SWOV
INSTITUTE FOR ROAD SAFETY RESEARCH

RESEARCH ACTIVITIES

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Contents:

Editorial

Attention in this issue for some of the Dutch innovations concerning traffic safety: the admission of the Segway on the Dutch roads and the introduction of hazard perception as part of the driving exam. Also, the changes in the ERSO-website are presented.

Considerable drop in number of blackspots

The number of traffic blackspots in the Netherlands has decreased considerably during the last decades. The number of casualties at those locations also showed a strong decline. Therefore, a blackspot approach can no longer be expected to make a large contribution to a further reduction of the number of road deaths in the Netherlands.

In the period 1987-1989, the Netherlands had 1.909 blackspots. In the period 2004-2006 (only) 427 remained: a 78% drop. Twenty years ago, the numbers of fatalities and in-patients on the blackspots were 397 and 4,367 respectively, whereas these numbers were 29 and 514 in the most recent period: decreases of 93 and 89%. A blackspot is defined here as a location with a minimum of six injury crashes in three years time.

Blackspot approach

The blackspot approach is appealing, because it tackles unsafety there where it is most conspicuous: at those locations which have the highest number of crashes. It became popular in the late 1970s. The Dutch central government saw to the publication of a manual and took care of training programmes for road authorities and consultancies. Above all, it financed both the blackspot analysis and the measures that followed. From 1992 not only specific locations, but also routes, areas en 'specific crashes' (not linked to a specific location) could become a blackspot and be treated as such.

Blackspot approach effective and cost-effective

Many studies have investigated the effective-

"Consistency is the key when teaching children any new skill or lesson, especially something as important as road safety"

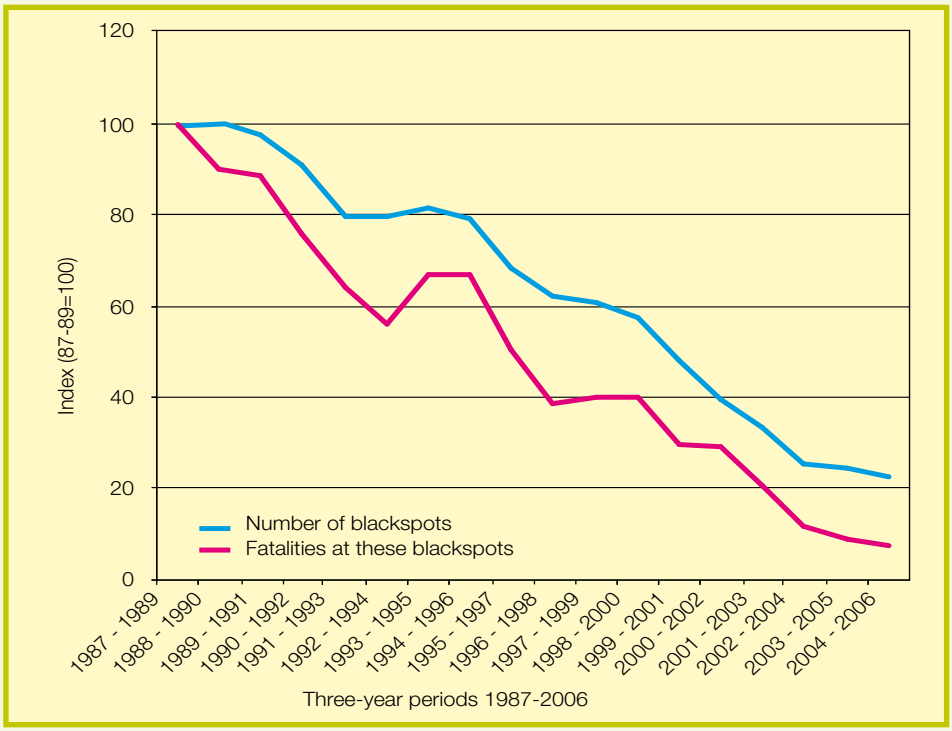
Ruth Coppard, child psychologist

QUOTE

ness of the blackspot approach. The results always show a reduction in the number of (injury) crashes, but the size of the effect differs widely between studies. The largest effects were found in studies that took no account of, for example, changes in traffic flow, general road safety developments, the number of crashes on the surrounding road network, or accidental fluctuations in the number of crashes. But the blackspot approach was also found effective if all these factors were taken into account and the estimation of the effect was as accurate as possible. According to a meta-analysis by the Norwegian researcher Elvik, the average decrease of the number of crashes at treated black spots still was 18%. The blackspot approach therefore has more benefits than costs from a economic point of view.

