S.C. Wong from Hong Kong University) focussed on the effectiveness of road safety target setting itself and its longer term effects. To this end, target setting in a number of OECD countries was evaluated. The study is a follow-up of a previous study published a number of years ago.

In his summary, Shalom Hakkert noted the comprehensive monitoring system in France and the specific difficulties in central European countries,



and made the concluding remark that it is better to use a bottom-up approach to the setting of safety targets by first designing programmes and setting the targets afterwards. He also stressed that more indicators are needed for setting targets as well as monitoring purposes.

Session 3

The presentations in the third session, which was chaired by Andrew Hale of Delft University of Technology, were on more diverse topics.

Rune Elvik discussed the use of cost-benefit analysis of road safety measures as an element of an effective road safety management system. He argued that the belief in the incentives generated by cost-benefit analysis is unfounded and may not

work in improving road safety. He suggested to convert the benefits of improving road safety into real monetary gains by including them in a comprehensive road pricing system. In the discussion the question was raised whether policymakers would transfer their power to such a system. Ezra Hauer's presentation covered various methods of time series analysis and outlined an approach to choose one. His data driven approach was the source of some discussion, as it favoured a simple data driven approach over an approach based on road safety theory. Stefan Siegrist outlined an elaborate method for the ex-ante estimation of the potential of a road safety programme, which takes into account existing scientific research, an estimate of the degree of implementation that can be expected at a certain point in time, and the interaction between individual measures. It thoroughly considers the consequences of the effects of overlapping road safety measures, which is a problem in many studies. It also acknowledges the possible 'synergy' effects of different measures. The discussion suggested that this was a timely and important approach to the ex-ante evaluation of complete road safety programs, which is considered to be applicable in many countries.

In his summary, Andrew Hale compared the fields of road safety to his own field of occupational health, on passing, noting the differences in available data. He also made a plea for studies into the use of evaluation research by decisionmakers.

Continued on page 6

Workshop in brief

Session 1: Predicting road safety developments

Chair: Richard Allsop (University College London, UK)

Presentations:

- Jeremy Broughton & Jackie Knowles from TRL (UK): *British casualty reduction targets;*
- Bruce Corben, David Logan, Lisa Fanciulli, Iain Cameron & Roger Farley from Monash University (MUARC), Australia: *Towards Zero' 2008-2020;*
- Henk Stipdonk, Paul Wesemann & Ben Ale from SWOV/Delft University of Technology, Netherlands: *The expected number of road traffic casualties.*

The discussions on the presentations were opened by Sylvain Lassarre, INRETS, France, Deirdre O'Reilly, UK Department of Transport, UK and Vojtech Eksler, CDV, Czech Republic.

Session 2: Evaluating road safety measures and programmes

Chair: Shalom Hakkert (Technion - Israel Institute of Technology)

Presentations:

- Jean Chapelon & Sylvain Lassarre from ONISR/INRETS (France): *Road safety in France: the hard path towards science-based policy;*
- Péter Holló, Vojtech Eksler & Joanna Zukowska from Hungarian Institute for Transport Sciences (Hungary), CDV Transport Research Centre (Czech Republic), Gdansk University of Technology (Poland): *To which extent do Road Safety Performance indicators allow to explain road safety*

development: A critical view based on the experience of Central European Countries;

- S.C. Wong & N.N. Sze (University of Hong Kong/TU Delft): *Is the effect of quantified road safety targets sustainable?*

The discussions on the presentations were opened by Geert Wets, University of Hasselt, Belgium, Klaus Machata, KfV, Austria and Rune Elvik, TØI, Norway.

Session 3: General methodological issues

Chair: Andrew Hale (Technical University Delft, NL)

Presentations:

- Rune Elvik from TØI Institute of Transport Economics (Norway): *The mistaken belief in the incentives generated by cost-benefit analysis;*
- Ezra Hauer from University of Toronto (Canada): *On prediction in road safety;*
- Stefan Siegrist from Swiss Council for Injury Prevention BFU (Switzerland): *Towards a method to forecast the effectiveness of national safety programmes.*

The discussions on the presentations were opened by Paul Wesemann, SWOV, the Netherlands, Joanna Zukowska, Gdansk University of Technology, Poland and Marjan Hagenzieker, SWOV, the Netherlands.

The IRTAD Conference: the importance of data for road safety improvement

On 16-17 September 2009, 120 leading safety experts from 33 countries attended the 4th IRTAD (International Road Traffic and Accident Database) Conference in Seoul to discuss key issues and challenges regarding safety data collection and analysis as an essential tool to improve road safety.

