SWOV in 1980

A review of research results published in 1980

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INSTITUTE FOR ROAD SAFETY RESEARCH SWOV
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Contents

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The Institute

The Institute for Road Safety Research SWOV was founded in 1962. Its object is, on the basis of scientific research, to supply the authorities with data for measures aiming at promoting road safety. The information obtained from this scientific research is disseminated by SWOV, either as individual publications, or as articles in periodicals or via other communication media.
SWOV's Board of Governors consists of representatives of various Ministries, of industry and of leading social institutions.

The Bureau is managed by E Asmussen, Director.
Its departments include Research Co-ordination, Research Services, Pre-crash Research, Crash and Post-crash Research, Methods and Techniques and Information and Scientific Editing.

As from 22 September 1981, SWOV's address is: Duindoorn 32, 2262 AR Leidschendam (in the Leidsenhage Shopping Centre).
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A list of publications, reports and articles can be obtained from the Information and Scientific Editing Department, which will also furnish further information.

Introduction

E.Asmussen
Director Institute for Road Safety Research SWOV

In the year 1980 several subjects demanded a lot of SWOV's attention. A number of contributions were made to the second National Road Safety Congress, a biennial event initiated by the Royal Dutch Touring Club ANWB and SWOV. The theme was: inequality and non equivalence in road traffic, the risks of confrontations between different categories of road users. Contextual and organisational planning was supplemented by the presentation of accident data for collisions between two vehicles of different categories, or by a vehicle with a pedestrian.
At the end of the year preliminary research was completed into road safety as part of the Demonstration project on 'Restructuring and Redesigning of Urban Areas'. SWOV supervised the eleven subsidiary reports in the field of traffic safety.
Some of the new publications related to drinking and driving, the use of seat belts, road safety in Noord-Brabant, while extensive reports were completed on traffic flow models and road side safety barriers on motorways.

A variety of publications

In order to increase the availability of research information, greater emphasis has been put on the publication of brochures and folders and on information to professional journals and the news media. The information bulletin 'SWOV schrift' proved to meet a great need.
A new brochure was published on the objectives, methods and organisation of our Institute.
The subject of drinking and road safety also called for a new brochure.
For the first time a summary was made of a report produced by a Research Group of the Organisation for Economic Co operation and Development, the OECD. This report deals with traffic safety in residential areas. SWOV usually makes a substantial contribution to these OECD reports, as also in this present case. The summary report was aimed, among other things, at greater attention being paid to these publications.
It was later used as the basis for a T.V. documentary broadcast by the AVRO Broadcasting Company on the same subject. The broadcast caused over a thousand requests for the brochure.
Especially the information bulletin 'SWOV-schrift' brought about an increase in the number of requests for our publications. The four numbers published in 1980 included eleven articles on research activities concerning the most vulnerable road users, seven relating to motor vehicles, seven on infrastructural measures and eight on research policy and procedures.

There were twice as many press releases in 1980 as in 1979. During the past year a total of 8300 publications were supplied on request: 1700 reports/publications and 6600 brochures.
The total number of brochures distributed was 14000.
A completely new information activity is the mobile stand set up with the assistance of the State Information Department RVD. It was first used at the Intertraffic exhibition in April 1980 in the RAI Exhibition Centre, Amsterdam. Three folders were produced as backing material for the stand and also as an introduction to SWOV through other channels. One gives a short review of SWOV, the second deals with four films about SWOV research which can be bought or rented from the Foundation Film and Science SFW, P.O.Box 9550, 3506 GN Utrecht, and the third provides information on the scope of the International Road Research Documentation, IRRD.

Target-group research

The big increase in requests for information and publications indicates a need for diversity in informative material. It is constantly necessary to examine whether the information presented answers the questions, whether it is adequately tailored and whether it strikes a clear note. Target-group research may be a great help in this respect.
The many requests for the brochure on 'Traffic Safety in Residential Areas' were seized upon in order to have such an investigation made among the applicants. One conclusion arrived at by SWOV was that the brochure probably had a distinct function, especially for the most important target group of our research, those more or less 'familiar' with road safety. Others, such as community groups active in making their streets safer, however, in the first place expected concrete answers to their specific problems – which are localised and moreover often go much further than road safety as such. SWOV will only be able to answer part of the questions by such groups and will otherwise have to refer them to other organisations. It again became clear that one and the same problem was defined and elucidated differently it approached from a different angle or a different sphere of interests. Information must be adapted to this so that any unnecessary confusion is avoided.
We trust that the brochure 'SWOV in 1980' will give our readers an idea of the results of our research published in the past year.