Little safety benefit left

In the Netherlands, however, the number of blackspots and casualties has decreased considerably during the past twenty years (see Figure). In the period 2004-2006, locations that could be labelled a blackspot were responsible for 10 road deaths per year. If all these blackspots were eliminated, this would save a maximum annual number of 10 road deaths. For an approach with an 18% effect, this is approximately two road deaths per year. Therefore we must conclude that in the Netherlands in 2007 the blackspot approach can no longer make a substantial contribution to the reduction of the number of road deaths.



Decrease of the number of blackspots and their fatalities

A system-focused, proactive approach

Increasingly, severe crashes happen at other locations than blackspots. Crashes on those locations can also be tackled, but a system-focused, proactive approach offers better possibilities than the blackspot approach. An example of such a proactive approach is Sustainable Safety. By tailoring, the road and the vehicle to the physical, perceptual and cognitive limitations of the human being in advance, and by using training and education to prepare the road user to his task in traffic, the sustainable-safety principles aim to develop an inherently safe road traffic system. On grounds of (cost-)effectiveness, the blackspot approach can incidentally still be legitimized. In those cases, the measures to tackle these blackspots must explicitly be targeted at the problems which were brought to the surface by analyzing the crashes that occurred there.

The fact sheet 'The blackspot approach' can be consulted and downloaded at www.swov.nl under Research, Fact sheets, Crash.

State Space Time Series Analysis: quantitative analysis and modelling of developments in road safety

Jacques Commandeur, senior researcher at SWOV, and Siem Jan Koopman, professor of econometrics at the VU University Amsterdam, are the authors of a book entitled *An Introduction to State Space Time Series Analysis*. In July 2007, the book was published by Oxford University Press in a series designed to make the latest econometric techniques accessible to practitioners, academics and students.

An important issue in road 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). 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 handle these issues properly may easily lead to incorrect conclusions from the monitoring, explanation, and forecasting of developments in road traffic safety. Time series analysis using state space methodology is a method well-suited for such analyses.

Practical and accessible introduction

An Introduction to State Space Time Series Analysis gives a step by step approach to time series analysis using state space methodology for readers who are neither familiar with time series analysis, nor with state space methods. The book gives a practical introduction to state space methods as applied to unobserved components time series models, also known as structural time series models. Practical problems such as forecasting and missing values are discussed in some detail. The background required in order to understand the material presented in the book is a basic knowledge of classical linear regression models. Yet, a brief review is provided to refresh the reader's knowledge. Most of the examples presented in the book concern road safety data, but examples from the world of e.g. finance are also used.

'An Introduction to State Space Time Series Analysis' (ISBN 978-0-19-922887-4) by Jacques J.F. Commandeur and Siem Jan Koopman is published by Oxford University Press (www.oup.com).

Bicycle path rather than pavement for Segway

If the Segway were admitted to public roads, for safety reasons it should use the bicycle path rather than pedestrian areas or the pavement. In that case both vehicle and rider must meet certain legal requirements. This is what SWOV concludes on the basis of a study it made of the consequences that are to be expected if the Segway were allowed on Dutch public roads.

Currently, in the Netherlands, the Segway is legally not allowed on the carriageways of public roads, including pedestrian areas and the pavement. The reason is that the Segway is not a 'type-approved' vehicle. Until recently, the Dutch police have tolerated the Segway on the public road, but early 2007 they decided to enforce more actively. Questions from the Dutch Parliament urged the Minister of Transport to take a clear stand. In preparation of a discussion with the Parliamentary Transport Commission about the position of the Segway in the traffic system, the Minister commissioned SWOV to evaluate the likely safety consequences.