More than 1.2 million people die on the world's roads every year. Road crashes impose significant economic costs in all our countries (of the order of 2% of the Gross Domestic Product). Recognising the need for action, Ministers of Transport who cooperate in the International Transport Forum (ITF) have set targets for reducing road casualties and Ministers from ESCAP (Nations Economic and Social Commission for Asia and the Pacific) countries met in 2006 to define a number of specific goals to improve the state of road safety in the region. Turning these initiatives into effective policies first requires the collection and analysis of good quality road safety data, including crash, exposure and performance data. This in turn requires cooperation between all key stakeholders (including police, transport, health, regional authorities).

Essential elements

Reliable crash and exposure data are essential elements to assessing the nature and magnitude of road safety problems and to designing and implementing effective policies. Targets for reducing deaths and injuries will be more credible if based on sound data; this is the basis for monitoring road safety programme effectiveness. SWOV's contribution, which was delivered by Niels Bos, focused on the importance of a reliable registration of traffic injuries by making use of the



Maximum Abbreviated Injury Score (MAIS). MAIS is also discussed in the article *Real numbers of traffic injuries more accurate with MAIS* elsewhere in this issue of Research Activities.

Subjects

The conference enabled participants to highlight and discuss common issues related to safety data collection, reporting and analysis. Even in countries with good data systems, there is room for improvement. International co-operation is an important step for identifying best practices and ways forward.

Discussions focused on four critical areas:

- *Investment in effective data collection systems:* while many countries have national road safety strategies that include goals and targets and some countries have established effective systems for road safety data collection and analysis, many countries still need to improve their data collection and reporting systems, particularly for monitoring and evaluating progress towards the targets set.
- *Failure to share and publish safety data* hinders research and serious analysis of safety policies. Many local, regional and national level agencies

collect safety data. However, a number of countries lack a systematic institutional framework to share data and information.

- *Underreporting of road crashes* is a persisting problem in all countries. It is an acknowledged problem even in the world's best performing countries, which biases information published on the consequences of road crashes, and needs to be accounted for in decisions on road safety policies.
- *Harmonised definitions* need to be used systematically in all countries. Road crash fatalities are widely defined on the basis of death within 30 days. However, this definition is not used in all countries, which makes international comparisons difficult. Absence of internationally agreed definitions also impedes effective use of data on injuries and crashes involving injury. ◀▶

Moscow

Road safety data and how to collect was also a topic for discussion during the first Global Ministerial Conference on Road Safety hosted by the Russian Government and the United Nations on 19-20 November 2009 in Moscow.

Fred Wegman

SWOV's managing director and Chairman of IRTAD group of safety data experts at the conference:

"Quantitative, ambitious but realistic targets, as well as top level political commitment, are essential to improve safety", said Wegman. He continued, "The essential first step is to develop good quality data reporting and analysis systems. Data helps understand the problem, motivates the public and politicians and is the only way of monitoring progress".

Workshop on Scientific Research into Road Safety Management

Continuing from page 5

Conclusion

In his concluding speech, SWOV's managing director Fred Wegman concluded that although the workshop did not lead to a "Haarlem statement", it might result in a best (or good) practice. He distinguished three types of contributions: Presentations which were oriented towards decision makers: the contributions of Siegrist, Corben and Broughton can be put in this category, and are aimed at providing answers, rather than posing questions. Ex-ante evaluations should take account of business as usual, improvements on that and introduce new measures. A clear cut

method to do this still has to be developed. A special topic is the application of research findings from other times and places (summarized in meta-analyses like the ones in the Handbook of Elvik and Vaa) in new situations. Presentations about the evaluation of our research activities: monitoring, targetsetting, defining safety performance indicators and structural factors. Are we really good at understanding what happened in the past? What do we really know about the implementation of policies? The presentations by Holló, Chapelon and Sze are examples of this type. Stipdonk, Elvik and Hauer held 'work in progress' presentations. Wegman thanked the speakers for

their willingness to talk about these exploratory topics even though they generated the majority of discussion. "We are extremely happy to have these contributions, because these are very helpful in finding new ways of thinking about research on road safety management".

Safety Science

Based on the presentations and the workshop, a special issue of the scientific journal *Safety Science* is being prepared. In addition to the nine invited papers based on the presentations at the workshop, another six invited papers are scheduled to appear in this special issue. ◀▶

Real numbers of traffic injuries more accurate with MAIS

When the international measure for injury severity, the MAIS, is used, the annual number of seriously injured road users in the Netherlands can more easily be determined than can be done until now. This is one of the conclusions of a SWOV study of seriously injured road crash casualties in the period 1993-2008.