E. Asmussen
Director Institute for Road Safety Research SWOV.

Trends in road safety

The number of deaths on the Dutch roads had decreased in recent years. This trend apparently did not continue between 1979 and 1980, because 1997 people died in traffic accidents in 1980 compared with 1977 in 1979. But the 1979 figures were affected by a severe winter. If we compare the last three quarters of 1980 with the corresponding period in 1979, it is again found that the number of deaths declined.

Nature of injuries

The annual advisory report on 'Traffic Safety in The Netherlands' in 1980 gave some information on the nature of injuries of those admitted to hospital (and did not die).
Among pedestrians, cyclists and occupants of cars and other motor vehicles head injuries were the most common. In these categories, leg injuries came second, except for car occupants where bodily injuries were next to the most common. Among moped riders and motorcyclists, the proportion of head injuries was substantially lower than in other road-user categories. It has been demonstrated that this is due to wearing crash helmets. In the motorcyclist category leg injuries are even more frequent than head injuries.

Mode of road usage

The SWOV paper for the National Road Safety Congress 1980 calculated for the period 1974/78 per road-user category approximate quotients for numbers of deaths per kilometre travelled among drivers and passengers in their own vehicles and among drivers and passengers in the other vehicle in the collision. The use of cars results in 36 deaths per 10^9 vehicle kilometres, 22 of them as car occupants and 14 as other road users. As to use of bicycles and among pedestrians these numbers overall are slightly higher. A major difference compared with cars is that cyclists and pedestrians are at risk almost exclusively to themselves: 58 + 1 and 43 + 1 deaths respectively per 10^9 km.
Riding a moped is overall nearly four times as dangerous as driving a car (126 + 13 deaths per 10^9 km). Motorcycles are again twice as dangerous (206 + 47 deaths per 10^9 km).
The use of lorries and delivery vans is only half as dangerous to the occupants (10 deaths per 10^9 km) as cars, but very dangerous to others: 68 deaths per 10^9 km.
Compared with lorries, buses produce half the deaths among occupants (4 per 10^9 km) and are the safest means of transport for themselves. The number of deaths among other road users, however, is the highest: 99 per 10^9 km.

NOTE. The number of deaths among other road users includes only victims of accidents involving two road vehicles.

As regards the risk to the road user *himself*, it is more appropriate to start with the number of traveller kilometres. The quotient for car occupants is then found to be over 11 deaths per 10^9 traveller kilometres. The quotient for pedestrians and cyclists is four to five times greater, in the case of moped riders ten times greater and in the case of those on motorcycles worst of all (168 deaths per 10^9 traveller kilometres). As to buses few reliable data are available on the number of traveller kilometres. The quotient is so much lower than for other vehicles, however, that it can safely be said that this means of transport is safest of all for the occupants.

National Road Safety Congress 1980

The 1980 National Road Safety Congress was held in the RAI Congress Centre Amsterdam on 21, 22 and 24 April 1980. As in 1978, the initiative was taken by the Royal Dutch Touring Club ANWB and SWOV. Representatives of fourteen other organisations, institutes and a political party joined in preparing the theme: 'Inequality and Non-equivalence in Road Traffic'.

Incompatiblity in road traffic is the principal cause of road deaths. Most fatal accidents are caused by collisions between unequal and non-equivalent road users, in spite of separated cycle paths, speed limits, right-of-way rules and so on. Traffic inequality is determined largely by the way people use the roads. A motorist behaves differently from a pedestrian because he has different possibilities of locomotion. This makes the accident risk unequal. Age also plays a part. Young pedestrians and cyclists, for instance, run a comparatively high risk. Besides this, the consequences of collisions are not the same. In a collision with a cyclist, a motorist has greater protection than the cyclist. Hence, the various categories of road users are not equivalent to one another. It is justified to ask whether road safety can be promoted by focusing policy particularly on this inequality. What possibilities are there of this? How far can we go? How far do we want to go?