Electric two-wheeler

The Segway is an electronically driven, self-balancing vehicle with two parallel wheels. Users lean forward to make the Segway go forward, they lean back to make it go backward. Steering is done by leaning the handlebar left or right. Hanging backwards switches from forward drive to reverse, and causes the vehicle to brake. The latest model, the i2, has two speed modes: the slow mode with a maximum speed of 6 km/h and the fast mode with a maximum speed of 20 km/h.

Current regulations

The EU regulations allow the Segway in pedestrian areas. On the other hand, the Vienna Convention only allows vehicles for the disabled in pedestrian areas. Many EU countries, including the Netherlands, do currently not allow the Segway on public roads, since it lacks the required type approval. In the Netherlands, if the Segway were technically limited to a maximum speed of 6 km/h, or if it were categorised as a vehicle for the disabled, a 'type approval' would not be required. In that case, the Segway could make use of the public road. Other EU countries have made special arrangements for allowing the Segway on public roads.

Practical test: Segway riding not more difficult

One of the elements of the SWOV study was a riding test under controlled conditions. This showed that test riders manoeuvred the Segway equally well and had the same reaction time to unexpected events as in a three wheeled mobility scooter for the disabled or on a bicycle. The three wheeled mobility scooter was used as a comparison for the Segway on the pavement (with a maximum speed of 6 km/h) and the bicycle was used as a comparison for the bicycle path (maximum speed 20 km/h). Riding the Segway required no extra mental effort as compared to riding a bicycle or a mobility scooter.

Segway on the pavement: more casualties among collision partners

The safety impacts of the Segway introduction have been estimated by once more using the three wheeled mobility scooter and the bicycle as a reference. In crashes involving these vehicles, approximately 90% of the casualties are among the riders themselves, and 10% are among the collision partners. If the Segway were to be allowed on the pavement, we expect an increase in the number of casualties among the collision partners, also when the maximum speed is set at 6 km/h. The reason for this is that the Segway rider is expected to be younger than the rider of a three wheeled mobility scooter and will have a hastier riding style. At higher speeds than 6 km/h, and this will often be the case in practise, more casualties are to be expected.

Segway on bicycle path and road: hardly any safety effect

Since the Netherlands has an extensive bicycle path network, it would also be an option to allow the Segway on the bicycle path, and, if no bicycle path is available, on the carriageway. The maximum speed of the Segway would then be 20 km/h, comparable to the speed of a bicycle. In this scenario, we do not expect the Segway rider to run a higher risk than a cyclist. Although the Segway is heavier than the bicycle, its centre of gravity is very low. A possible crash with a bicycle will therefore probably have limited consequences for the collision partner. However, the larger mass of a Segway will cause more material damage in an incident than a bicycle.

Legal requirements for vehicle and rider

If the Segway were allowed on bicycle path and road, a number of legal requirements for vehicle and rider would be necessary to ensure an acceptable safety level. SWOV recommends a compulsory basic training and a minimum age of, for instance, 16 or 18. SWOV is of the opinion that the Segway rider can best be qualified as a 'rider' rather than as a pedestrian because of the priority rules that will then be valid. Furthermore, SWOV recommends fitting the vehicle with a bell, lights, and reflectors, and to make third-party liability insurance compulsory. Like for cyclists, wearing a helmet would reduce head injuries in case of a collision. However, in the Netherlands, helmets are not compulsory for cyclists and there is no specific reason to make them compulsory for Segway riders and not for cyclists.

