SWOV
INSTITUTE FOR ROAD SAFETY RESEARCH

RESEARCH ACTIVITIES

issue 26 October 2004

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

Contents:

Editorial

This issue of Research activities contains a wide variety of subjects. One article answers the question whether goods traffic measures can be profitable and we also report on practical guidelines for cost-benefit analyses. In both the article on car front collisions and in the article on mopeds and light motorcycles we ask for changes in EU requirements and regulations.
Also in this issue we introduce a new SWOV-product, distributed via the SWOV website, and also available in English: the fact sheet.

Adapt EU requirements for car front also to collisions with cyclists

When determining the safety requirements for car fronts, not only must collisions with pedestrians be taken into account, but also those with cyclists. SWOV advocates this in its *Cyclist-car-front collisions* report.

Together with car manufacturers, the European Union is working on pedestrian-friendly car fronts. However, research has shown that cyclists only partly benefit from these requirements. This is because, when cyclists collide with a car, they come into contact with completely different car parts than pedestrians. A car-cyclist injury crash usually involves the cyclist being injured by hitting the windscreen or windscreen frame hard. Pedestrians usually come into contact with the bonnet. This means that a crash with a cyclist makes quite different safety demands of the bonnet from a crash with a pedestrian.

QUOTE

When we speak about an improvement in road safety, like halving the number of road fatalities, it also means that 20 000 people would still be killed on our roads every year.

Loyola de Palacio, Vice-president of the European Commission

EU safety requirements

It is possible that, starting 2005, additional requirements will apply to the crash-friendliness of the car front. These requirements refer to the bumper and bonnet of cars, in other words, the areas typical for pedestrian crashes. In addition, to limit cyclist injury, the windscreen and windscreen frame would also have to be tested for safety requirements. SWOV, therefore, advises extending the intended European evaluation research to attention being paid to crashes with cyclists.

Although there are not any safety requirements for the windscreen and windscreen frame yet, starting 2005, there will be a registration obligation of safety tests carried out on these car parts. This registration can contribute to the risk estimation of various windscreens, which in turn can be important for the EuroNCAP score.

There are nearly 200 road deaths among cyclists in the Netherlands every year. Next to the pedestrians, they are a very large group among the vulnerable road users. The Netherlands has the largest national share in Europe of cyclists among road deaths (18%).
In 80% of the crashes between a bicycle and a motor vehicle, a car is involved. Besides requirements that concern the safety of pedestrians, the cyclists do deserve special attention as well. Taking their safety into account in the EU requirements for car fronts is a step forward in reducing the number of casualties. ◀

The Dutch-language report R-2003-33 'Cyclist-car front collisions; Factors that influence occurrence and injury severity' can be consulted and downloaded on the SWOV-website. The report has an English summary.

Can goods traffic measures be profitable?

Investing in goods traffic measures can be socially profitable, from a road safety point of view. However, the companies that invest in safety do not always cover the costs. This is a result of a SWOV study of the costs and benefits of various heavy lorry traffic road safety measures.

Crashes in which lorries are involved are often severe. In 2003, 14% of all road deaths were from crashes with heavy vehicles. The casualties were usually from the crash opponent. They numbered 140 fatalities, among which 40 were vulnerable road users.

Reducing casualties and damage

This study made a distinction between measures for reducing casualties (road safety measures) and measures for reducing damage (damage prevention). The costs of the measures were compared with their benefits. Where the benefits go to depends on the type of measure.
The road safety measures benefit "society" most of all. Examples are on-board computers, provisions to improve the field of vision (using mirrors and cameras), side-underrun protection, front and rear end protection, and retroreflective contour marking.

The damage prevention measures benefit the company. These consist of saving on costs not covered by insurance, such as loss of production. An example of such a measure is the carrying out of a damage protection programme.

European obligation

Companies are not very prepared to invest in measures if they do not profit the company itself and mainly benefit society. The best guarantee of ensuring that such provisions are present is to make them obligatory in, for instance, the European vehicle regulation. For example, this is already the case for open side-underrun protection, but there are many more possibilities.

