Research activities 1985/1986

1988

SWOV INSTITUTE FOR ROAD SAFETY RESEARCH, THE NETHERLANDS

Photos: Studio Verkoren, Stichting Film en Wetenschap, W.P.H. Metselaar, Pevry Press a.o.

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How SWOV is organised
The Institute for Road Safety Research SWOV is governed by a board of governors and a director. SWOV's board of governors consists of a minimum of seven and a maximum of nine members. Six members are appointed: the board is free to elect the remaining members, including the Chairman. The following each appoint one member:
- the Minister of Transport
- the Royal Dutch Touring Club ANWB
- the Netherlands Association for Automobile Insurance NVVA
- the Netherlands Association of Bicycle and Automobile Industry RAI
- the Director General of the Public Works Department
- the SWOV works council.

The management is responsible for the day-to-day running of the organisation. The director represents the board of governors, both internally and externally.
Director of the Institute is Mr. M J. Koornstra.

Functions
Three main functions have been laid down for SWOV in close consultation with the Ministry of Transport, SWOV's main client and source of subsidy.

1. Information control function
SWOV is responsible for ascertaining the information needs of the government, keeping records of the information available from Dutch and foreign research and making it applicable to the formulation and implementation of road safety policy.

2. Architect of contract research
SWOV contracts out road safety research projects to specialised research institutes, designs and supervises them, integrates the results, and compiles the reports.

3. Research function
SWOV will carry out interdisciplinary and basic research. Where contracting out a special project or part of a project, will be possible, SWOV will not do the research itself.

SWOV's objects
The Institute for Road Safety Research SWOV was founded in 1962 on the initiative of the Minister of Transport, the Royal Dutch Touring Club ANWB and the Netherlands Association for Automobile Insurance NVVA. The reason was the constant increase in the number of road casualties and the realisation that scientific research was indispensable for an effective approach to road safety problems.
SWOV's object is to contribute to road safety by means of scientific research and dissemination of the results. Its activities cover all aspects and areas of road safety. SWOV also contracts research to third parties. In this way it has a co-ordinating function in planning road safety research in the Netherlands.

The research results and know-how are spread:
- among policy-making bodies which can put the research results into practice;
- among scientists, in order to exchange research results and methods, and
- among institutions and persons concerned with road safety.

Much of SWOV's research is focused on obtaining information for policy measures. Most assignments for this come from the Ministry of Transport. In recent years, however, more and more assignments have been received from provincial and municipal authorities and private institutes.

SWOV's philosophy

About a million traffic accidents occur in the Netherlands each year, killing about 1,500 and injuring more than 50,000 persons.
The total economic loss caused by traffic unsafety amounts yearly to about 6 milliard Dutch guilders.
There is every reason for tackling this gigantic problem with united strength. In the first place because it involves a great number of human lives, but also because of financial-economic considerations. Somehow we accepted traffic unsafety in the course of time as a kind of natural phenomenon, which cannot be modified essentially.
SWOV has always vigorously contested this opinion and also indicated in which way traffic unsafety can be reduced. In the first place we must get rid of the idea that the total problem can be finally solved by continually looking for isolated solutions for various problems. We have to look for multi-causal instead of mono-causal explanations.

In order to reduce traffic unsafety to an acceptable level, the functioning of the entire traffic and transport system has to be improved. This requires a deep insight into the interplay of traffic participants and other factors of the system, i.e. roads, vehicles and surroundings. More particularly the knowledge of various branches of science has to be combined and a more thorough integration of research, policy and control is necessary as well. For this reason, SWOV seeks for ways and means to realise these aims in an effective and efficient manner in co-operation with foreign associated institutes. And to all appearance, not unsuccessfully.
In the interplay between traffic participants, vehicles, road and surroundings (so-called "critical situations") may arise, which, in turn, may lead to traffic accidents. What matters is the detection of such critical situations in the traffic. This requires a close co-operation between scientists of various disciplines, e.g. psychologists, sociologists, physicists and engineers. However, this is not enough. A comprehensive approach is only possible with the aid of systematically collected data concerning the traffic and accident process, and highly advanced analysis techniques. The application of computers to such investigations is of vital importance. The computer also plays a significant part in developing mathematical models of the traffic and accident process. Such form of simulation of real situations is relatively cheap in comparison with other simulations methods.

Results of SWOV research 1985/1986

Identifying problem areas in road safety

The main problem groups as regards road safety are to be found among young people and the elderly: this is the conclusion SWOV reaches in an exploratory study of road safety problems carried out for the Transport Ministry's Road Safety Directorate. The report is one of the elements which is to underpin the Medium-Term Plan for Road Safety, which will set out policy for the next few years.

The government described its National Road Safety Plan, which appeared in 1983, as the first step towards an ongoing medium-term plan. The Road Safety Policy Group, consisting of representatives of the Directorate and SWOV, is now working on the Medium-Term Plan, the successor to the National Plan. The Medium-Term Plan, based on the new approach, is to take full effect in 1987.

The social context
One of the first requirements was to decide where the emphasis in future policy should lie, and the SWOV report provides criteria on which to base these decisions. Before the problem areas can be indicated we need to look at road safety in the social context: how large and important is the problem in comparison with other social problems? In the first part of the report the authors conclude that, despite the fall in the annual road accident casualty rates in recent years, they are still high, averaging 1,500 fatalities, 50,000 injuries and 1,000,000 accidents a year. The effects on the quality of life are completely unmeasurable.

In comparison with some other threats to life, road accidents are a major cause of death among young people: they account for 35% of mortality in the 5-26 age group; indeed, they are the principal cause in the 15-20 age group.

The accident rates in the Netherlands are fairly good compared with those in neighbouring countries. The casualty rate per 100,000 of population is low and has also dropped fairly substantially, although there are countries with better rates, e.g. Norway. Favourable developments in the past cannot be expected to continue, however, unless suitable policies are adopted, the foundations for which must be laid now.

Problem areas
The second part of the report discusses a method for determining problem areas. The hazards are not equally distributed by geographical area, age group, sex or type of road user, for example. It is possible, therefore, to select those problems which are more serious and demand special attention. To establish which these are, the hazards are described in terms of indicators, chosen on the basis of the people's ideas on road safety hazards, the extent to which they relate to the objectives of road safety policy and political pronouncements on the matter. The question of whether they actually represent measurable quantities and are capable of being compared was also considered.

The next step is to decide on the priorities: this is necessary because all the problems cannot be tackled at once - in many cases simply for lack of funds. In the decision-making model described in the report the indicators "size" (number of casualties), "risk" (casualties per kilometre travelled) and "vulnerability" (ratio of seriousness of injury in collisions between non-equal road users) play an important part. On this basis, taking unfavourable developments for particular sections of the population in the past into account, the authors identified the following priority areas:
(a) moped riders aged 15-25 in conflict with cars.
(b) motorists aged 18-25.
(c) cyclists and pedestrians over 65.
(d) cyclists aged 6-19 and pedestrians under 12 in conflict with cars.

The next step in a problem-oriented approach to road safety is an analysis of the hazards faced by these groups on which to base measures: SWOV has begun work on this.

Ten years of research into road accidents in North Brabant

The North Brabant provincial authorities recently approved the last of a series of ten reports on how to improve road safety in the province. This marks the end of ten years of phased studies carried out in collaboration with the Ministry of Transport and the Provincial Public Works Department.

Given that there were indications of a relatively high accident rate, the first question to be considered was whether there was something unusual going on in North Brabant. It was decided, therefore, to examine the anti-skid qualities of road surfaces. These investigations resulted in new realizations and developments - including the use of draining hot-rolled asphalt - which have been applied even at national level. It was found that a surprisingly large number of cars left the road on bends and/or collided with trees or poles in North Brabant. One cause was identified as the historical development of road layouts in the area and the way in which they were landscaped. Methods of preventing such accidents or reducing their seriousness without immediately having to cut down the trees were suggested. Research was also done into ways of improving other accident black spots, e.g. grade intersections, and suitable methods were suggested. New recording techniques were devised and tested to enable features of accident locations to be related systematically to data on the accidents themselves to enable the most unsafe elements in the traffic system to be identified. In the long term it is extremely important to be able to predict what road characteristics are likely, sooner or later, to give rise to accidents and should therefore be changed as a preventive measure. One outcome of the studies was the recommendation that, instead of trying to make as many local improvements as possible to as many roads as possible, the authorities should take a network of roads, make it as safe as possible for heavy traffic and ensure that traffic is concentrated there.

The studies were intended as a basis for the long-term policy which Province of North Brabant has developed - it is the first province in the Netherlands to do so.