Segway not as vehicle for the disabled

The Segway is also suitable for people who are physically unable to walk far, but have no motor or equilibrium problems. One specific question of

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the Minister was what the safety consequences would be if the Segway would just be allowed as a vehicle for the disabled. Vehicles for disabled people do not require type-approval. SWOV concludes that, when using the Segway, the disabled are expected to have the same risk as able-bodied people, and, hence, will have a higher risk on the pavement as well. If the Segway were classified as a vehicle for disabled people, it automatically would also be allowed on the pavement. That is why SWOV recommends not allowing the Segway into the category 'vehicle for disabled'. In addition, making a distinction between Segways for the disabled that are allowed to use the pavement and other Segways that are not, requires strict enforcement. It is very questionable if that could be realised in practice.

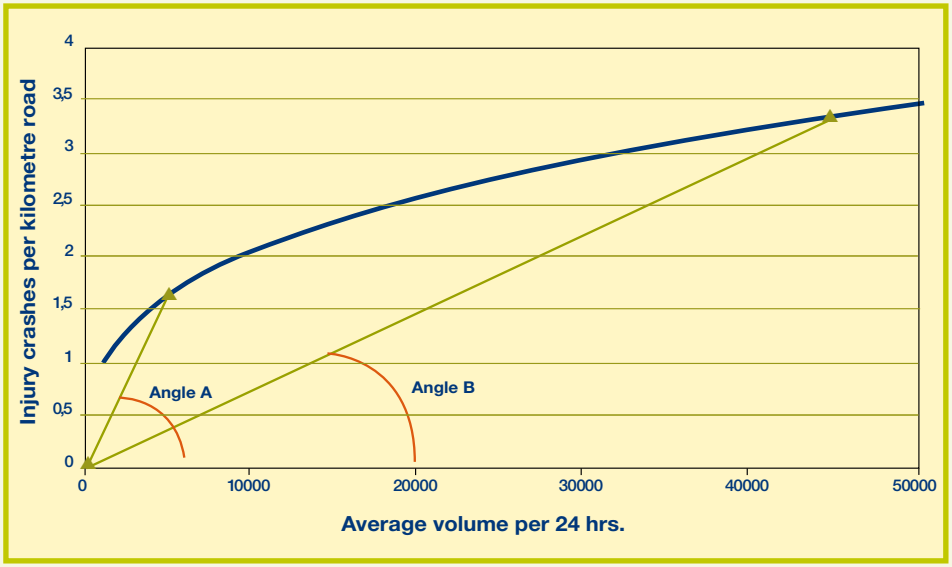
The Minister's position

Recently, the Dutch Minister of Transport Camiel Eurlings communicated his position in consultation with parliament. In line with the SWOV recommendations, the Minister intends to allow the Segway on bicycle paths and carriageway. Contrary to the SWOV recommendations, Eurlings intends to also allow the Segway as a vehicle for the disabled. In that case the Segway can be used on the pavement. In determining the final conditions the minister wants to consult with his European colleagues and take the directives of the European Commission into account.

The report 'Road safety consequences of allowing the Segway on public roads' (R-2007-6) is available on www.swov.nl under Research, Publications. The report is in Dutch, but has an English summary.

More traffic, lower crash rate

The increase of the number of crashes per kilometre road length diminishes with increasing traffic volume. This means that a larger traffic volume results in a lower crash rate. This is one of the findings from calculations with new accident prediction models. Accident prediction models are mathematical descriptions of the relationship between, for instance, crashes and traffic volumes for specific road types.



Injury crashes per kilometre road length plotted against the average traffic volume for carriageways per 24-hour period. Angle A indicates a small traffic volume and angle B with a large volume. Angle B is smaller than angle A, which means that the crash rate is lower for the large volume than it is for the small volume.

Most accident prediction models use the length and traffic volume of a road stretch to express the number of injury crashes on that road stretch. Traffic volume is defined here as the number of vehicles per 24-hour period. In addition, models can be made for various road features, like the number of lanes, the lane width, or the presence of entries/exits. These types of road layout features are also known to affect road safety. SWOV researchers developed separate models for different road types and some of their layout aspects.