Positive result

Of all the measures studied, the expectations are that damage prevention programmes and

on-board computers will have a positive benefit in reducing both the number of casualties as well as the amount of damage. Both are especially suitable for larger companies with more than 5-10 chauffeurs.

Damage prevention programmes

Damage prevention programmes are aimed at the registration and analysis of damage and crashes. Haulage companies can carry out the analyses themselves, but others, like driver insurance companies can also do them. Based on the analysis, a package of measures is drawn up; training and revolution-number limiters are examples of this. It is desirable that damage prevention programmes are a part of the so-called safety culture within a company. A safety culture involves (road) safety playing its part in management decisions.

On-board computers

On-board computers can be used to register the driving behaviour, and to register other vehicle data. A special type is the accident data recorder that registers the vehicle data just before and after a crash. The presence of data recorders leads to the driver being more careful and using less fuel! A SWOV study for the EU has shown that these recorders result in a 20% reduction in crashes and damage, with a maximum of 35% and a minimum of 5%. The greatest effect is achieved when chauffeurs know that they can be made liable for their driving behaviour. We therefore expect that such recorders will especially affect larger companies where they are embedded in the safety culture policy.

Integral analysis

Until now, research has been limited to a road safety cost-benefit analysis. Investments that are profitable because they reduce damage can be counted as company operating costs. A positive side effect is that these measures often result in a decrease in the number of casualties. Investments that are specifically aimed at reducing the number of casualties often have important social side effects. In order to achieve a more balanced distribution of investment costs, an integral cost-benefit analysis is necessary. Apart from road safety effects, they also deal with, for example, the value of the freight, environmental aspects, and fuel savings.

The Dutch language report R-2004-11 'Cost-benefit analysis of measures for lorries and haulage companies; Measures for reducing the number of casualties and material damage' can be consulted and downloaded on the SWOV-website. The report has an English summary.

Keeping the elderly safe while driving

The elderly need more time to prepare themselves for the next traffic situation. It is, therefore, of great importance that information about this situation can shorten the preparation time. This is just an example of the changing needs when getting older.

As part of her PhD dissertation research, Ragnhild Davidse has studied whether Intelligent Transport Systems (ITS) applications can provide specific support especially for elderly motorists. Most of the ITS applications have been designed to increase the motorist's comfort by supporting the driving task. One system aims to increase road safety. According to Davidse, ITS applications are only capable of increasing road safety if they really do support those parts of the driving task that motorists experience as being awkward. They should not take over those tasks that the human being is good at.

Compensation for the elderly

In general, people find it difficult to carry out different tasks simultaneously. For example, selecting relevant information from the total supply (such as traffic signs in the road surroundings) is a complex task. It should be carried out sufficiently quickly to be able to react in time. As they get older, the elderly find this increasingly difficult and need more time. Fortunately, the elderly generally have more driving experience. They can use this experience to anticipate what is coming next, for specific situations have specific characteristics. If, however, the road situation deviates from the one expected, the elderly road user has an extra disadvantage. The chance is then greater that, for example, a longer reaction time will prove to be a hazard.

Research has shown that, in traffic, the elderly especially encounter problems with:

- judging whether other road users are moving and how fast they approach a crossroads,
- noticing other road users joining traffic and changing lanes,
- noticing traffic signs and traffic lights,
- increased reaction times in complex traffic situations and fewer correct decisions if they have to be made in a hurry.

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More and more timely information about the situation the elderly motorist is approaching, would thus be a solution. For example: "watch out, you soon have to give way", or information about where objects are in the blind spot, or information about relevant traffic signs. Is it possible to provide this information by using ITS applications?

Davidse converted the needs of the elderly motorist into the functions required of supporting systems and examined whether any systems already existed that can provide such support now or in the foreseeable future. A number of systems seem to meet these requirements. These are systems for: collision warning at crossroads conflicts, automatic merging and lane changing, parking assistance, projection of traffic signs and warning signs onto the vehicle windscreen, intelligent cruise control that brakes when there are traffic lights or warning signs, and one that provides information about any complex crossroads approaching. She then made an inventory of whether the systems had the required effects and what the side effects are.