Road safety in Beemster: study concluded

A working party of provincial and local highways authorities in the Beemster Polder (Province of North Holland) noted a high accident rate on the municipality's roads in 1973. There had been a sudden increase in road accident fatalities to 23 in 1972, double the figure for previous years. This led the Minister of Transport to employ SWOV as advisor to the working party, whose main duty was to recommend infrastructural measures to improve road safety in the polder.

The accident figures for the 1970-71 and 1973-80 periods were monitored and compared with those of other rural municipalities. In the Netherlands as a whole there was a decrease in accident rates during this time; the drop in Beemster was larger than elsewhere, also when compared with similar municipalities.

The structural measures (a trunk road and motorway plus slip road were constructed) were found to have had a good effect. The drop in Beemster was not in the absolute number of accidents (including damage to property) but in the number of casualties. Taking the rise in traffic performance into account, the accident rate fell 22% and the casualty rate 50%. The number of fatal accidents also decreased. There was no great difference between the accident trends for roads (i.e. not including intersections) and intersections respectively, thus the conclusions as regards the road network as a whole apply equally to roads and intersections. In relation to the amount of traffic there was a fall in both the accident and casualty rates.

The increase in traffic following the opening of the new roads coincided with a decrease in traffic on the old road network, and the number of accidents fell proportionately with the latter. The number of casualties per vehicle-kilometre on the old road network rose, however, i.e. the seriousness of accidents there increased. Possible causes were higer speeds (extensively monitored) and a reduction in the level of attention. The accidents trends for roads and intersections on the old network where measures had been carried out were not measurably different from those for other roads and intersections. Since the accident rate for the original Beemster network fell more than that for the road networks of similar municipalities it must be assumed that the local measures had a good effect on road safety on the network as a whole.

Structural measures which attracted traffic to new roads had a more beneficial effect on the accident figures in Beemster than those involving reorganization of the original road network. In general this is an argument in favour of measures to shift motorized traffic from old networks to new trunk roads. There may be an increase, however, in relative accident rates on the old network, i.e. the number of accidents/casualties per vehicle-kilometre. Consideration should be given to the effect measures may have on speeds.

Research as part of the Pilot scheme on Reclassification and reconstruction of urban roads

Purely from the point of view of improving road safety the relatively expensive and complex "woonerf" approach is not absolutely necessary. Since 80-90% of injury accidents in urban areas occur on main roads it is here that road safety measures are likely to produce the greatest returns. Simpler measures are therefore sufficient for residential streets, and these should be designed to keep out unwanted through traffic and restrict speeds. These are some of the conclusions from the report on the research carried out by SWOV as part of the Roads Pilot scheme on Reclassification and Reconstruction of Urban Roads for the Ministry of Transport. The project was subsidized by the latter Ministry and the Ministry of Health and Physical Planning.

The project took place in two urban areas, one in Eindhoven and one in Rijswijk (near The Hague). Various packages of measures were implemented to improve living conditions and road safety, ranging from the creation of "woonerf" areas to simpler measures such as creating one-way streets and placing physical restrictions on speed, e.g. bends, narrower carriageways and "sleeping policemen". Some unwanted through traffic disappeared from the streets as a result of the measures, and the speed of the remaining traffic was reduced. The number of injury accidents per vehicle-kilometre fell, by half in residential streets and by about 15% on main roads. It is not yet possible to say precisely which package of measures had the greatest effect in improving road safety; accident data over a number of years are needed for this. It is clear, however, that even the simpler measures had a beneficial effect.

As well as the effects on safety, the Pilot scheme also looked at the effects on the environment and on economic activity. Research showed that the reorganization of the urban areas had nor harmful consequences on the retail trade, and there were even some beneficial effects on the environment. In particular, the fall in traffic intensity in the residential areas of Eindhoven and Rijswijk produced a drop in the daytime noise level; emissions of exhaust gases also fell slightly.

Even small-scale measures improve road safety

The "woonerf" system in particular and similar systems for shopping areas and villages all have a beneficial effect on road safety. The greatest effect is achieved with the most intensive measures, i.e. obstacles, changes in road layout, "sleeping policemen" and ramps, while keeping the footways intact as far as possible. These are some of the cautious conclusions of a SWOV study of the effect of infrastructural road safety measures implemented under a government-aided pilot scheme. Once again we find that it is perfectly possible to improve road safety in built-up areas. The study also confirmed that the road safety hazards in residential and shopping areas are concentrated in "mixed-function" streets, access and collector roads with shops and/or a bus route and main roads. In other words, the real road safety problems in residential areas are not to be found in the residential streets. There was an improvement in the safety of pedestrians and, to a slightly lesser extent, of moped-riders; there was apparently no beneficial effect on cyclists. Collisions between "fast" vehicles are also reduced.

If we look at the effects of the measures in relation to road and area characteristics we find that there was a reduction in accidents in residential areas located between the town centre and the peripheral suburbs, i.e. encircling the centre. There was a greater reduction in accidents in larger municipalities and where the measures took the form of "woonerf" systems (or similar systems for shopping areas and villages). The decrease was larger the greater the use of official parking spaces. The accident rate increased, however, where the number of junctions with peripheral roads and intersections increased. The report describes the study and lists the measures taken.

No improvement in safety on level crossings

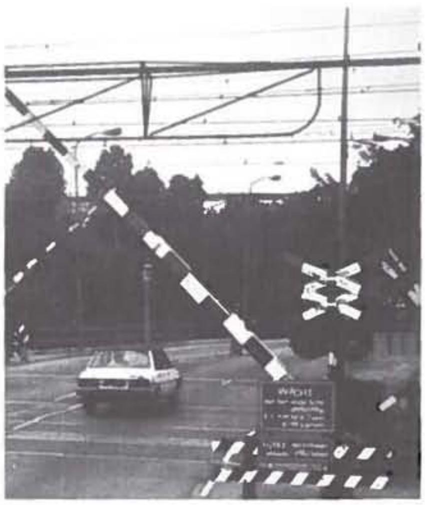
While the annual fatalities due to traffic accidents fell from 2,546 in 1974 to 1,615 in 1984, those due to accidents on railway level crossings remained at around 50. Not all collisions with trains resulted in fatalities: two in five resulted solely in damage to property.

In 10% of the fatal accidents a "second train" was involved. Evidently there are road users who take little notice of the warning systems at crossings but instead look to see if a train is coming. They then base their behaviour on the passage of the train they are looking at and do not notice one coming from the opposite direction. Another 10% of all cases involved road users being dazzled by the sun.

SWOV carried out an exploratory survey of the literature to find further explanations for accidents at level crossings using a model of the accident process: an analysis is made of the decisions a road user makes in traffic, the possible underlying motives and his reactions in problem situations. The model is divided into a number of phases; in each phase the relationships between the driver, vehicle, road and environment factors are different. The situation becomes more critical for the road user in each successive phase: he has less time to make corrections and fewer behaviour options available. The model was used to structure the literature.

Conspicuousness
It was found that most of the information available on accidents at level crossings relates to the conspicuousness of the crossing and the warning system; little is known on the behaviour of road users. According to Nederlandse Spoorwegen (Dutch Railways), however, there are millions of cases of drivers "jumping the lights" at level crossings every year. A higher proportion of accidents take place at level crossings protected only by an automatic flashing light system than at those with half barriers as well. It is assumed that poor visibility of approaching trains and possibly inadequate understanding of the warning system, combined with the tendency of motorists to jump the lights, are factors in the occurrence of accidents. The literature gives no indications of other explanations. There is scarcely any information available on the circumstances in which collisions with trains have a less serious outcome.

SWOV presented its report to the Safety of Level Crossings Steering Group, which is to make recommendations to the Minister of Transport and Public Works. Research is also taking place in this context. The Steering Group contains representatives of central government, Nederlandse Spoorwegen, the local authorities and SWOV.



Extensive study into safety of roads

As part of its "Safety Criteria for Traffic Facilities" research project SWOV has produced a report on the so-called Class I network or trunk road system, which comprises mainly motorways and trunk roads. This attempts, having identified the various (a) road, traffic and traffic behaviour factors and (b) road accident factors, to analyse the relationship between them. The ultimate purpose of the project is to serve as a basis for recommendations on measures concerning the design, surfacing and immediate environment of roads. An important point is the classification of roads and road networks on the basis of their traffic function. The Class I network has been assigned the highest traffic function and has been analysed first because of the relative ease of access to the various road, traffic and accident data. The project was commissioned by the Traffic Engineering Division of the Public Works Department and involves the collaboration of numerous public bodies.