Separation of driving directions

The generalized linear modelling method was used to develop the accident prediction models. As input, SWOV used data files from three Dutch regions.
These data files made it possible to distinguish between single and dual carriageway roads. The difference between these two road types is the separation of driving directions; in the case of dual carriageways, the driving direction is physically separated, in single carriageway roads it is not. As frontal crashes between cars from opposite directions are almost impossible on dual carriageways, this distinction will influence the number of crashes. Indeed, dual carriageways were found to have a lower crash rate (crashes per kilometre driven) than single carriageways.

Volume and crashes

An increase in traffic volume causes an increase in the number of encounters between road users. It seems a matter of course that this also has more crashes as a result. After all, there are more road users who are exposed to risk and will be involved in a crash.

However, the increase in the number of crashes per kilometre road length (crash density) was shown to be smaller with increasing traffic volume. This implies that the number of crashes per kilometre driven (the crash rate) goes down when the traffic volume increases. In addition, SWOV data showed a decrease of crash density when the traffic volume exceeds the number of 20,000 motor vehicles per 24-hour-period. A possible explanation may be that roads that have to cope with much traffic have also been given a better (safer) layout.

Usage by road authorities

Road authorities can use accident prediction models in two different ways. In the first place they can compare the number of crashes on a certain road with the number predicted by the accident prediction model, and then look for explanations for the safety on that road segment, or the lack of it. The other possibility is to use the results from the accident prediction models for decision-making about safety improvements for roads, for example to decide on separation of driving directions.

SWOV report 'The relation between traffic volume and number of crashes for various road types; An overview of traffic models ', R-2006-22, can be consulted on www.swov.nl under Research, Publications.

Hazard perception test
new in Dutch driving exam

Commissioned by the Dutch Ministry of Transport, Public Works and Water Management, the Dutch Driving Test Organisation (CBR) will introduce a renewed driving exam in early 2008. In both the theoretical and the practical part of the exam, there will be more emphasis on traffic understanding. One of the new topics is hazard perception.

In the period 2007-2010, SWOV will study to what extent hazard perception can be measured and trained. The study will be carried out in cooperation with CBR. In the short term, part of the study will yield information that can be used by CBR for the renewed driving exam. In addition the study is part of the PhD study of SWOV researcher Willem Vlakveld. He is expected to complete his thesis in 2010.

A situation used in the prototype of the newly to be developed hazard perception test. For each photo the candidate must answer the following question: "What do you do in this situation? Do you brake, release the throttle or maintain the same speed?"

Inexperienced drivers weak in hazard perception

Immediately after having passed the driving exam, young inexperienced drivers have a four times higher crash rate than experienced drivers in the age group 30-60. Gaining experience causes the crash rate to go down. Poor hazard perception probably contributes to the high crash rate in the early part of the driving career. Indeed, most studies show that older, more experienced drivers do better at a hazard perception test than young, inexperienced drivers. That is why hazard perception has already been made part of the driver training and driving exam in Great Britain and Australia.

Various skills required for hazard perception

Broadly speaking, hazard perception is timely recognition of possibly hazardous traffic situations. But that is not all. For example, road users must also know how to avert the danger in time. According to the British professor Groeger four skills are important for hazard perception:

1) Hazard detection: early perception of (potential) danger;
2) Threat appraisal: correct estimate of the severity of danger;
3) Action selection: choosing actions to avert the danger; and
4) Implementation: performing the chosen actions.

Can hazard perception be tested?

When hazard perception is incorporated in the driving exam, there must be a test that can measure these skills. Using experiences in other countries and a literature study as a basis (see box), SWOV has developed two prototypes of a test that could be used in the new theoretical exam. One test uses photos, the other uses animated films. Several times during each animated film the candidate has to indicate what he wants to pay specific attention to. This can for example be a traffic sign with relevant information, a pedestrian who may cross the road, or a side street from which a car could emerge. In the photo test the candidate has to say what he would do in the given situation: continue at the same (indicated) speed, release the accelerator, or brake. CBR has worked out both prototypes into complete tests, and SWOV is now investigating their reliability.

Can hazard perception be trained?