Elderly test subjects

Manufacturers of ITS applications can increase the use and safety of the various systems by taking into account the needs of the elderly. For example, they should not only use young road users in the testing phase, but also the elderly. It is reasonable to expect that if elderly motorists are capable of carrying out a task safely and without much trouble, the application will also be suitable for other motorists.

Help from the infrastructure

Davidse views the future ITS applications as a supplement to the possibilities that changes in the infrastructure offer to assist elderly motorists. For example, traffic signs that inform the road user about the lane configuration in time, give the motorist more time to change over to the correct lane to be able to turn left. Well-maintained contrasting road surface lines provide the road user with information about the course of the lane in which he/she is driving. These, and other examples of infrastructural measures that meet the requirements and wishes of elderly motorists, are part of a previous study by Davidse (R-2002-08).

Hardly any yet for sale

The main conclusion is that most of the above-mentioned systems are still being developed. Partly for this reason, not much research has been carried out about the acceptance and behavioural effects of these systems. Such research should show whether they really do provide the necessary support and whether they will be used and result in increased road safety for elderly motorists. In a supplementary study, Davidse will study, using a driving simulator, how effective certain ITS applications and infrastructural measures are for easing the driving task at crossroads. ◀

The Dutch language report R-2003-30 'Older drivers and ITS: stronger together?; Literature study of the added value of Intelligent Transport Systems for the safety of the elderly driver ' can be consulted and downloaded on the SWOV-website. The report has an English summary.

1995-2002	Walking	Cycling	Car driving	Total participation in traffic
Age 60-64	31	20	4	6
Age 65-74	52	48	8	12
Age ≥ 75	204	176	23	38
All ages	34	16	5	6

Fatality risk for elderly (>60), casualties per kilometre travelled (from AVV/CBS).

It is desirable that the elderly continue to be road users for as long as possible. Table 1 shows that the death rate for elderly cyclists and pedestrians is many times greater than for elderly motorists. In a car that allows for their capacities and limitations, the elderly are safer.

Practical guidelines for cost-benefit analyses

A recently completed SWOV report has delivered practical guidelines for carrying out integral safety cost-benefit analyses of road safety measures.

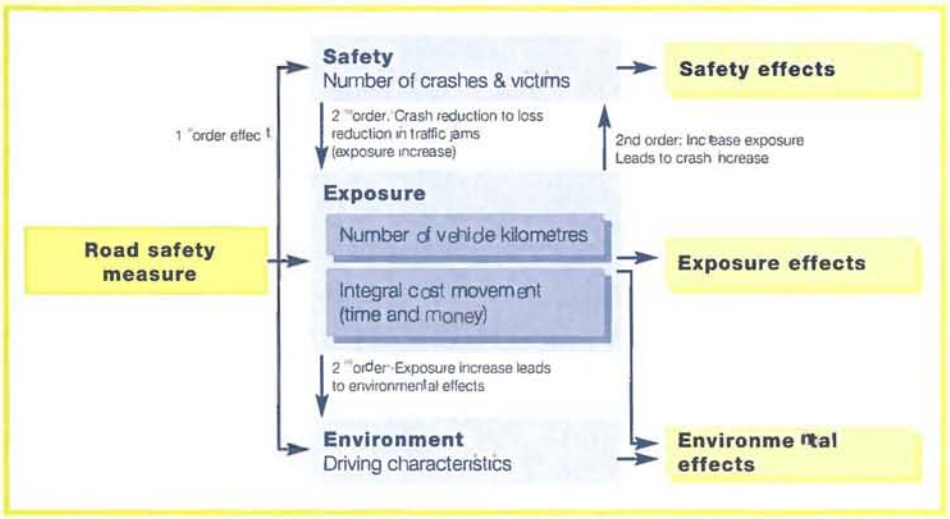

Figure: Example of relations between safety, exposure, and environment when taking a road safety measure (Source: ECORYS, 2002).

Traffic and transport budgets should be spent as optimally possible, at the national as well as at the regional level. Policy decentralization has lead to regional governments having to decide more frequently about how these budgets are spent. There is also more to choose from: the freedom of budgetary spending is increased. This all makes it necessary to be able to assess the various measures properly and to compare both the costs and the benefits of measures.