Survey

A special form was used for the survey of road and traffic factors, which was carried out with the cooperation of the national and the many provincial Public Works Departments and other highways authorities in the Netherlands. In total over 2,000 km of road was surveyed for relevant factors, with a division into roads and intersections. The accident survey was restricted to accidents involving casualties (injuries and fatalities) in 1979 and 1980: these data were obtained from the Traffic Accident Records Division in Heerlen, whose location coding system was also used to relate road and accident factors.

Analyses

Before actually analysing the relationship between the road and traffic factors and accident data that had been assembled, the road and traffic factors were classified. This was done (in the form of a "homogeneity" analysis) using computer programs which are able to provide an optimum analysis of many factors simultaneously. The unique feature of these programs, developed jointly by the Data Theory Department of the University of Leiden and American universities, is that the factors can be on different levels, e.g. qualitative factors such as the presence or absence of something and quantitative measured data such as traffic intensities. Within the homogeneous groups of factors the relationships between these qualitative and quantitative data and accident data were investigated.

Results

First of all we found it was perfectly feasible to identify homogeneous groups. 708 sections of road were classified into six groups; only 72 sections could not be classified in this way. Weekday traffic intensity gave little pre-indication of the injury accident rates for the homogeneous groups in general, but the relationship was fairly well marked in the case of the 2x2-lane motorways group: 40% of the accidents were explicable in terms of weekday traffic intensity.

"Key figures" were subsequently used in the analysis as an expression of accident rates (in this case the number of injury accidents per kilometre of road or vehicle kilometre). Low key figures were found for roads higher in the hierarchy (within the same intensity category): a reduced conflict potential on these roads may be a factor here.

Relatively high accident rates were found for a number of groups in the highest intensity category: this shows that a particular intensity limit should be taken as a criterion of safety when deciding what category of road is required. It was not possible at this stage, however, to classify the data in sufficient detail to indicate what the limit should be.

The data did not prove suitable for testing certain hypotheses, mainly because there were too few non-homogeneous groups (in which it was hypothesized that accident rates would be higher).

The report concludes with recommendations for follow-up studies and analysis on the Class I network, in particular 2x2-lane motorways, on which the data available are more than adequate.

Electronics in traffic

SWOV has presented a report on electronics in traffic to the Road Safety Council; the Conference of European Ministers of Transport (CEMT) also asked SWOV for a report on the subject. The aim of both reports is to provide a more solid basis for discussion of the use of electronics in traffic in general, and road safety in particular, and to survey the possibilities and gaps.

Electronics covers a wide area, from anti-lock systems which maximize vehicle braking power to designs for complete traffic guidance systems which would virtually take charge of road users and deliver them at their destinations. Knowledge and techniques have grown enormously in recent years. Microelectronics is beginning to find a place in traffic, but its application often depends on random factors. The government has not yet developed a policy to control the introduction of electronics in traffic. In view of the rapid developments taking place - some of them perhaps undesirable - and the existing possibilities it is high time to take matters in hand.

Electronics influences the activities of individual road users on the one hand and central/local government, highways authorities, the police etc. on the other. In many cases the effects are interactive. The authorities, for example, may be interested in influencing individuals' decisions on destination, timetable and route. Road users will often benefit from information which can be supplied by the authorities, e.g. on traffic congestion, roadworks, accidents and weather conditions. Electronics can assist with particular tasks or take them over completely; it is even possible to take over the whole chain of observation, decision-making and action and the associated risk control.

Caution is called for with the introduction of electronic systems in traffic. To a certain extent they work like the human brain: observations are made, the information is processed and there is then an output - decisions and actions. It is very important for the information fed into the system to be extremely reliable. Experience shows, however, that this is often difficult to achieve. The correct processing of the information (by the software) requires a very good understanding of the way traffic works.

Motorway signalling systems

Traffic regulation systems on motorways have been used increasingly in recent years to increase their capacity and improve road safety. Signalling systems that inform road users about hold-ups and roadworks were introduced in 1981 and 1982 on some sections of motorway in the Netherlands which carry heavy traffic (the A13 and parts of the the A16 and A20 near Rotterdam and the A2 and A12 near Utrecht). The system comprises lane indicators and recommended speed indicators (in the form of overhead illuminated matrix panels). Various other countries use systems designed not only to provide information but also to control traffic flows, e.g. by indicating alternative routes.

The advantage of a signalling system is that it can influence drivers' behaviour if circumstances so require. A system that reacts rapidly enough to changes in the situation gains in credibility, with the result that more and more drivers are likely to adapt their behaviour accordingly.
The main effect of systems designed to inform road users of hold-ups is in reducing the numbers of secondary accidents. The information can be given in the form of words or speed indications; in the latter case the effect is to reduce the range of speeds. Signalling systems can be particularly effective in bad weather conditions, e.g. fog and ice. Different road users assess the risk of such conditions differently, which can

result in relatively large speed differences. A recommended speed indication may reduce these, especially if the cause (fog, ice, hold-up) is also shown.

Cost-benefit studies of signalling systems suggest that they are more economic the worse the accident rate on the section of road in question. In the Netherlands it seems that the cost-benefit ratio of traffic signalling systems is better on the A 13 than on the A2/A12. It is not feasible at present to introduce electronically controlled corridor systems, owing to the absence of suitable parallel routes with good interconnections.

Steep slopes

Steep slopes along the edge of roads are a danger to vehicles leaving the road. The danger can be reduced in various ways: by widening the shoulder at carriageway level, by making the slope safer or by guarding it with a safety barrier. The report recently published by SWOV looks at the second approach: what form should a slope take to prevent injuries to vehicle occupants in the event of an accident? The answer to this question involves three aspects of slopes: angle of inclination, height and radius of curvature.

Method

The study began with life-size trials, which were needed to establish whether a mathematical model was capable of accurately simulating accidents on slopes. The trials were carried out with a medium-weight car on slopes along the A15 trunk road, which was not yet open to traffic. The computer model used in the first simulations was MAMIAC (Mathematical Model for Impact Against Crash-barriers). During the study the more advanced and universal VEDYAC (Vehicle Dynamics And Crash Dynamics) model was developed. This is capable of simulating moving bodies such as vehicles as well as fixed objects such as a road surface or obstacle, and thus enables various collision factors to be analysed. Retardation forces can be calculated, for instance, which enables the risk of injury to occupants to be estimated. The advantage of simulation techniques is that the influences of various factors on an accident or incident on a slope can be investigated cheaply and in a reproducible manner.

The study looked at incidents where no vehicle manoeuvres took place: the vehicle descends the slope at a particular angle in a straight line. The conditions were as follows: motorways: an approach speed of 100 kmph and an approach angle of up to 20 degrees; other roads: approach speeds of 80 and 60 kmph and an approach angle of up to 30 degrees. Since in incidents of this kind the vehicle is still travelling at a high speed when it reaches the foot of the slope, the results apply only to situations where there is a wide area without obstacles or ditches there. The report details the findings of the various simulations.

The results of the study, which was carried out for the Traffic Engineering Division of the Public Works Department, will enable the government to draw up or amend guidelines for the cross-sectional design of roads and to decide whether it is necessary to guard slopes. Drivers' steering and braking manoeuvres will be simulated in a follow-up study.

Heavy vehicles must be made safer at reasonable cost

While buses and heavy goods vehicles (HGVs) are very important and often indispensable means of transport, they present the greatest dangers to other road users. Measures are needed to reduce the danger and if possible increase their profitability.

Buses are about twice as dangerous as private cars in terms of injury accidents per million kilometres travelled; in terms of fatal accidents they are about three times as dangerous. The rates for HGVs are somewhat lower, about the same as private cars as regards injury accidents and about twice as dangerous as regards fatal accidents. Relatively few casualties are met with among occupants of buses and HGVs; most are found among car occupants and - the highest proportion - pedestrians and cyclists.

The differences between the responsibilities of the professional driver and the average private motorist are outlined, as are the technical differences between the types of vehicles.

Heavy vehicles could be made safer by improving braking systems, incorporating front and rear collision zones and fitting side guards. SWOV noted that introducing measures piecemeal would not always be beneficial to the social function and safety of heavy vehicles. A follow-up study will therefore be carried out to indicate the main points of an "integrated" policy on heavy vehicles, i.e. the effects of various possible measures will be contrasted and examined from the users' standpoint (the economic factor).

Stationary HGVs
Collisions with stationary HGVs are a relatively frequent type of accident, causing over 20% of all deaths and serious injuries in accidents involving HGVs (200 out of 900 in 1982 as against 360 out of 9,000 - 4% - in the case of private cars). Forty percent of these cases involved stationary trailers or semi-trailers. SWOV presumes that darkness and loading and unloading were important factors here.