Of course, we want to be able to train hazard perception, so that young inexperienced drivers do not need to learn this skill in traffic by trial and error. Here also we have looked at the results of international research. Both classroom training and individual study with the help of a computer programme were shown to have a positive effect on hazard perception in other, similar situations. SWOV hopes to have completed its own study of trainability and the best approach early in 2008.

The fact sheet 'Hazard perception' is available on www.swov.nl under Research, Fact sheets, Hazard.

Measuring hazard perception

Many methods have been devised to measure the hazard perception skills of drivers. The methods can be divided into four groups:

- *Testing reaction time.* An example is a series video fragments which are made from the driver's viewpoint. Candidates have to press a button when they find the situation is becoming dangerous. The time between the first indications of approaching danger and pressing the button is measured;
- *Testing Searching Strategies*. This can for instance be measured by registering eye movement (is visual attention consciously focused at dangers?) in instrumented vehicles or in driving simulators. A simpler way of testing is by showing photographs. On the photographs, candidates must point to what they see as a hazard and sometimes they have to say why they think it is hazardous;
- *Testing Behaviour Choice.* This tests if the driver knows what must be done to avert the hazard. For example, a video fragment (from the driver's eye position) can be shown. The picture is then stopped at certain moments and candidates have to indicate what they would do, e.g. brake;
- *Testing Situation Awareness*. This means that one knows what is happening around him at all times. The tests are similar to the reaction time tests, but here the screen goes blank and the candidate has to describe the traffic situation he/she has just seen. Those with good situation awareness not only describe accurately what they have seen, but also focus on those elements that are important for road safety.

No mixing of longer heavier goods vehicles and vulnerable road users

As a pilot, the Dutch government has decided to allow longer heavier goods vehicles (LHVs) on the secondary road network in the Netherlands from 1 November 2007. SWOV is not in favour of allowing LHVs access to other roads than those in the main network, because it will result in further mixing with vulnerable road users. This is in conflict with the Sustainable Safety principles.

The present economic growth causes an increase in freight transport. Previously it had already been decided to allow LHVs with a maximum length of 25.25 m. and a maximum weight of 50 tons on the Dutch main road network. Allowing access to LHVs reduces the number of lorries, which reduces vehicle emissions, according to Eurlings, the Dutch Minister of Transport. Road safety on the main network is likely to benefit as well from less lorries.

However, SWOV expects the decision to admit LHVs to secondary roads may have the opposite effect, and indeed damage road safety on those roads. The reason is that LHVs could also be allowed to use secondary roads without separate facilities for vulnerable road users. In the Netherlands, in particular cyclists, and not in the least cycling school children, are common users of this type of roads.

According to the Sustainable Safety vision, the mixing of heavy traffic with vulnerable road users must be avoided at all time. One way to realise that would be to locate industrial areas, terminals, et cetera, in the immediate vicinity of the main road network. Further distribution of goods would then be taken care of by small freight vehicles that are attuned to secondary road and urban traffic situations. A decision to allow LHVs to use secondary roads would not exactly stimulate municipalities or companies to do so.

In the current SWOV research programme a feasibility study is foreseen into the consequences of a more structural way to separate heavy vehicles from other traffic, and from vulnerable road users in particular. One of the issues to be considered are designated lanes for heavy good vehicles on main roads. Another is to find the safest balance between more light freigth vehicles and fewer, but heavier HGVs on secondary roads and in urban areas. Clearly, this study will need to look into all different aspects: economic interest, accessibility, environment, and safety.

We also expect that this type of issue will be dealt with by the recently installed expert group on Heavy Goods Vehicles of the Joint OECD/ECMT Transport Research Centre (http://www.cemt.org/jtrc/).

SWOV in seminar programme Intertraffic 2008

Intertraffic Amsterdam 2008, the exhibition for infrastructure, traffic management, safety and parking, will take place in the Amsterdam RAI in the Netherlands from 1 to 4 April 2008.