Apples and oranges

Road safety measures often have an effect on exposure (kilometres travelled) and the environment, as well as on road safety. An exposure effect can be direct because, for example, the speed limit is lowered and the journeys take longer. It can also have an indirect effect of lowering the number of crashes. There is thus less traffic congestion, the traffic system is more reliable, and the modal split can change. The environmental effects of road safety measures are often indirect, as a result of the changes in exposure (the distance travelled and the vehicles used). This leads to a change in the amount of exhaust fumes and noise annoyance. The driving speeds, acceleration, and braking of vehicles also influence this. There are, therefore, many different, possible effects of road safety measures. These 'apples and oranges' can be compared with each other in an integral cost-benefit analysis.

Cost-benefit analysis

In a cost-benefit analysis of a road safety measure, all costs and all relevant impacts on society during the whole working period of the measure are made visible. The situation after the measure would be implemented is compared with that where the measure would not be implemented. This is called the null alternative. First the effects are quantified in, for example, the number of casualties saved, loss of time, or emission saved. Then all effects are expressed in monetary terms. Finally, the social benefit can be calculated and compared with that of other measures.

Guidelines

The recently published SWOV report contains practical guidelines. These are useful for road safety cost-benefit analyses, both at the national and regional level. Attention is paid to determining the correct points of departure, such as economic growth scenarios, the measure's working period, and the method of weighing the effects over the whole working period. Exposure and environmental effects are considered, as well as road safety effects. Attention is paid, step-by-step, to the quantification and monetizing methods. The various criteria for social benefit are also given.

The Dutch language report R-2003-32 'Cost-benefit analysis of road safety measures; A methodological exploration' can be consulted and downloaded on the SWOV-website. The report has an English summary.

Only use 'area-wide approach' if road safety is guaranteed

At the regional level in the Netherlands, a trend is developing in which motorways are relieved by diverting some of the regional car traffic to less safe lower order roads. If this continues unaltered, it will lead to more casualties on these roads.

It is common knowledge that the crash rate of motorways is low. In the Netherlands, about 10% of the fatal crashes occur on motorways, whereas they carry about 40% of all motor vehicle kilometres. The fact that the annual increase in motor vehicle kilometres does not result in a proportional increase in fatal crashes, is largely the effect of these extra kilometres being driven on the relatively safe motorways. It is, therefore, remarkable that the trend named 'area-wide approach' has appeared.

The area-wide approach

For a long time now, the capacity increase of the motorway network has lagged far behind the incease in their use. In order to use the capacity as much as possible, the government is attempting to spread the traffic flow (in time and space) over the whole available network to ensure its entire capacity is being used. At the national and regional level, approaches and instruments have been developed for traffic management under the name of 'Architecture for Traffic Management'. This is defined as 'the process of guiding, steering, or informing traffic by means of traffic measures'. The capacity problem on the main road network expresses itself, especially regionally, as a commuter traffic problem during rush hours. A commission especially installed to tackle this problem concluded that a change is needed, from the way of thinking in terms of infrastructure to thinking in terms of an area-wide approach. One needs to look at the totality of a road network. Such an approach also leads to the collective action of the various road authorities.

In the meantime, the government has taken the initiative of applying an area-wide approach in about 25 regions. In each of these regions there is a congestion problem on at least one motorway, or such problems will occur during lengthy road works, especially those involving the construction of rush hour lanes and buffer lanes. The size of a region depends on the problems observed and the possible space for solving them.

For the time being area-wide approach focusses on the flow aspects. The increased use by car traffic of the lower order roads will result in worse safety and quality of life aspects.

Road safety impact assessment

Quantifying the effects of a different distribution of the traffic is necessary to make a good estimate of the road safety effects. In such a way the different variants can be compared in a transparent way.
SWOV has developed some methods for testing the extent that 'use variants' meet the Sustainably Safe requirements. One of these methods is the 'road safety impact assessment'. This assessment contains a number of criteria that are explained in greater detail below.