Other hazardous situations
There are certain features of HGVs that can produce hazardous situations in conjunction with their environment (other road users and traffic situations): their size, weight (as much as 50 times heavier than a private car and 800 times heavier than a pedestrian), aggressive construction (high rigidity, absence of crumple zones and lots of parts a person could become caught in or beneath). The lack of streamlining can cause wind turbulence which can be a problem for smaller road users. HGVs also have relatively poor roadholding and there are big differences between their handling qualities loaded and unloaded. The braking system is set for a compromise between the two, resulting in relatively poor braking performance and - perhaps more seriously - lack of stability when braking, which can cause the much-feared phenomenon of "jackknifing". Add to this the poor acceleration and often inadequate rear and side visibility and we have a major problem. Consequently in relation to distance travelled HGVs cause significantly more fatalities among other road users than other vehicles (except buses) - five times more than private cars, for example.

Possible measures
The following measures could be envisaged in the short term:
1. The use of anti-lock systems, which enable the braking system to be used to full advantage and prevent jackknifing - not cheap, but if just one emergency stop is carried out the system could repay its cost in terms of reduced tyre wear.
2. Improving drivers' side and rear visibility. Every year in the Netherlands some 20-25 cyclists and moped-riders are killed in collisions with HGVs turning right. Better and better mirror systems are being fitted but not yet universally.
3. Reducing splash and spray by using effective splashguards in conjunction with wheelguards and spoilers on cabin roofs (these reduce turbulence and thus spray). The investment in these features is also repaid in lower fuel and cleaning costs.

In the longer term it is a question of introducing well-drained skid-resistant road surfaces throughout the road network. These would reduce not only the amount of spray but also the number of accidents involving skids (saving yet more money!) and reflection dazzle. A highly open form of hot-rolled asphalt would meet these requirements.

The future

Streamlining could be still further improved by fitting lateral spoilers and aprons to the underside of HGVs, thus reducing fuel consumption still further and preventing smaller road users from being caught in or beneath part of the vehicle. Chassis should be shortened at the front and rear and crumple zones fitted; if well-designed these could also help reduce fuel costs. Other features of the "HGV of the future": an improved, self-aligning mirror system, a system to prevent damage to persons and objects when reversing, seat belts for accupants and good-quality fire extinguishers. A vehicle of this kind will of course be more expensive but also considerably more economical (and therefore cheaper to run) and safer.

Regular vehicle testing must be combined with other measures

The system of regular vehicle tests recently introduced in the Netherlands (know as the "APK") is expected to have effects on safety, the environment and the state of repair of the country's vehicles. It is useful, of course, to know precisely what the effects are. With this in mind the Road Transport Department RDW has asked SWOV to devise a suitable method. The first step is to find out what effect the system has on the state of repair of private cars. It is important to separate the results of general trends in the mix, quality and use made of the national "fleet" from the effects of the system; the latter can be isolated by comparing groups of similar vehicles before and after the introduction of the system. Age of vehicle and annual mileage are factors here, as is the social status of the owner (which has an effect on maintenance). The data will have to be collected from random police roadside checks on some 1,000 vehicles a year (aged over 10 years, 7-10 years and 4-7 years).

The proportion of car accidents in which a technical defect is a principal cause is about 2-6%. The figure for "contributory factors" ranges from 8% to 21%. The majority (about half) of the principal causes are defects in the braking system; a quarter are tyre defects. There are the conclusions from studies of the effectiveness of regular vehicle testing carried out in the United States, Australia, West Germany and Sweden. The Road Transport Department RDW asked SWOV to study over 40 reports and other documents relating to the results of regular testing of private cars. It emerged that there was no direct observable connedtion between regular testing and road safety. One explanation for this could be that the tests detect only a small proportion of major brake and tyre faults. Given a period between tests of one year such faults are likely either to have been repaired or to have had consequences already, possibly an accident. Thus the rest is more or less random.

SWOV believes, therefore, that regular testing should be combined with other measures, e.g. a fault indication system in vehicles. The tests do have a beneficial effect on the average state of repair of vehicles, albeit a slight one. The SWOV study was part of research into improving the returns from the tests carried out by the Road Transport Department RDW, for which SWOV is providing advice and other services. SWOV is also involved in evaluating the APK system and is examining the connection between maintenance and road safety.

Emergency vehicles too often involved in accidents

In 1983 and 1984 there were 153 injury accidents and fatal accidents in the Netherlands involving ambulances and fire brigade and police vehicles. The total number of casualties was 219, 77 of which were in the emergency vehicle at the time of the accident. In about 40% of the accidents the emergency vehicle was using its emergency signals (flashing lights and multiple horn). SWOV carried out a survey of accidents involving emergency vehicles at the request of the Royal Dutch Touring Club ANWB.

Rules and regulations

Drivers of emergency vehicles on urgent missions making use of their special powers and dispensations drive in such a way as to cause increased risks. The statutory legislation, instructions and working regulations deal with the urgency of missions, the use of signals and the special powers and dispensations in detail. It emerges that not all high-risk actions by these drivers are justified. Drivers of emergency vehicles must at all times ask themselves whether the need to use their special powers is sufficiently strong to warrant the often increased risk to road safety. They must also decide whether other road users can see and hear their emergency signals.

Numbers and nature of accidents
Most accidents involving emergency vehicles took place in built-up areas. The majority of accidents where signals were used took place at intersections; in over 60% of them the emergency vehicle jumped the lights. Almost a third of accidents involving police vehicles occurred when chasing and stopping suspects. Urgent journeys by ambulance are over three times as dangerous as non-urgent journeys.

Possible solutions
First, the legislation on emergency vehicles and the rules for other road users could be changed, an all drivers of emergency vehicles should be given special driving instruction. In addition, the number of journeys where unjustified use is made of special powers should be reduced by applying the rules strictly and enforcing them more effectively: for example, vehicles jumping the lights at intersections should do so at low speed in accordance with the rules.

Need to improve safety of moped and motorcycle riders

A drastic improvement in the safety of moped and motorcycle riders could be achieved by developing a new type of moped and discouraging the use of fast motorcycles and mopeds. The effects of merely modifying and tightening up the standards for vehicles and riders (driving licences, technical improvements etc.) are likely to be restricted.

Risk
Moped and motorcycle riders run a relatively high risk of being involved in road accidents. For every fatality among collision partners with mopeds there are nine fatalities among moped riders; the ratio for motorcyclists is 1:4.6. If we add hospital casualties the figures are 1:6.5 and 1:4.7 respectively. The risk of death in terms of fatalities per 10^8 traveller-kilometres is again particularly high for moped and motorcycle riders: as against a figure of 4 for cyclists - already a vulnerable group - the rate for moped riders is 10 and for motorcyclists as high as 21. This latter difference is due largely to the high average speeds of motorcycles. Both motorcycles and mopeds are used mainly by teenagers and young adults. With any type of vehicle new users run a high risk: it need come as no surprise, then, that the accident rate for moped riders is highest among 16 and 17-year-olds; the peak among motorcyclists occurs a year later.

Other factors that contribute to the relatively high risk are the lack of stability of the vehicle-rider combination and its lack of conspicuousness due to the narrow outline. The fact that this category of road users is relatively uncommon also results in alow expectation rate among other road users. Lastly, these vehicles offer little protection to their riders in a collision.

Collision speeds
A SWOV study into the relationship between pre-collision speed, collision speed and outcome of collisions between two-wheeled vehicles and motor vehicles shows that, to achieve a major reduction in serious and fatal injuries among the riders it is necessary to keep the speed of collisions below 30 kmph. Four foreign accident studies were looked at to compare the theoretical and practical relationships between pre-collision speed and collision speed and between collison speed and outcome. In virtually all the studies the "front of car against side of cycle/moped" type of collision was the most common, a typical "intersection accident" which is also predominant in the Netherlands. The foreign studies are not relevant to the Netherlands in some areas, e g. where the vehicle mix or road and traffic conditions differ. Nevertheless the common ground between the various conclusions is of interest to us.

Threshold
American research shows that there are virtually no fatal injuries to cyclists at collision speeds lower than about 30 kmph. A German study indicates that the number of serious and fatal injuries is four times higher at collision speeds

above 24 kmph. There would thus seem to be a threshold collision speed, presumably somewhere between 25 and 30 kmph. This should be reflected, of course, in pre-collision speeds; unfortunately it is impossible to draw any hard and fast conclusions, other than that collision speeds are on average - as we would expect - a few kmph lower than pre-collision speeds. We do not know of any research indicating precisely how much lower.