Recommendations

The theme was divided into eigh subthemes: Traffic Planning aspects, Traffic Engineering aspects, Vehicle Characteristics and Protection from Injury, Road Users' Characteristics, Political Policy-making, Policy, Implementation and Co-ordination, Norm-setting and Enforcement. The Minister of Transport, Mr.D.S.Tuijnman, also the road safety coordinating minister, opened the Congress. On the first day, papers were read on the main theme and the eight subthemes. The second day was a day of workshops on the sub-themes.
The third day was opened by Mr Pieter van Vollenhoven, Chairman of the Provisional Road Safety Council, VRV. This day was referred to as the 'harvest day'. The workshops' conclusions were discussed under the chairmanship of Mr. T.E.Westerterp, a former Minister of Transport. These conclusions, mostly with amendments, were then put to the vote.
These Congress decisions were presented as recommendations to the road safety coordinating minister. At the next National Road Safety Congress, in 1982, a report will be presented on the follow-up to the 1980 Congress.

Vulnerable

To sum up, the congress theme drew attention particularly to the risks of the **most vulnerable road-users**. The congress findings give priority to the safety of these categories.
Yet it was stated that road safety in general is still not an integral part of traffic and transport policy planning. The same applies to physical planning. The Congress believes that road safety should be a vital part in all political bodies at all levels of traffic and transport policy. This should lead to politicians having more information available on road safety, in order that they can take road-safety effects into account when assessing plans.
In decision making on road-safety policy account should be taken of the people's contributions and opinions.
The people's experience (feelings) of road hazards should weigh heavily in decision making, especially by local authorities.
An alert road-safety policy makes it necessary to decentralise duties, powers and resources within the authorities. The government should for this purpose provide local authorities with the (mainly financial) means for this purpose. The province is the most suitable local authority level for co-ordinated policy implementation.

Traffic inequality is the principal cause of road deaths

Adaptations

Setting priorities for the safety of the most vulnerable road users should lead in particular to **extensive adaptation of the traffic structure** (restructuring of roads and streets, safer amenities). Where roads and streets have a dual function (for high mobility and for strolling, shopping, playing and so on) the main function must be established and made indentifiable. If high mobility is the principal purpose, the safety of weaker road users must be better assured; if sojourning is the main function, the behaviour of motorised traffic will have to be adapted with the aid of physical measures. More than in the past, traffic engineering will have to provide the instruments for this.
Codes of conduct not felt to be 'obvious' by road users are often ignored by them. The structuring of traffic areas must make codes possible which road users themselves in these situations regard as logical, making the codes clearer and easier to apply.
Police enforcement of traffic regulations must likewise be geared to the 'obvious' behaviour of road users. For the time being the penal system will play an important part in counteracting dangerous behaviour, but it will have to be examined how to try out other methods, such as educative measures. The police must be able to deal with

more offences themselves on the spot in order that road users immediately experience and learn from the consequences of their dangerous behaviour.
Traffic education will have to concentrate on the skills of acting correctly in confrontations between different categories of road users for their own safety and the safety of others.
Research projects should directly involve local authorites. One central body should develop the requisite knowledge, methods and procedures in consultation with designers and users.

Hazards

SWOV prepared a background paper for the Congress.
It included data on traffic hazards per mode of transport, distinguishing between the risks pedestrians and vehicle riders and occupants run themselves and the risks one mode of transport involves for other modes. The risk was expressed as number of deaths per thousand million vehicle and traveller kilometres.
It was found that the risk of being killed on the road is greatest for motorcyclists, followed successively by moped riders, cyclists, pedestrians, occupants of cars, of lorries and lastly of buses.
Looking at the risk one mode of transport involves for other modes, it appears that, based on vehicle kilometres, the greatest risk comes from buses, followed by lorries and delivery vans, motorcycles, cars and mopeds (See also page 6).

SWOV cannot offer any ready-made solutions for a safer residential environment, but only a number of general principles. Road traffic is clearly one of the biggest obstacles to making residential areas more attractive. SWOV therefore focuses a large part of its research programme on traffic hazards in residential areas. In 1980 this work resulted in a number of publications. A T.V. programme on this subject was broadcast by the AVRO Broadcasting Company in close co-operation with SWOV.