Connections between residential activity and population concentration

The residential concentrations differ from each other in many ways. The German guidelines for road categorizing (FGSV, 1988) use the functions of each concentration in an area (i.e. management, jurisdiction, culture, service) to divide the concentrations into five levels. There are different sorts of connections between them which suit the traffic that results from these functions (production/attraction of people and goods). With regard to this, the population per concentration is very important because, to a large extent, it determines how many journeys are made to and from a concentration. The population in a concentration type depends on its distribution over the whole region it is in, and is not determined by a fixed class. There are fifteen different connection types possible between five concentration types; see Table 1. Each connection type has its own place within the traffic network. A characteristic traffic volume travels between the various concentration types. The capacity of the connections (number of motor vehicles per normative rush hour) must be tuned to this volume. The Sustainably Safe road categories must fit the desired capacity. The chosen category must, of course, be in accordance with the traffic function of the connection. The access road function is not meant for connections between sizeable concentrations. This approach only chooses the residential access road function for connections between concentrations of type 5.

Table 1 shows that there are no direct connections needed between types 1 and 4, between types 1 and 5, and between types 2 and 5. These connections may go via larger concentrations. Anyway, in practice such connections are already there or, for one reason or another, are still necessary.

Size of residential areas

According to a Sustainably Safe requirement, residential areas are 'as large as possible'. Residential areas are normally situated between main roads (through-roads or distributor roads). According to the concentration approach discussed above, rural residential areas can contain the connections between (two or more) concentrations of type 5. Road safety research does not indicate a maximum size for rural residential areas. Urban residential areas may have a maximum size of 1.25 km2.

Mesh - intersection distance - intersection class

The mesh and intersection distance are related to the concentration density of an area. The various road types also have a characteristic average intersection/crossroad distance, although there can be large deviations from this average. For this test criterion, the intersection distance is less important than the present or proposed intersection class: the intersection class shows which categories cross. The following intersection classes are undesired or permitted in a sustainably

	Concentration type				
Concentration type	1	2	3	4	5
1	TR I	TR I	TR II	via concentration type 2/3	via concentration type 2/3/4
2		TR II	TR II	DR I	via concentration type 2/3
3			DR I	DR I	DR II
4				DR I	DR II
5					AR I

TR = Through-Road; DR = Distributor Road; AR = Access Road
Each road type is subdivided into two types (CROW, 2002a, b, c)

Table 1 *Connections between different concentration types: choice of road type.*

Road type crosses with	TR100/120	DR 80	DR 50/70	AR 60	AR 30
TR 100/120	Crossroad	Split level	Undesired	Undesired	Undesired
DR 80		Roundabout	Roundabout	Roundabout	Undesired
DR 50/70			Roundabout	Priority X-ing	Priority X-ing
AR 60				Plateau	Plateau
AR 30					Plateau

Source: CROW (1997a) en Info point Sustainably Safe (1999 and2000)

Table 2 *Various intersection classes: typology and desirability.*

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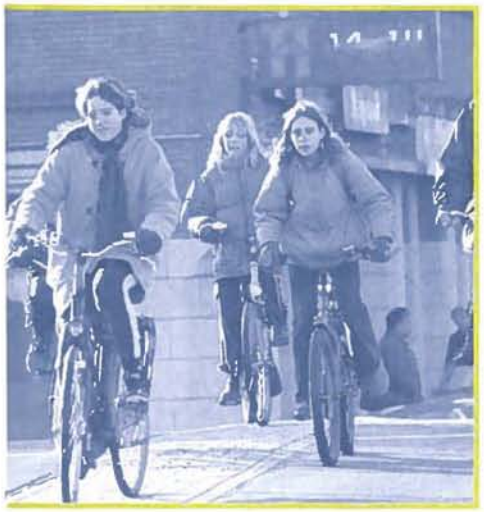
Fact sheets on the SWOV-website

SWOV wishes to keep its knowledge in the field of road safety up-to-date. In the project Knowledge Management, we follow the scientific, actual and policy developments of a large number of road safety aspects. As an outcome of this, a large number of so-called fact sheet will make relevant state-of-the-art information accessible. Recently the first fact sheets have been published containing a brief outline of the most important facts and data on a specific topic. In the English part of our website www.swov.nl under Publications the fact sheets on the topics mentioned below can be found in English.