As a general principle, therefore, it would seem that the speed of two-wheeled vehicles should be restricted to not much more than 30 kmph to improve road safety. This would also benefit pedestrians.

Modifications to private cars are also conceivable as a means of preventing injuries to riders of two-wheeled vehicles, e.g. energy-absorbing structures at dangerous rigid locations such as the front of the bonnet and window stanchions. this is not so much the case with heavy goods vehicles, where it would seem that structural solutions should be sought particularly in the area of avoiding conflicts between HGVs and two-wheeled vehicles by separating them in time and space. There are, however, improvements that should be made to the design of HGVs, e.g. side guards, which would also result in improved aerodynamic performance.

Developing the conflict method

It is virtually impossible for researchers to observe accidents as they occur, which makes the task of analysing them more difficult. In many cases historical data are used, i.e. information on accidents which have already taken place. Reconstructions are employed in an attempt to explain how they occurred.

Some other points on the occurrence of accicents:
1. Accident data provide information solely on recorded accidents: this covers only about a third of the accidents that take place in the Netherlands. Nor are those that are recorded representative of the whole: some types are overrepresented and other underrepresented.
2. Since relatively few accidents occur it is often impossible to obtain reliable data in sufficient quantity. To collect large enough quantities of accident data for statistical analysis would take too long in many cases; moreover, over a long collection period the conditions and circumstances might change.
3. The current standard records do not include detailed information on how the accidents occurred, e.g. the manoeuvres preceding an accident.

An alternative to analysing accidents is to study traffic behaviour, in particular behaviour presumed to cause danger. The system most used is the study of conflict behaviour, the number of conflicts observed often being taken as an indicator of hazard level. To analyse conflict behaviour, however, it is important to look not only at the correspondences between numbers of accidents and numbers of conflicts but also at the differences. When does a conflict result in an accident, and when is an accident avoidable? In other words, what aspects of behaviour determine the seriousness of a conflict, and in what circumstances? Thus conflicts are no longer regarded as an indicator of hazard level but as a quantity in an explanatory analysis of hazard.

A Dutch technique
There are currently about ten conflict observation techniques in use in Europe and North America. Since all of these have their advantages and limitations, as well as being developed for local conditions, there was a need for a Dutch conflict observation technique that would be universally applicable, methodologically sound and used under controlled conditions. The result is the Dutch Objective Conflict Technique for Operation and Research (DOCTOR).

Since the technique uses field observers, a manual giving clear instructions on how to use it is required to ensure that the observations of behaviour are carried out in a systematic and controlled way. The manual accordingly includes a description of the theoretical background to the conflict method, its applications, use of the technique in practice and instructions for observers. An instruction and training tape is to be provided.

Conclict Method Advisory Group
The Conflict Method Advisory Group was instituted at the end of 1984 to bring together those working in this field in the Netherlands - government bodies, research organizations and users - and ensure that the method was used correctly. The Advisory Group's activities were formalized in March 1985.

Its remit was as follows:
1. To indicate the applications of the conflict method in road safety research, i.e. in those cases where central government is the client.
2. To provide quality control of the techniques in use.
3. To guide and assist with further developments in relation to the method.
4. To encourage use of the techniques.

The aim is to coordinate the use of conflict observation techniques in the Netherlands. This will also lay the foundation for more permanent consultations on the further development and use of systematic behavioural research in road safety.

Conclusion
Provided the conflict observation and analysis method is regarded as a method for making systematic observations of hazardous behaviour as part of a road safety theory which centres on the traffic process - rather than the accidents that occur as an unwanted by-product - it will prove an excellent aid to improving road safety.

In particular, the conflict method can be used in road safety research in the following ways.

(a) As a method of detection at locations and/or in areas with relatively low accident rates (and usually low traffic intensities); even here, of course, there will be a threshold for the number of conflicts below which the work entailed is out of all proportion to the cost.
(b) As a diagnostic tool, to explain the hazards at particular locations.
(c) To study certain aspects of the accident process in depth; here the research will be more of a theoretical kind.
(d) To evaluate measures and assess their effects on road safety using "before" and "after" studies.
(e) As a criterion for deciding priorities in a programme of research into improving road safety at particular locations and/or in particular areas.

Subjective traffic risk

How did the term "subjective traffic risk" find its way into our vocabulary in the mid-seventies? The debate in the Netherlands began in connection with a report on traffic and the quality of life, which recommended improving the residential environment with such things as greenery and children's play facilities. Traffic, it said, should make less dominant demands on street space, cause less nuisance and present less of a danger. The risk of accidents should not increase with more children playing on the streets, and people should feel that they could use the streets safely. The fact that there have been no accidents in a street during a particular period does not necessarily mean that it is not unsafe, was the feeling.

Thus a second criterion of traffic risk came into being. The existing criterion was the accident rate. The new criterion was a "feeling of insecurity", anxiety that an accident might happen. This second criterion was difficult to apply, difficult to put into practice. When can we reasonably use the term "fear"? Feelings of insecurity are a "soft" yardstick, as it were, compared with the hard fact of accident rates. The terms "objective" and "subjective" risk suggest not just two different criteria but two completely different aproaches. Accident rates are the yardstick in the "objective", impersonal approach, as laid down by the experts. Everything not directly related to this is "subjective", the approach of an individual or a group of residents or road users.

The fact is, however, that accidents - fortunately - are not a daily occurrence for road users. Many researchers and bodies concerned with road safety, on the other hand, use accidents as the main source of data for their analyses. Road users are thus talking on a different wavelength from the experts. Road users talk about their problems in terms of behaviour: they notice how heavy the traffic is, how fast people are driving, that they are not given right-of-way, and conclude that the roads are unsafe for them. They cannot give an opinion in terms of accidents. The first solution to the language problem, then, is to start talking on the same wavelength. It is not really necessary to use two different quantities, accidents on the one hand and feelings or opinions on the other: the different approaches in fact relate to the same problem, merely approached from different angles.

Measures
To establish how the traffic process should be organized if it is to meet its objectives, we need analyses of the skills of different groups of road users, the strategies they use and the problems as they experience them. SWOV is collaborating with other institutions on studies of this kind to improve the effectiveness of road safety mea-

sures. Measures must also be based on the right traffic objectives: pressure groups representing road users - motorists, pedestrians and cyclists - and other sections of the population, e.g. local residents and shopkeepers, can of course participate in these decisions through the public participation procedures. For the highway managers the result could be a set of standards for the design and construction of different categories of roads, e.g. main traffic arteries, access roads and residential and shopping areas. Once the function of a road has been decided, in a traffic circulation plan, say, the types of behaviour permitted can be indicated: in a residential street, for example, a speed limit of 30 kmph might be the norm.

The danger with norms is that they may be applied too strictly and ultimately seen as an end rather than a means. Properly used, however, they can provide a framework within which decision-makers and highways authorities can assess problems and possible solutions more quickly. The important thing, after all, is how to identify road safety problems and interpret them so that suitable measures can be taken.

Conclusion

The term "subjective traffic risk" should be abandoned: it is too closely linked with the idea that road users' opinions do not correspond to an "objective" reality, or are of a completely different kind. Road users' opinions are important, because they provide information: (a) on behaviour and its potential and limitations - thus giving us objective data on the factors involved in road safety problems; (b) on traffic objectives, which influence the selection of safety measures. These objectives reflect a social attitude to traffic and are thus subjective.
This is just as much the case whether it is a policy-making body formulating the objectives or a group of road users. In other words, any person or body wishing to bring about changes in traffic has to use objective data as far as possible but also has to use his - subjective - judgement when making proposals. Road users, highways authorities, researchers and everyone else involved must put themselves on the same wavelength, irrespective of their particular viewpoints; then they can consider the best way to solve the problems of road safety with as many facts and figures at their disposal as possible.

Old people on the roads

SWOV carried out an exploratory study in 1985 for the Ministry of Transport and Public Works to ascertain what road safety problems should be given priority. Six problem areas were identified on the basis of age and category of road user: young motorists, young moped-riders, young cyclists, young pedestrians, elderly cyclists and elderly pedestrians. A closer look at the last two categories revealed that they run a greater risk of being involved in an accident and that the outcome is likely to be more serious than for many other age groups.

The average annual distance covered by car drivers and cyclists decreases as they grow older but remains about the same in the case of pedestrians. Their accident risk rises, however, and they run a high risk of being involved in a road accident. The fatality and casualty rates per 100,000 of population are higher among the elderly than in the lower age groups. Consideration certainly needs to be given to the problems of old people on the roads: if we look at the age structure of the population we find that the elderly account for a growing proportion.