The Dutch road safety target is expressed in both the number of fatalities and the number of injured: a maximum of 500 traffic fatalities and 12,250 injured in 2020. 'Injured' here means 'seriously injured road crash casualties'. So far the casualties in this group were considered to be in-patients: those road crash casualties who spent at least one night in hospital. However, research showed that 'admitted to hospital' is not necessarily the same as 'seriously injured'. For example, casualties who are not seriously injured are sometimes admitted to hospital for observation. According to the old definition these casualties are indeed in-patients, although they did not sustain serious injury. In recent years this group has been growing in size. This made it necessary to use a new definition of seriously injured.

MAIS 2+

The international measure Maximum Abbreviated Injury Score (MAIS) indicates a casualty's injury severity. We can use this measure to determine when a casualty is seriously injured. In 2008, the Dutch Minister of Transport announced in a letter to Parliament that all in-patients with a minimum MAIS of 2 were to be considered seriously injured. This definition includes injuries like concussion, fractures and more serious injuries. To visualize the develop-

ment of the number of seriously injured, SWOV has made a time series for the period 1993-2008.

Linkage

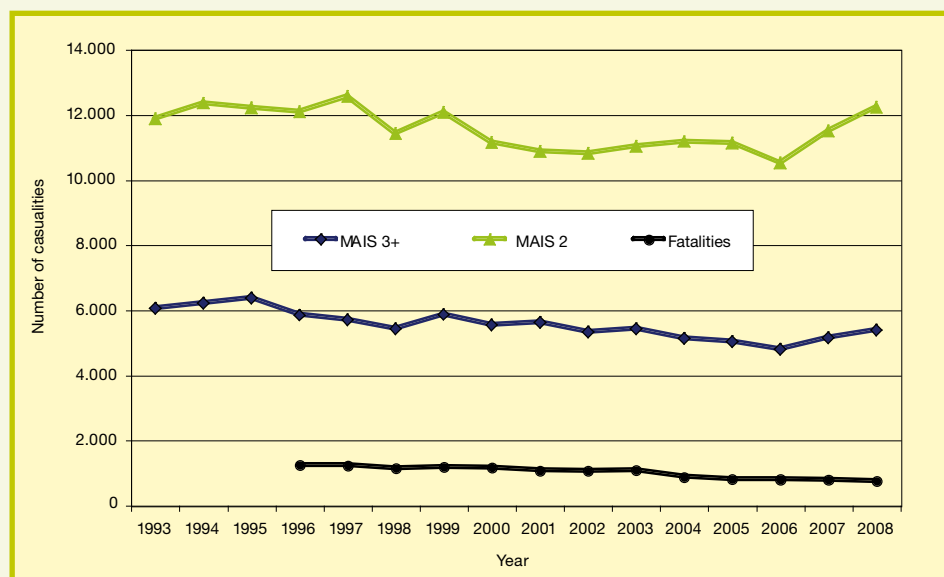
To make a time series, two data files were linked: the BRON data file which contains registered crashes in the Netherlands and the national medical registration LMR. BRON is used for the police registration of road crashes in the Netherlands and their consequences. LMR is used for the registration of in-patients in Dutch hospitals. For the period 1993-2005, LMR is fairly constant with a registration of about 83%. The missing 17% are casualties which have not been correctly registered in LMR, which fails to make them recognizable as traffic casualties. The registration level in BRON of casualties with a minimum MAIS of 2 is considerably lower: for casualties in crashes between motorized vehicles this has been declining from 73% in 1993 to 59% in 2008. For casualties in crashes between non-motorized vehicles the registration level is much lower: it has been declining from 8.5% in 1993 to 4% in 2008.

The linkage of BRON and LMR involves that both files are searched for records which relate to the same casualty and the same crash. Based on the links that are found, the matching records in other words, an estimate can be made of the real number of seriously injured.

Novel approach

A linkage between BRON and LMR was previously used in the Netherlands to determine the number of seriously injured, but for the new definition the procedure had to be adapted. Fur-

Continued on page 8



The real number of MAIS 3+- and MAIS 2 casualties for the period 1993-2008. MAIS 3 is a subset of MAIS 2+ with even more serious injury.

Colophon

Research Activities is published three times a year by SWOV, Institute for Road Safety Research in the Netherlands. Research Activities contains articles about road safety research and scientific projects carried out by SWOV and by others.

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The SWOV website contains a wealth of information about a variety of road safety topics. SWOV fact sheets are all available in English. The library has extensive possibilities to search for international road safety literature and publications.

Real numbers of traffic injuries more accurate with MAIS

Continuing from page 7

Furthermore, the calculation was made for a relatively long period (1993-2008), to make it possible to study the casualties with MAIS 2+ over a longer period of time. The new linking and estimation method differs from estimation methods that were used previously on two points. In the first place, larger LMR and BRON files were used than the ones used for earlier linkages. The new linking procedure has shown to be reliable. A validation linkage between an LMR and a BRON file of different years demonstrated that the linking procedure almost never incorrectly matches two records that do not belong together. In the

second place, the method that is used after the linkage to determine the real numbers has been adapted. This new procedure yielded a reliable time series of the real number of seriously injured for the period 1993-2008 (see *Figure*).