In 2006, Intertraffic Amsterdam had 690 exhibitors and attracted 23,890 visitors from 110 countries, which makes it the largest exhibition in its field. Intertraffic Amsterdam is aimed at policymakers, decision makers, and professionals who are employed within governments, consultancy and advice, and within companies.
On 2 and 3 April the ITS conference will be held with “Multi-Modal Mobility & The Passenger Experience” as its central theme. SWOV will contribute to this seminar programme.

Furthermore, at the ITS/IPTS Plaza, companies will present intelligent products and services for the traffic and public transport sector.
Like in previous years, the Intertraffic Innovation Award for the most innovative product at the exhibition will also be presented at this 19th Intertraffic. SWOV's managing director Fred Wegman is one of the members of the jury.

For more information go to www.intertraffic.com.

Large scale evaluation of the ERSO website: the results

Within SafetyNet, the ERSO information website was created as a window to SafetyNet results and to form the basis for a European Road Safety Observatory (ERSO). The ERSO website is intended to make relevant road safety information available for policy makers and other road safety professionals in Europe.
Users were involved in the early stages of the website's development, and in 2006 the initial structure and content of the website were completed and made accessible.

Because it is unknown whether present and potential users are content with its current navigational structure and whether users find the posted information relevant to their search, user group testing was considered necessary. In the period January - June 2007 a test was conducted to investigate whether the 2007 version of the website was in line with the users' needs.Three different test methods were used:

- A heuristic evaluation which assessed the website's quality on the basis of expert analyses of its layout, organisation and content;
- An online questionnaire which asked questions about opinions, and experiences, but also set small tasks (scenarios) to assess whether information was easy to find and to understand;
- User feedback: an onsite observation of the use of the website.

Results

The website was positively received by large groups of users. Almost all users commented on the general pleasing graphics of the website and the use for such a website in the world of road safety. However, the testing also brought to light some weaker points of the ERSO website. The following points are a selection of the most frequently mentioned drawbacks of the site:
Keep text, language and layout short and simple;
Links to raw data are found lacking;
The design of the website deserves somewhat more attention;
The menu could be improved by giving it a 'mouse-over' function and by using shorter titles;
Some sort of help function is could be useful;
The search function is seldom used, and could be improved with a clearer appearance.

SWOV, who is in charge of maintaining the ERSO website, has already made the first changes to further improve the site. Of course further user comments will be welcomed.

The ERSO website can be accessed on www.erso.eu.

New Fact sheets

Safe road shoulders

In 2005, there were almost 1,500 fatalities and severely injured in the Netherlands in crashes with cars and vans ending up in the road shoulder. This crash type mainly occurs on rural roads. A reduction in the number of casualties as a result of these crashes can be achieved by making the road shoulders safer. Different measures can be taken; examples are the application of acoustic markings or the construction of obstacle free zones. The fact sheet *Safe road shoulders* looks at the problems concerning both urban and rural road shoulders, and goes into the possibilities to prevent shoulder crashes.

Motorcycle and moped helmets

In 1972 wearing a helmet was made compulsory for motorcyclists in the Netherlands, followed by a mandatory helmet wearing law for moped riders in 1975. A helmet that meets the requirements is a good protection for moped riders and motorcyclists. In crashes it can prevent head and neck injury or limit its severity. However, there are indications that the protective function of the helmet can still be further improved. This may require adapting the test procedure requirements so that advanced materials and constructions can contribute optimally. Correct wearing of the helmet is vital in preventing casualties and police enforcement and public information can play an important part. The fact sheet *Motorcycle and moped*

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Colophon

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New Fact sheets

helmets discusses different aspects of helmet use by motorcyclists and moped riders.

Euro NCAP

Euro NCAP, European New Car Assessment Programme, is a programme which tests cars on a number of passive safety characteristics and communicates the results to the consumers. Euro NCAP consists of four parts and tests a new car's frontal impact, side and pole impact, and pedestrian protection. Euro NCAP has stimulated the interest in vehicle safety and has had a positive effect on the increased vehicle safety in recent years. The fact sheet *Euro NCAP, a safety instrument* explains the Euro NCAP programme, and discusses what the effects may be.