The fact that the elderly are described as a problem group is not to say that they are the cause of the risk; SWOV defines an accident as a coincidence of critical factors. The analysis did however look at the factors which the elderly themselves - as well as other road users - can influence and should take into account. Various factors emerged from the analysis.

Mobility (traffic performance)
As people grow older their mobility decreases. It is determined to a large extent by demographic factors such as place of residence, socio-economic factors such as car/cycle ownership and the activities they engage in, e.g. their participation in social life and leisure activities. In general, traffic performance decreases with increasing age. Women's traffic performance, except as pedestrians, is lower than men's. The decrease begins at an earlier age for women than for men. Mobility and exposure to dangers on the roads are related. the general picture is that the risk of injury increases with age, and from a certain age women begin to run a greater risk than men of the same age. This age is different for different categories of road users, i.e. motorists, cyclists, pedestrians etc. The increase in risk begins at an earlier age for women than for men.

Skills
Certain skills can decline as a result of ageing. There can be problems with assimilating information and taking decisions in complex situations with heavy traffic travelling at high speeds. It becomes more difficult to estimate speeds and distances, especially at dusk and in the dark, and following traffic is perceived later. Walking and vehicle-handling are often less straightforward matters than at an earlier age. These changes are highly personal, and differ widely from one person to another. We can give only a rough indication of the age at which they become a factor. In general, people develop as they grow older; the process stops at a certain age and certain skills even decline. It emerges that the first signs of declining skills appear at the age of about 45, in many cases in connection with sight.

Vulnerability
The third factor in traffic risk is vulnerability. The elderly are not in general as physically resilient as young people. The concept of "lethality" is used as a yardstick for vulnerability: it is defined as the number of traffic fatalities per hundred casualties and thus represents the risk of death for a casualty in an accident. It has been found that lethality rises with age and is higher for men than for women.

Possible measures
The question, then, is in which areas we should take action. Little can be done about the vulnerability of the elderly in itself. Exposure to situations which present danger to their age

group should be avoided, not by stopping them from using the roads but by taking other steps, e.g. modifying certain situations and helping them to retain their skills as long as possible. They should also keep in practice by continuing to use the roads and thus remain in control of even the more "difficult" situations. Any problems with sight, for example, could be compensated for by increasing observation times.

The traffic and accident process can be divided into a number of phases, starting with travel behaviour and ending with the rehabilitation of road accident casualties. In the successive phases of this model the road user has less and less time to adjust his behaviour in order to prevent an accident and the resulting injury. Moreover, as the accident process becomes more advanced the road user has fewer and fewer behaviour options. This applies even more to elderly people, especially in the phases just before the collision: they need more time for "observation, decision-making and action". Critical situations are not always identified, and if a conflict situation arises they cannot just swerve or jump out of the way as young people can. In addition they are more vulnerable in the event of a collision.

There are areas where action could be taken in every phase of the traffic and accident process, e.g:
(a) Mobility could be improved by educational work to stress the importance of keeping in practice with certain routines and skills, providing training courses, taking infrastructural measures and providing optimum public transport facilities.
(b) Special pedestrian and cycle routes could be provided and vehicles modified (e.g. the step could be lowered on bicycles).
(c) The behaviour of motorized traffic could be changed and the complexity of traffic situations reduced.
(d) The collision speed of cars could be lowered, their rigidity reduced and their shape improved.
(e) Medical assistance at accidents could be improved by knowing about patients' physical condition and the medicines they are taking.

These and associated points offer numerous opportunities for improving road safety for the elderly. The problems of elderly cyclists and pedestrians should be tackled together as far as possible, however, since any intervention in part of the traffic system can affect other parts. The aim should therefore be to achieve the greatest possible coordination between the various parts and between the total system and the social environment in which it operates.

Drink-driving and police surveillance

Research is taking place as part of the national Targeted Traffic Surveillance Pilot Scheme into how traffic surveillance could help cut down dangerous behaviour on the roads and thus improve road safety. SWOV is carrying out one of the studies, on the effectiveness of surveillance of drink-driving, in collaboration with the University of Leiden. "Opinions on surveillance of drink-driving" is a report of a poll conducted among police officers to provide information on the police attitude to enforcing Section 26 of the Road Traffic Act, the associated problems and their opinions on the matter. Recommendations are finally made on how to make surveillance more effective.

The results of the study may be summarized as follows. The police officers questioned emerged as a relatively homogeneous group as regards their opinions on drink-driving and the value of surveillance. They recognized the seriousness of the problem and had a positive and fairly optimistic attitude to what could be achieved by surveillance. They believed that problems were quite likely to arise in the course of such surveillance because of various practical limitations. They were in favour of more intensive use of traditional methods of surveillance, e.g. normal patrols and selective breath-testing, provided sufficient manpower and good equipment were deployed. The majority of the respondents believed that drink-driving was a prime cause of road accidents; there was a tendency to overestimate the percentage of drunken drivers at weekends significantly. The expectation was that swifter justice, harsher penalties and improved surveillance would have a major effect on drink-driving. Other measures, such as improving public transport or trying to control alcohol consumption, were expected to have much less effect. In general it was the view of police officers that there was too little surveillance of drink-driving. The reasons they gave were:

(a) insufficient time of manpower,
(b) dissatisfaction with the testtube and blood test as a means of proof, and
(c) insufficient prosecutions and over-lenient sentencing.

The report makes recommendations for measures in the areas of training, equipment, internal communications, investigation guidelines, feedback regarding the effect of police action and the implementation of new surveillance strategies.

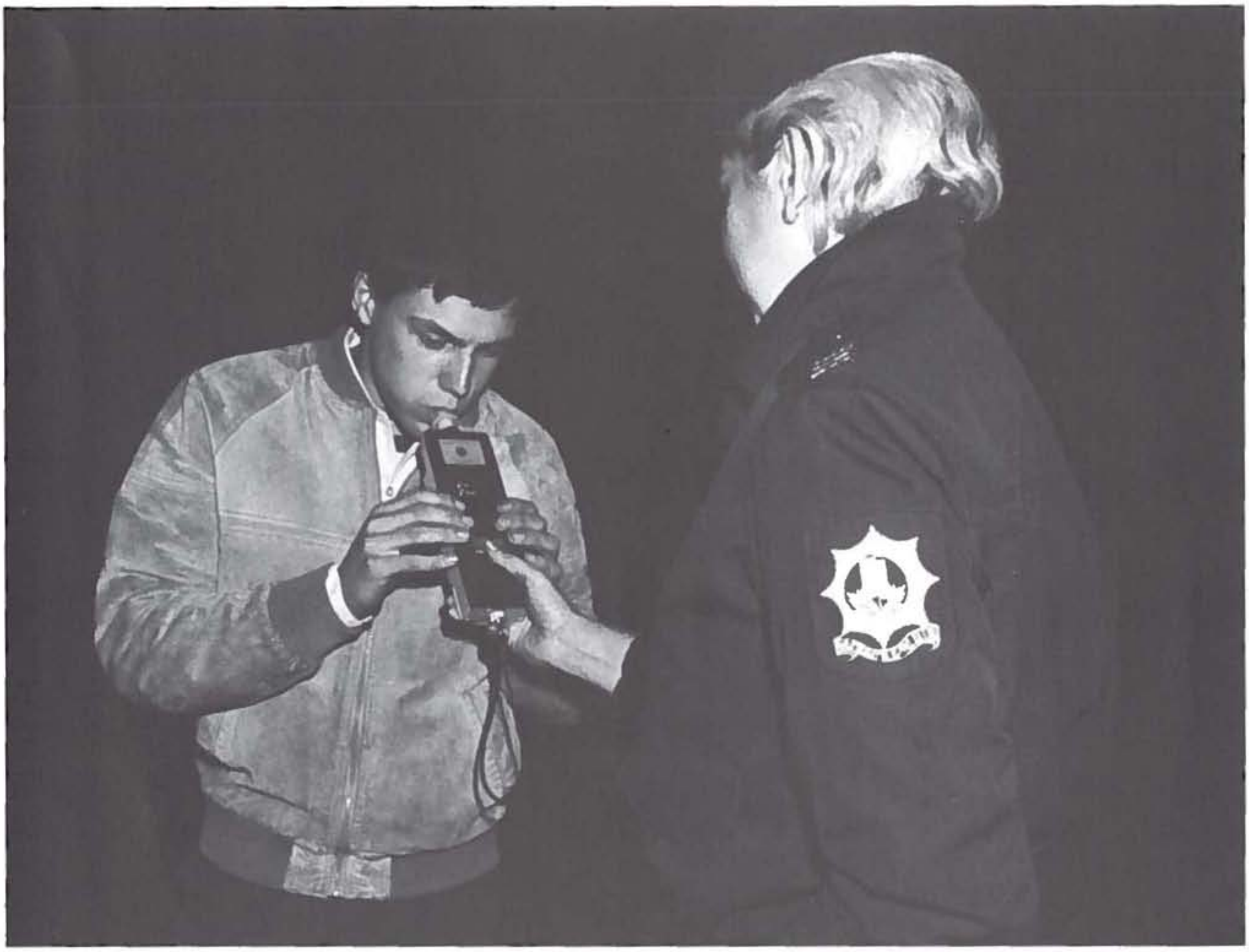
New method of alcohol testing

SWOV is carrying out research into the effectiveness of police surveillance of drink-driving in collaboration with the University of Leiden. The first study was a poll conducted among police officers; the second was a practical experiment carried out in the field with the cooperation of police forces in Utrecht, Nijmegen and The Hague.