Road safety of children in the Netherlands

In comparison with other age groups, relatively few children of up to 14 years old are killed in traffic in the Netherlands. In addition, children's safety has increased considerably during the last few years. A lot more older children (12-14 years old) are killed than younger ones. This coincides with the fact that older children cycle a lot more. That is why it is important that road safety policy pays extra attention to the safety of cycling children. It is also in the interest of residential areas to relentlessly continue striving for slower driving speeds of motorized vehicles.
More information can be obtained from the fact sheet.

How do light railways fit Sustainably-Safe?

Light railways (tram-like trains or train-like trams) are a new type of vehicle that falls outside the current Sustainably-Safe vehicle types. Because of the increase in the number of light railway vehicles, there will be an increase in the number of crashes where they mix with other traffic. Light railway lines only fit in a sustainably-safe traffic system if they are subject to strict conditions. Split level junctions are required at points where they cross other road users, but this is probably not possible or feasible everywhere. Where the intersection is at the same level (completely) guarded intersections are desirable. If this is not possible, the light railway vehicle should pass the intersection at a speed of less than 30 km/hour.
More information can be obtained from the fact sheet.

Fatigue in traffic: causes and effects

The role of fatigue must not be underestimated, not even in a small country like the Netherlands, when studying the causes of crashes. Moreover, fatigue crashes are not only a matter of having spent too long behind the wheel; they can also be caused by too little sleep, stress, or time of the day. According to a conservative estimate based on studies abroad, driver fatigue is involved in 10-15% of all severe crashes.
Although technical aids that prevent fatigue crashes are being developed, they are not yet ready for use. At this moment in time, the only means available to combat fatigue crashes are a) consistently applying (and enforcing) the driving and resting hours and b) a safety culture in the road haulage industry. Ordinary car drivers (i.e. non-professionals) should be warned of the risks of fatigue via campaigns.
More information can be obtained from the fact sheet.

Zone 30: urban residential areas

A road categorization has been chosen in Sustainably-Safe that concentrates through traffic on motorways and other main roads. Residential areas have living, shopping, and work functions and therefore cars driving through residential areas are discouraged by a speed limit of 30 km/hour, and speed reducing measures such as speed bumps, road narrowing etc. On average the number of injuries decreases by about 25% when a 50 km/hour residential area is redesigned as a 'Zone 30'. The Zones 30 also have a positive effect on the quality of life: there is less noise, crossing the road is easier, and the emissions are less. According to the requirements of Sustainably-Safe, residential areas should be as big as possible, but 2 km2 is the largest feasible area. A comparison of road structures is made in order to choose the most suitable type for a 30-km/hour area. ◀
More information can be obtained from the fact sheet.

Colophon

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

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Free copies are available from SWOV. Please send subscription requests and address changes to SWOV.

ISSN: 1380-703X

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safe road traffic (including prescribed type). See Table 2.

An important reason for not taking the intersection distance as a test criterion is the meagre relation between road type and intersection density. Regional and national data show that, on rural as well as on urban roads, there are as many or more intersections per kilometre on distributor roads as on residential access roads. This situation will hardly change in the implementation plans for the second phase of Sustainably Safe. It seems obvious to lower the intersection density in distributor roads because this road type deals with a lot of traffic, and such a reduction would result in fewer disruptions. The regions appear to regard such a structural change as not being feasible.

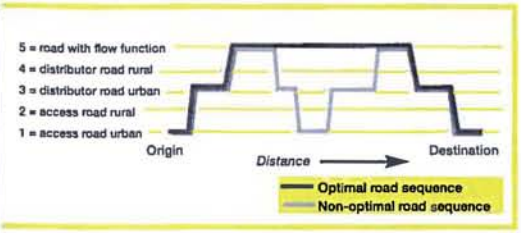

Figure 1. Example of an optimal road sequence according to the sustainably-safe functionality principle. (Proceedings of the European Transport Conference, 2004).

Detour factor - route choice

The detour factor and route choice are of course closely related: a route mainly along main roads will usually have a longer detour factor than short cuts along minor roads. The size of this deviation from a straight line is a standard. The test criterion is a route that is 60% longer than a straight line.