Restructuring and redesigning of urban areas

In our cities the traditional variegated character of the streets has largely been lost through mass motorisation. Not only do cars take up much space but they also harm the environment and the safety of cyclists and pedestrians. With a view to enhancing urban 'livability' a Demonstration project on 'Restructuring and Redesigning of Urban Areas' is being carried out in Eindhoven and Rijswijk, the urban area being subdivided into traffic and residential areas. In a residential area functions other than traffic are given priority. Such areas often need redesigning.

The demonstration project

In the demonstration project three types of countermeasures (options) are distinguished for the residential areas:
1. Exclusion of non-local traffic. This is done with simple, inexpensive measures such as affixing signs (for instance one-way traffic), closing streets with bollards, fences, flower boxes, or continuing a pavement.
2. Excluding non-local traffic and limiting the speed of other vehicles. Speed limitation can be effected with road humps and/or intersection shelves or by staggering the carriageway. The last of these can be done by positioning flower boxes or by providing localised parking spaces at right angles to the traffic route. A feature of option 1 and 2, is that the existing difference in level between carriageway and pavement is maintained as fully as possible.
3. Excluding non-local traffic, limiting the speed of other vehicles and a visually and practically attractive structural design. This is a form of overall restructuring in which the difference in the levels of carriageway and pavement has to be eliminated as much as possible.

The effects of the countermeasures are evaluated by a before and after study regarding five different aspects: traffic circulation, road safety, environmental hygiene, socio-economic aspects, use and subjective experience of the public areas.
The research into the road-safety aspect is carried out by SWOV.

SWOV research

The most common way of establishing changes in traffic hazards is to measure changes in the number of traffic accidents – the objective traffic hazard. In small-scale research, however, it will often be impossible to collect enough accident data within a reasonable time to give statistically reliable findings. For some years, therefore, alternative standards have been sought instead of accidents, especially data on certain forms of conflicting behaviour of road users, such as serious conflicts. Enough such data can be gathered in a short period to permit statistical processing.
Many problems at present still attach to the use of alternatives, and can be devided into two categories:
1. problems regarding the measuring instruments and observation techniques that have to be used to record the relevant behaviour characteristics;
2. problems regarding the precise relationship between behaviour aspects and road accidents.
Apart from their relationship to accidents, driver behaviour data also have a value of their own. They can provide information about the origin of accidents, the desirability of countermeasures and the degree of acceptance of such measures. The same applies to data on how residents and road users respond to road hazards.
As part of the demonstration project, SWOV carried out both accident research and behaviour and response research.

Preliminary research completed

The preliminary research into road safety was completed with a summarised report. In addition to a description of the structure and organisation of the preliminary research, it gives the results of the eleven subsidiary studies.
Four accident research projects and four behaviour and response projects were carried out. Two literature studies were made in order to take stock of existing information on the effect of measures in residential areas.
Plans were also prepared for research into the effectiveness of the countermeasures that formed part of the demonstration project.

Carrying out of the follow-up research depends on completion of the restructuring and redesigning measures. It is expected that it can be started in the course of 1982.

Brochure on 'Traffic Safety in Residential Areas'

'SWOV in 1979' gave a summary of the report on 'Traffic Safety in Residential Areas' by the Organisation for Economic Co-operation and Development. The various countries proved to have much in common in their approach to this problem and their ways of solving it.
SWOV thought it a good idea to publish a brochure derived from this report, which was in English, in view of the importance of the subject and the considerable amount of work that SWOV itself had done for the report. The brochure has been written for a wide public, from action groups to policy makers, scientific jargon being avoided wherever possible.
It deals with analysis and subjective experience of traffic hazards, the most common principles in traffic planning for new residential areas and measures for existing ones. It also indicates how the public can be consulted when countermeasures are put into effect.
The general tenor is that it is certainly possible to influence traffic safety in residential areas in a positive direction.