Drink-driving presents a major threat to road safety. It is not likely, however, that the police will be able to deploy any more manpower to deal with it than at present, and so it is important to increase the effect of their current efforts.

An trial of two different approaches to breath-testing took place on weekend nights in autumn 1984. Police officers dealt with some 900 motorists selected at random. In the first approach the officer dealt with the stopped motorist in the customary fashion: he had to assess whether a breath test was needed and to give an estimate of the BAC (blood alcohol content). If he decided that a breath test was necessary, the motorist had to provide a sample of his breath; any further steps depended on the result. If the officer decided it was not necessary to test the motorist's breath, a research worker asked the latter to volunteer for a breath test which would have no further consequences; the research worker then recorded the BAC. This approach was referred to as the "personal judgement" approach.

The second approach entailed breath-testing every motorist who was stopped. The research workers asked the officers to estimate the BAC so as to indicate whether a test would have been carried out under "normal" circumstances. This approach was referred to as "breath-tests for all". In both cases the motorists involved were questioned on such things as their driving and drinking habits and experiences of surveillance. The BAC was measured using breath-testing equipment. The comparison between the two approaches indicated how many over-the-limit motorists were passed over in the normal approach and what the police officers thought of a new approach entailing the testing of every motorist who was stopped.
The most striking results of the survey were as follows.
1. Despite the fact that about 770 of the motorists stopped had a BAC below 0.5 ppm, the police officers thought that one in four of these needed to be tested.
2. The police thought that one in three of the motorists who were over the limit (BAC above 0.5 ppm) did not need to be tested. In other words, over 30% of those over the limit were able to drive on unprosecuted.
It should be noted that the police officers applied a very strict criterion: if they had any suspicion that a driver had consumed alcohol they performed a test. Clearly it is difficult for officers to estimate the BAC correctly; high BACs in particular were often underestimated.



One solution to this problem might be to adopt the "breath-tests for all" approach.
The police did not have a very high opinion of this approach. Over 18% of them regarded it as unnecessary and exaggerated, 9% said it was too time-consuming and just under 50% considered it unfair to test a motorist's breath if there was no suspicion of alcohol consumption. The vast majority of the motorists, on the other hand, considered it justifiable that they had (a) been stopped (96%) and (b) asked to give a sample of breath (90%). Those who considered being stopped and obliged to undergo a breath test unjustifiable were mainly the ones who suffered adverse consequences as a result (e.g. driving ban or blood test).

The following are ways of increasing the effect of the current level of surveillance:

1. Subjecting every motorist stopped to a breath test.
2. Offering the police the possibility of dealing with offenders in such a way that they are prosecuted and sentenced quickly, for example by using breath test instead of blood tests, improving clerical procedures (e.g. by computerization), and allowing the police to impose on-the-spot fines in the case of low BACs.
3. Regularly moving the location of the roadside checks.
4. Using better testing equipment than the test-tube.
5. Making it clear to the public that the drink-driving problem is being tackled seriously, e.g. by making police checks regular and conspicuous and publicising them well.
6. Checking alcohol consumption when doing other types of roadside checks.

Seat-belt wearing in the Netherlands

The Ministry of Transport and Public Works' Medium-Term Plan for Road Safety, 1987-91, sets a target of 25% fewer deaths and injuries on the roads by the year 2000. Improving the wearing of seat belts is one of the main points on the agenda.

In the Netherlands wearing of seat belts was made compulsory in June 1975 for drivers and front-seat passengers of cars built in or after January 1971. Seat belts were fitted to all cars in the Netherlands by 1979. Before this legislation came into force seat belts were worn by 13% of drivers on urban roads and 28% on rural roads. One year after its introduction the figures had risen to 49% and 67%. A record was reached in 1980, with 57% and 73%. The rates then fell to 50% on urban roads and 67% on rural roads and have remained constant for a number of years. It should be noted that the rates are highest on motorways and decrease with the class of road. Merely making seat-belt wearing compulsory is not enough, then, to achieve 100% compliance. In general we are unable to say why people do not wear their belts.

Research into seat-belt wearing has also been done in other countries. There are reports from some countries that compulsion has encouraged their use and that there has been a reduction in road accident casualties. These studies do not support the "risk compensation theory", according to which drivers who wear belts take more risks.
Campaigns to encourage people to wear seat belts must be based on compulsion and instil the habit of always wearing them. There are various ways of doing this. A pilot scheme carried out in the Province of Friesland suggests that a combination of police enforcement of seat-belt wearing and a publicity campaign has a positive long-term effect, i.e. the percentage of people wearing them rises. We need to examine what amount of police enforcement and publicity has the optimum effect. Another method entails rewarding those who wear seat belts: this has not been tried in the Netherlands, but there are favourable reports from America. A third approach, which could be described as "demonstrational", involves using simulations of collisions (a) with seat belts worn and (b) without seat belts to show the difference.

Another way of motivating people to wear seat belts might be through the industry, which could provide belts adapted to individual wishes or use different materials which would make them more comfortable to wear. There are also developments in the area of airbags; in this connection the government should encourage innovation in the industry. Why should there be standards for vehicle exhaust gases (for environmental reasons) but none for the development of cheap, effective, user-friendly seat belts?

Effects of a car seat belt campaign in Friesland

Seat belts are considered to be one of the most effective means of protecting motorists against against fatal and serious injury in an accident. The statutory obligation to wear seat belts is a major means of encouraging their use. Many countries, however, including the Netherlands, are finding that a legal obligation is not enough to make their use universal. Thus the Friesland Regional Road Safety Authority decided to launch a campaign to encourage the use of safety belts in Friesland. This consisted of a combination of police surveillance and education and publicity work. The Road Safety Directorate DVV of the Ministry of Transport asked SWOV to evaluate the effects of the campaign and to analyse and report on the results.

The main features of the campaign, which began in August 1984, were surveillance, information and publicity through the media, distribution of

leaflets and stickers and demonstrations of falling cars and simulated collisions. A large number of organizations took part, including the Dutch road safety organization Veilig Verkeer Nederland and the Royal Dutch Touring Club ANWB. The police invested some 2,800 man-hours in surveillance (this did not, however, represent a substantial increase). Some 41,000 motorists were checked for use of seat belts: about 1,300 were given on-the-spot fines. The actual time involved in surveillance varied from one force to another and from one month to another. The tip of the province of North Holland, where there was no increase in surveillance, was used as a control area. An important detail: Veilig Verkeer Nederland was carrying out a national publicity campaign at the same time as the campaign in Friesland. The national campaign covered both the trial area (Friesland) and the control area (the tip of North Holland); the difference in the trial area was the special activities. A series of observations was carried out in both areas. During the survey period, which lasted from a few months before the beginning of the campaign to twelve months after its completion, five series of checks on weekday use of seat belts by individual motorists were carried out. The observations took place in both built-up and rural areas. Half the motorists involved were given questionnaires to fill in; about 46% of these were returned.

Results

There was a distinct increase in seat belt use in Friesland in both built-up and rural areas as a result of the campaign. There was also a longer-term effect which lasted at least twelve months after the end of the campaign. No major changes were found in the control area.

Young and/or male drivers tended to use seat belts less. The campaign was not found to have different effects according to sex or age: the effects on men and women and the various age groups were the same.

The questionnaire included a large number of topics, e.g. the circumstances in which seat belts are worn, reasons for not wearing one and whether the respondent was aware of the publicity campaign. It emerged that motorists in the campaign area were fairly well aware of the campaign: they had heard about it on the radio or in conversation with other people or read about it in the newspaper, etc. More motorists in Friesland said that they wore their seat belts after the campaign. They also had a relatively good opinion of the legislation, surveillance and publicity. More of them believed that a lot of notice was being taken of seat belt use. The side-effects were thus more positive than negative.