Increasing number of seriously injured

The time series shows a decreasing trend of 17,900 seriously injured in 1993 to 15,300 in 2006. The two following years, however, their number increased to 17,600 in 2008. This means that the development of the real number of seriously injured deviates in a negative way from the development of the number of road deaths. The number of road deaths not only shows a steeper

decline than the number of seriously injured, but it has also continued its decline during recent years. Further research is necessary to shed light on the factors that may offer an explanation for the unexpected negative development of the number of seriously injured, especially during recent years. SWOV recommends first carrying out this research before setting the target for the seriously injured for the year 2020. ◀▶

SWOV report R-2009-12 'Seriously injured road crash casualties in the Netherlands in the period 1993-2008; The real number of in-patients with a minimum MAIS of 2' can be found on www.swov.nl under Publications.

Publications

Below is a selection of reports that have recently been published by SWOV. Most SWOV reports are written in Dutch, but they all include an English summary. Reports that were published in or after the year 2000 can be found on our website (www.swov.nl) and may be downloaded free of charge. Fact sheets are also placed on our website under Research.

Road safety effects of the introduction of A Different Way of Paying for Road Use

G. Schermers & M. Reurings. R-2009-2. 82 + 79 pp. € 25.- (Dutch).

The study presented in this report was aimed at determining the effects of A Different Way of Paying for Road Use on road safety. A Different Way of Paying for Road Use is a Dutch version of 'road pricing'. First, as a basis, an estimate was made of the autonomous road safety development, which is the continuation of the present developments without the effects caused by the introduction of A Different Way of Paying for Road Use. In this study road safety is expressed in the number of road crash fatalities and in-patients. It must however be noted that the in-patients as a result of crashes in which no motor vehicle was involved were not taken into account.

Road safety effects of Anti-Crash Systems; Estimation of the effects on crashes on motorways involving lorries

R.G. Eenink. R-2009-11. 30 pp. € 8.75 (Dutch). A number of anti-crash systems for lorries were tested in a large scale operational test. This was done with the purpose of finding out which contribution these in-vehicle systems can make towards the prevention of (serious) injury and the traffic jams and lost vehicle hours which are the consequence. This report limits itself to the pre-

vention of crashes on Dutch motorways involving lorries. Based on the results of the operational test, a crash analysis, and research literature this report gives an estimation of the road safety effects of anti-crash systems in terms of road deaths and in-patients saved.

Seriously injured road crash casualties in the Netherlands in the period 1993-2008; The real number of in-patients with a minimum MAIS of 2

M. Reurings & N. Bos. R-2009-12. 64 + 61 pp. € 20.- (Dutch).

In the Netherlands a 'seriously injured road traffic casualty' has until recently been the same as an in-patient, a casualty who has been admitted to hospital for at least one night. However, SWOV research indicated that in-patients are not always seriously injured. The Dutch Minister of Transport has therefore decided to only use those casualties who are indeed seriously injured in road safety assessments; those casualties with a minimum Maximum Abbreviated Injury Score (MAIS) of 2. This report gives the real numbers of seriously injured for the years 1993-2008 according to this definition. It also describes how the new method is used to estimate the real numbers of seriously injured.

Ten years of Sustainable Safety; Road safety assessment 1998-2007

W. Weijermars & I. van Schagen (ed.). R-2009-14. 158 + 15 pp. € 25.- (Dutch).

In the early 1990s, the road safety vision Sustainable Safety was introduced. After the covenant Start-up Programme Sustainable Safety had been signed in 1998, the actual implementation of Sus-

tainable Safety began. This road safety assessment discusses the present situation concerning the implementation of measures that have been taken within Sustainable Safety or are in line with the vision and looks at their safety effects during the past ten years.

Road safety monitor 2009; Analysis of crashes, mobility, behaviour and policy in 2008

W. Weijermars, Ch. Goldenbeld & N. Bos. R-2009-15. 64 + 15 pp. € 12.50 (Dutch).

Every year, SWOV carries out a study of recent road safety developments. This report describes the developments in 2008 for the numbers of traffic fatalities and in-patients for different groups of road users, modes of transport, conflict types and locations, and for combinations of these indicators. In addition, the report looks at the fatality rate and casualty rate in comparison with the previous year. Finally, the report also discusses the road safety improvement measures that were taken in 2008.

Factsheets

New

- Post-licence training for novice drivers
- Dutch road safety in international perspective

Updated

- The Road Safety Audit and Road Safety Inspection
- Cyclists
- Pedestrians
- Vehicle regulation