Road humps

The principal starting points in promoting road safety in residential areas are the exclusion of through-traffic and a decrease in the speed of the remaining motor vehicles. One means meeting both purposes is road humps. Discussions in the press, however, show these to be a very contested measure.
SWOV had a literature study relating, inter alia, to the effect of humps. British research by the Transport and Road Research Laboratory, TRRL, showed that road humps of a specific design promoted road safety. Average speeds and their distribution decreased greatly in streets with these humps, and so did traffic density. The number of casualties declined by 61%, while there was no demonstrable increase in surrounding streets, which would have been the case had the problem merely been displaced.
Both residents and drivers found the humps useful: the latter category to a less extent however.
Incidental effects were less noise and the use of the humps as pedestrian crossings.
SWOV concluded that the effect of the humps depends on their design and location. A good design is that recommended by the Dutch Study Centre for Traffic Engineering, SVT. It can be regarded as an improved version of that which formed the subject of the TRRL research. Further experiments are needed to make recommendations concerning the proper location of the humps. A complete guide to road humps can only be drawn up after these experiments are completed.

Lower speeds desirable

There is also ample material for discussions on the question of what speed limits should apply in built-up areas.
The Netherlands Association for Protecting of Pedestrians, VBV, which began a campaign with other organisations under the title '50 is too fast', enumerated the various viewpoints in a theme number of its journal 'People in the Street'. SWOV was also invited to write an article. It said that the proposed 30 km/hr limit might provide the answer to the hazards caused by fast traffic in residential areas. Accident research in other countries shows that the impact speed reaches a critical boundary for pedestrians at 30 km/hr. Above this boundary, injuries are usually serious; under it, there are generally only minor injuries. At impact speeds over 50 km/hr injuries are mostly dangerous or fatal.
Here, too, of course there are exceptions that prove the rule.
Lowering speed limits can therefore reduce the severity of injuries in accidents. But setting limits does not solve the problem. It is not known whether fresh problems may arise, for instance owing to the reduction of differences in speed between cars and cycles and

An example of a 'physical' speed limitation measure

mopeds. Another question is: in which streets whould the speed be reduced. Although traffic arteries primarily have a through-traffic function and should therefore qualify last, it is found that most pedestrians are run down precisely on these arteries.
Effective speed reduction in fact requires more than a change in the law. As long as a road pattern invites speeding, many road users will take advantage of this. Road where speeding is undesirable should therefore have features making speeding unattractive.

There has been a great increase in the popularity of bicycles in recent years. Yet the cyclist is one of the most vulnerable road users. Proper facilities are therefore needed to avoid the greater use of bicycles being accompanied by more traffic casualties. The moped is unsafer still. But both kinds of two-wheelers can be improved to make them safer.

Stability and manoeuvrability

About one-third of all road deaths concern cyclists and moped riders. One of the causes is the limited stability and manoeuvrability of two-wheelers. This leads, for example, to changes in steering so that they suddenly get into the track of a car.
To avoid this, cyclists and moped riders must in the first place be given enough space. On straight roads this means a minimum lane width of one metre. In more complicated situations, such as intersections and bends, 1.25 metre is needed. It must be borne in mind that irregularities, such as tram rails, cracks in asphalt surfaces or gaps in surface tiling, make control very difficult.
Cycling tests made by the Institute of Perception TNO, IZF-TNO, at SWOV's request disclosed that some bicycles have better riding properties than others. Bicycles with racing handlebars are less manoeuvrable, and this may be an additional hazard in busy traffic. Children's bicycles bought for 'when they grow bigger' and 'all-family bikes' sometimes make it difficult for cyclists to reach the ground with their feet. The bicycle is more unstable still at low speeds, and it is then important to have firm ground under one's feet. This might be solved by having a device to change saddle-heights quickly and reliably.
Looking behind also causes additional instability. This can be avoided in the case of mopeds by fitting rear mirrors. These have greater priority for mopeds than for bicycles and involve fewer problems.
Another technical adaptation important for road safety is a good carrier.
The research results indicate that cycling with one hand impedes the cyclist in his stability, steering, speed regulation and coping with trouble. Restriction of one-handed riding should be considered. For direction indication, the advantages and disadvantages of flashing indicators on mopeds should be examined.
Nor is enough known about the effect of coupling front and rear brakes. An advantage is that braking power would be retained during one-handed steering.
Since carrying passengers seriously affects riding, it seems advisable to set an age limit of, say, 16 years for this.
In order to limit the influence of mechani-

Owing to their limited stability, cyclists and moped riders must be given enough space

cal defects on cyclists' and moped riders' road hazards, vehicle designs and mechanical construction of cycles and mopeds should be in keeping with realistic practical requirements. Defective adjustments should be prevented as fully as possible or be automatically corrected.
As regards design, further regulations are desirable to shield moving parts and eliminate unnecessary protrusions.