The survey shows that an intensive campaign combining surveillance and publicity can produce a considerable change in the use of seat belts with results that are still apparent even after some time. Organizing police work and motivating officers in campaigns of this kind is something of a problem. Often it is less important what the police do and how much they do as long as road users are under the impression that they are under close scrutiny. The results show that habits can be acquired with a corresponding change in opinions. It is to be hoped that the campaign will result in more permanent changes in behaviour, since it has been calculated that such safety measures are cost-effective.

Fewer casualties with daytime use of vehicle lights

Every year dozens of deaths could be avoided if all motor vehicles, including private cars and heavy goods vehicles, were to use their lights during the daytime: also, hundreds of people would be spared hospitalization as a result of a road accident. This is the finding of a recently published SWOV report of a study carried out on behalf of the Netherlands Association for Automobile Insurance NVVA.

Swedish, Finnish, Canadian, American and other research into the effect of introducing vehicle lighting during the daytime shows that there is a significant reduction in accidents involving one or more motor vehicles in collisions both with slow traffic and with other fast traffic. In the Netherlands, with its densely populated areas and a slightly more southerly location, the potential overall reduction in accidents and casualties has been calculated at approximately 5%. Many motorcyclists and scooter-riders have for some considerable time been using their lights during the day voluntarily; legislation for this category of road users is in preparation.

Dipped headlights not suitable
The report discusses various forms of daytime lighting. Dipped headlights, it says, are the least satisfactory form, since they can dazzle other road users and are a rather expensive solution. Other possibilities, e.g. brighter sidelights or additional lights, would seem to be more suitable. Daytime lighting entails certain costs, for higher fuel consumption, minor modifications to vehicles, replacement bulbs etc. It has been calculated that the additional expense is more than justifiable in terms of the benefits: fewer accidents would mean much less expenditure on the treatment of casualties, repairs to vehicles, etc.

Slow traffic
Daytime visibility of motor vehicles is improved by the use of lights. This enables "vulnerable" road users to see them sooner and better. SWOV does not concur with the often-heard argument that cyclists and pedestrians would be at risk because they would be less conspicuous among the better-lit vehicles. There were no indications of harmful effects on slow traffic from the study: substantial reductions in casualty figures were also reported among cyclists and pedestrians.

Measures
In SWOV's opinion it is in the interests of road safety to consider making it obligatory for motor vehicles to use lights during the daytime. We recommend raising the topic at international level. It could also be investigated in more detail whether there might be harmful effects in the Netherlands, and if so, on what scale. Lastly, the various types of lighting and the conditions under which it should be made obligatory will have to be examined.

Provisional driving license suggested

Certain conditions are attached to the issue of a car driving licence: in the Netherlands the applicant must be at least 18 years of age and have passed a theoretical and practical test, among other things. Some countries first issue a provisional licence, which may entail restrictions on driving or a requirement to take supplementary courses of instruction. Alternatively, the holder may be required not to be involved in an accident or commit a traffic offence. In some countries these conditions are combined. A full licence is issued only after a certain number of years. In general the purpose of the provisional licence is to restrict the behaviour options of the new motorist or channel his behaviour so as to reduce the risk of accidents.

The Netherlands
Provisional licences are not issued in the Netherlands, though the Ministry of Transports Medium-Term Plan for Road Safety, 1987-1991, mentions the possibility of introducing them. SWOV is in favour of provisional licences and suggests that they should impose restrictions on new drivers and require them to take further instruction.

Risk of accidents
On average, young learner drivers of 18 to 24 run three times as much risk of an accident in relation to mileage as older, experienced motorists of 35 to 54. Their risk of injury in relation to mileage is as much as four times greater. There are three factors in this increased risk: (a) lack of experience, (b) age-related characteristics and (c) more driving in high risk conditions, e.g. at night (especially at weekends).

Ban on night driving
The instruction they receive is not sufficient to produce experienced drivers; practice is also an important teacher. The most high risk conditions should be avoided in the beginning. A step-by-step learning process is necessary for experience to be gained. This is why restrictions such as a ban on night driving, a complete ban on alcohol consumption by drivers and/or area restrictions are needed.

Over a third of casualties among young motorists occur between 22.00 and 7.00 hrs. On weekend nights the risk for young male motorists is eight times higher than for male motorists aged 35 to 55.

Additional police surveillance would not be essential if the penalties for breaking the rules were of the right kind, e.g. renewal of the restrictions, and rewards are given, e.g. lower insurance premiums for avoiding accidents and driving under parental supervision.

Courses could be given to supplement the basic driving instruction during the period of validity of the provisional licence. These should concentrate on recognizing dangers and feedback of information on drivers' own behaviour.

Points system
In some countries provisional licences operate on a points system. If a certain number of points are awarded against a driver for accidents and offences he is obliged to take a supplementary course. This is a way of providing special treatment for "problem drivers". Research findings, however, do not indicate that there is sufficient reason to link provisional licences to a points system: the number of points gained is determined not only by behaviour but also, to a large extent, by mileage. Nor do we possess a good method of selecting high risk drivers. Future accidents can be predicted to only a very small extent on the basis of past accidents and offences.

The risks faced by new motorists are largely due - as we have seen - to lack of experience; what is needed, then, are general restrictive and educational measures.

Dozens of deaths due to incorrect use of crash helmets

Less than 20% of moped-riders in the Netherlands wear a properly secured, effective helmet. Every year dozens of riders are killed and at least five hundred are admitted to hospital with head injuries as a result of careless use of helmets. The cost to society undoubtedly runs into twenty or thirty million guilders a year.

These facts emerged from a survey in which 1,127 moped-riders in various Dutch towns were questioned and their helmets examined. It was revealed that two-thirds of them did not fasten the chin strap tightly enough, if at all; thus there was a high risk that the helmet would fall off in the event of a collision or fall. The comfortableness of the chin strap and the ease with which it could be fastened were found to be particularly important factors in its correct or incorrect use. In general, moped-riders had inadequate knowledge of the safety risks and the legal requirements concerning use of helmets.

Among the other findings were that one in five helmets lacked the type approval mark required by law and that one in three were painted, covered with stickers or damaged (some severely). Paint and glue from stickers can attack the helmet's outer coating with the result that it shatters in a collision and ceases to afford sufficient protection.

Given the findings of the survey, SWOV urges an international review of the type approval standards for crash helmets, since the situation in the neighbouring countries seems to be equally unsatisfactory. The new standards should require all helmets to be fitted with a comfortable fastening system designed to encourage correct use. To ban all helmets other than those with a press-stud fastener would be a step in the right direction. Standardized fasteners would also make it easier for those giving emergency assistance to casualties. Additional benefits are likely to result from educating moped-riders on the risks of incorrect use of helmets and the legal requirements.

Possible effects of 120 kmph limit on motorways

An increase in the motorway speed limit from 100 to 120 kmph was likely to result in more and worse accidents: this was SWOV's view as stated in a report on "Speed Limits on Motorways" presented to the Ministry of Transport and Public Works in 1985. This was based on the assumption that average speeds and speed differences would increase if the limit was increased. In the same report SWOV supported ideas on differential limits, however, provided there was no confusion or ambiguity about the various limits among road users. The various limits would also have to make sense to road users.

SWOV also considered that more police surveillance would have a good effect on road safety: the limits would be exceeded less often and by smaller margins. In this connection SWOV argued in favour of an adequate amount of rational surveillance, in other words at the most dangerous places and times, e.g. in rainy weather if drivers fail to adjust their speeds accordingly. Another suggestion was that the police could "cream off" the highest speeds by concentrating on the fastest drivers first. Lastly, the SWOV report argued in favour of a particular system of repetitive surveillance and associated publicity, which would probably increase the effectiveness of the surveillance still more. SWOV's views have been confirmed in the meantime by the findings of research into drink-driving - the "Hague" model - and the study of surveillance of seat-belt wearing in Friesland.

Government decision
The government's decision to raise the motorway speed limits from 100 to 120 kmph included explicit reference to differential limits and surveillance. Without knowing the details of the measures it is impossible to predict how much credence they will lend to the new limits and thus what the effects will be on road safety. Average speeds are likely to rise, which will make for accidents with more serious consequences. It is to be hoped that the supplementary measures will reduce the speed differences. It is possible that, on balance, the effect on motorway safety need not be unfavourable. SWOV urges that an evaluation of the effects be carried out. Conclusions on the effect on road safety cannot be drawn directly from a study using recorded accident data, however, in SWOV's opinion; these should be drawn from research into actual changes in speeds and the consequent effects on road safety over a twelve-month period.

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