With regard to the route choice, the test criterion is the extent to which a journey/trip goes via a sequential choice of the next higher road types (see the functionality diagram in Figure 1).

Additional measures necessary

If no additional measures are taken, it is inevitable that more traffic on the lower order road network will lead to more crashes and casualties. SWOV has various methods available such as the Sustainably-Safe Indicator and the Road Safety Audit (D-2003-15), to determine which measures are necessary to prevent this increase.

More information about area-wide approach can be found in SWOV-report R-2004-6: Road safety aspects for accessibility. The report is written in Dutch, but contains an English summary. The report can be consulted on the SWOV-website.

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.

Road safety aspects of the 'Bypasses for accessibility';

Analysis of the TNO Inro concept in the perspective of Sustainably-Safe

A. Dijkstra & drs. ing. T. Hummel. R-2004-6. 28 + 5 blz. € 10.00. (In Dutch)

TNO Inro's accessibility concept contains a proposal that could lead to a considerable improvement in the traffic flow and a reduction of the number of traffic casualties. SWOV assesses the road safety effects in this study and, simultaneously proposes a way of ensuring that the road classification that TNO Intro is introducing to meet the requirements of Sustainably Safe Road Traffic.

Drink driving in West Zeeuws-Vlaanderen, 1995-2003;

The alcohol use of motorists in weekend nights

Drs. S. Houwing & M.P.M. Mathijssen. R-2004-7. 29 pp. € 8.75 (In Dutch)

This reports the 2003 measurements of motorists' alcohol use in West Zeeuws-Vlaanderen. The purpose of the measurements was to establish the effects of the 'Duurzaam Veilig West-Zeeuws-Vlaanderen' project.

Towards a second generation of sustainably safe measures;

Starting a discussion about the future of Sustainably Safe

Ir. F.C.M. Wegman. R-2004-8. 30 + 35 pp. € 12.50 (In English)

The road safety in the Netherlands has not been doing so well during the last few years as it had during the previous years. SWOV wishes to contribute to answering the question: how further? To do this, a discussion was started in early 2004 about the further implementation of Sustainably Safe. This report contains a record of this discussion, and a proposal to make a Road Safety Agreement in mid 2005.

Speed, speed distribution, and the chance of road crashes;

Literature study and inventory of research methods

Ir Dr. L.T. Aarts. R-2004-9. 57 pp. € 11.25 (In Dutch)

This report contains a discussion of the most important and most recent studies of speed and crashes. In this, a distinction is made between studies that have reported results of the relation between absolute speed and crashes, and those of the relation between speed distribution and crashes. Besides this, we made an inventory of the research methods used up till now to study the relation between speed and crashes.

Traffic legislation and safety in Europe concerning the moped and the A1 category (125 cc) motorcycle;

A literature and questionnaire study commissioned by the Swedish National Road Administration

Chris Schoon. R-2004-10. 58 + 3 pp. € 12.50 (In English)

A study of the differences in laws and regulations within Europe with regard to mopeds and light motorcycles. Among other matters, the following were examined: the minimum age, theoretical exams and driving tests, speed limits, obligatory helmet use, and registration numbering. The report discusses the problems within the various European countries with regard to: the tuning up of mopeds, the separation of mopeds and other motor vehicles, and the minimum age. It also makes recommendations.

Cost-benefit analysis of measures for lorries and haulage companies;

Measures for reducing the number of casualties and material damage

Ir. P.M.M. Langeveld & ing. C.C. Schoon. R-2004-11. 54 + 3 pp. € 11.25 (In Dutch)

This cost benefit analysis helps road haulers to select profitable measures. The calculations make distinction between measures that aim at reducing the number of material damages and measures that that aim at reducing the number of casualties in crashes with lorries. With regard to the first group, the damage prevention programmes and in-vehicle computers are discussed. With regard to the second group, the blind area mirrors and cameras, side protection, and front and rear protection are (among others) studied further.

Fact sheets:

- How do light railways fit Sustainably Safe?
- Road safety of children in the Netherlands
- Fatigue in traffic: causes and effects
- Zone 30: urban residential areas

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