Light moped

Wearing of crash helmets by moped riders has a demonstrable favourable effect on road safety. This became quite evident again in a SWOV advisory report for the Department of Road Transport, RDW, on the introduction of a new light moped.
The industry had proposed a type of renewed low-power moped with bigger wheels than the old type and a slightly higher top speed of 25 km/hr. The minimum age for users would be 15 and wearing helmets would not be compulsory.
The technical changes are likely to have little influence, if any, on road safety. But the lowering of the minimum age and the lack of compulsory helmet-wearing would, in SWOV's view, have an adverse effect.
The calculations were based on certain

expectations regarding the market share of the new mopeds. After some time the proportion among persons aged 15 might become the same as that of mopeds among those aged 16 and 17, which eventually means that 40 per cent of 15-year olds would have a new, light moped. For the 16-onward group the declining trend in use of mopeds is expected to stop because part of this group would buy the new type.
Experience in other countries does not show that there will be fewer casualties among other road-user categories if a new type of moped is introduced. Nor is the extra riding experience 15-year olds might gain likely to result in fewer accidents at a later age.
The ultimate effect of the introduction on road safety can only be estimated. If 40 per cent of 15-year olds have such a light moped and helmet-wearing is compulsory, there will still be about 45 more deaths a year in this group than at present, taking the reduction in other kinds of road usage into account.
If the total number of mopeds remains the same for 16 and older but the proportion of new, light mopeds among them is, for instance 70 per cent – which happened for example in the German Federal Republic when the 'Mofa' was introduced – then, if helmet-wearing is not compulsory, the annual fatalities among these users might rise with 50 to 30 per cent, and the number of seriously injured (hospital admission) with 35 to 25 per cent, respectively, depending on voluntary wearing of helmets by 0 to 30 per cent.

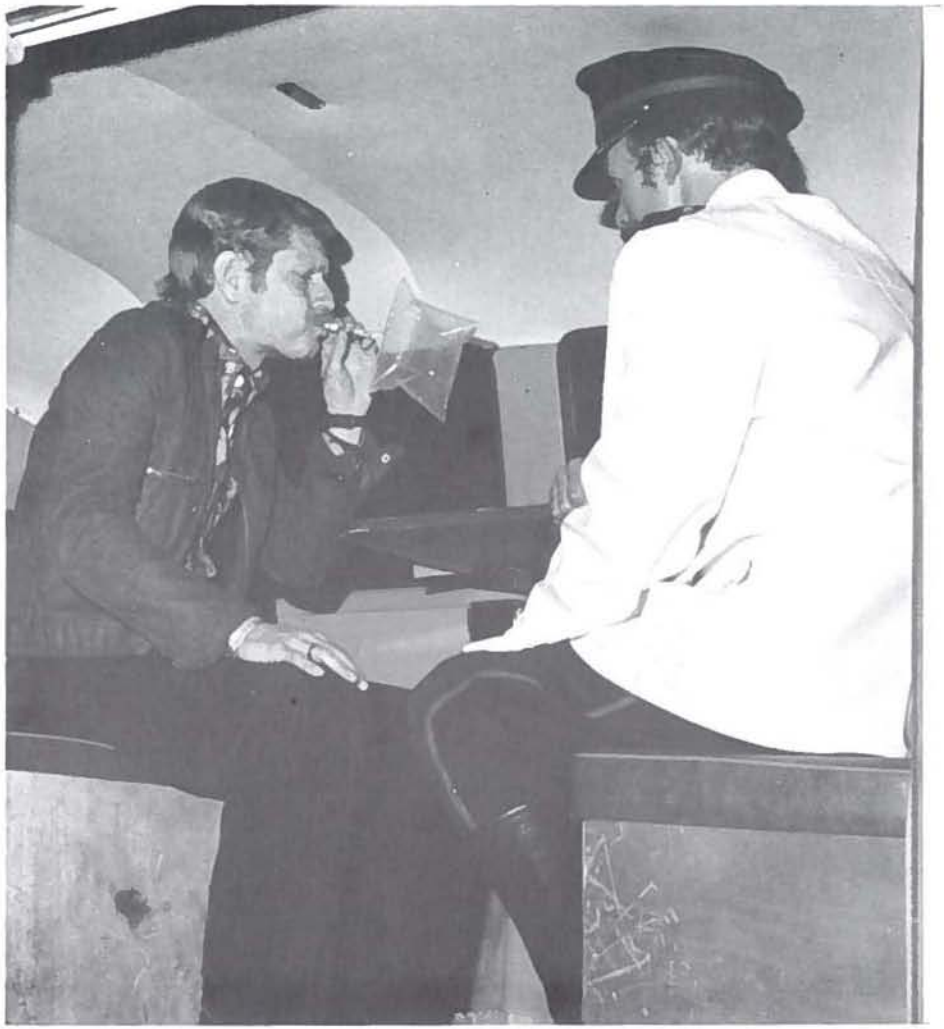
There are various considerations for revising the existing categories of motorised two-wheelers. The first step towards such new categories has been taken by setting up a subgroup on 'Two-wheeler Categories' of the Permanent Contact Group on Road Safety, PCGV. Speedy introduction of the proposed type of moped would in fact be running ahead of this subgroup's work. It would therefore seem advisable to await the working party's final report before taking any decision.