Network Management and Sustainable Safety

There is a trend at the regional level to concentrate traffic no longer on motorways, but to divert some of it to the secondary road network. This trend is known as Network Management. Because the secondary road network is not as safe as the main road network, this strategy will inevitably result in more road crashes and casualties if no additional measures are taken. There are various methods to examine at the network level which measures are necessary to prevent this decline in road safety: the road network test, the Sustainably Safe Indicator, the Road Safety Audit, and crash rate data. SWOV recommends using an independent road safety auditor to test the road safety aspects of a Network Management project. The fact sheet *Network Management and Sustainable Safety* explains the concept 'Network Management' and looks at its position in Sustainable Safety.

Roundabouts

Roundabouts reduce the number of potential conflicts between road users and lower the driving speed and thus contribute to a safer traffic environment. The factsheet *Roundabouts* looks at the different types of roundabouts and their effects on road safety, mobility and polution. Furthermore, it pays attention to the question what is better from a road safety point of view: priority or no priority for cyclists on separate cycle tracks along a roundabout. The costs and benefits of converting an intersection into a rounabout are also discussed.

Traffic education of children 4-12 years old

Both formal education programmes at schools and the education parents give their children are meant to improve chldren's behaviour in traffic. This fact sheet looks at what children must learn to ultimately become safe road users and how this can best be taught. .
The fact sheet *Traffic education of children 4-12 years old* is largely based on a recent literature study of education programmes in the 1995-2005 period and on the results of the recent EVEO study, a study of the effects of traffic education, in which eleven education programmes were assessed.

All SWOV fact sheets can be consulted and downloaded at www.swov.nl under Research, Fact sheets.

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.

International orientation on methodologies for modelling developments in road safety

M. Reurings & J. Commandeur. R-2006-34. 47 pp. € 11.25 (In English)
This report provides an overview of the models developed in Belgium, Canada, France, Great Britain and Sweden to evaluate past developments in road traffic safety and to obtain estimates of these developments in the future.

Hospitalized road crash injured; Developments in numbers, injury severity, and length of stay since 1984

L.T.B. van Kampen. R-2007-2. 34 pp. € 10.-
During the last two decades, according to the road crash registration, the number of road deaths has decreased by 54%. However, according to the hospitals' national patient register 'LMR', the decrease in the number of in-patients is, with 16%, considerably smaller in this period. In order to find an explanation for this smaller decrease, SWOV analysed the LMR databases for the 1984-2005 period. The variables examined were: length of stay, the number who died in hospital, the number of injuries per patient, the injury severity, and the registration rate per crash type. This report describes the results of these analyses.

Road safety at roadworks; A literature study

A.L. van Gent. R-2007-5. 64 + 4 pp. € 12.50
This report presents the results of the first phase of the Road Safety at Roadworks study that CROW (Information and Technology Platform for Infrastructure, Traffic, Transport and Public space) commissioned SWOV to carry out. It consists of a literature study and a review of useful sources for crash data and data of road works. The main goals were (1) increasing insight into the number, nature, and causes of road crashes at roadworks and (2) constructing a more detailed plan for the second phase of the project: a crash analysis of recent crashes at roadworks in the Netherlands.

Road safety consequences of allowing the Segway on public roads; Advice to the Ministry of Transport, Public Works and Water Management

C.C. Schoon, M. Houtenbos, J. Mesken (DHV) & V. Kars. R-2007-6. 58 + 83 pp. € 12.50
On request of the Ministry of Transport, SWOV studied the likely road safety consequences of admitting the Segway on Dutch public roads. The study consisted of literature study, a practical test, validating the Segway against Sustainable Safety principles, a survey of the present legislation, an inventory of the opinions of relevant organizations, and an estimate of the road safety risk of the Segway.

Fact sheets:

- Euro NCAP, a safety instrument
- Intelligent Speed Assistance (ISA)
- Roundabouts
- Motorcycle and moped helmets
- Bicycle helmets Safe road shoulders Hazard perception
- Traffic education of children 4-12 years old
- Network Management and Sustainable Safety

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