In 1980, SWOV paid a comparatively large amount of attention to the problem of drinking and driving. Much of this related to the publication of a consultative document on this problem. It deals with eighteen possible countermeasures, which are discussed one by one reviewing their advantages and disadvantages. The document is being discussed by the Sub-group on Drinking and Driving of the Permanent Contact Group on Road Safety, PCGV.

The drinking and driving legislation of 1974, which reduced the legal BAC-limit for road users and provided more power to enforce the law at first had a considerable effect. Even now, there is still probably less driving after drinking than before the Act, but much more than just after its introduction. Motorists discovered that there was less risk of being stopped by the police than they had at first thought.
In Great Britain, where a comparable Act was introduced in 1967, its effect has as good as disappeared. SWOV fears that the Dutch Act will meet the same fate. Some re-considering is therefore needed, say on the basis of SWOV's consultative document.
It is an enumeration of all the measures that have at times been considered by policy-makers either for directly reducing traffic hazards or for furthering the effectiveness of existing policy. In

Many people go scot-free in conventional breath tests

the latter case, there might be more possibilities to carry out safety measures.
At first sight, none of the measures taken separately offers much perspective.
A very effective measure such as a rigorous increase in police control is politically difficult to bring about, quite apart from the question of the additional cost.
Introduction of good breath analysers to replace both blood tests and the bag and tube has various advantages but requires considerable investment.
Even apart from the cost, little favourable effect is expected from more information campaigns, intensifying police screening, extending driving and school training, self-measuring devices and alcohol ignition interlocks.
Some measures will even merely cost more and have no noticeable effect. These include more severe penalties, further research into sobering remedies and giving insurance bonuses for absence of claims attributable to drinking.
Milder penalties and a slight increase in the limit of 50 mg alcohol per 100 ml blood, however, save money without any appreciable increase in road hazards.
Permitting waiting in the car will not cost more either, but may slightly improve road safety.
Although the effects of the measures individually are likely to be meagre or meet with practical drawbacks, this is no



reason for giving up. A combination of measures can eliminate some drawbacks of the individual ones.

New brochure

Publication of the consultative document was a good opportunity to produce a revised SWOV brochure on the problems of alcohol in motorised traffic and to stimulate wider discussion.
This brochure deals firstly with the social harm done by drinking and driving and the risks of driving while intoxicated. Next it discusses present regulations and the effect of the drinking and driving legislation. The question of who the drinking drivers are and where and when they drive is also dealt with. Lastly, the brochure briefly discusses the countermeasures touched upon above, while their advantages and disadvantages are reviewed. Police forces have been particularly interested in receiving this new SWOV brochure.

Replacement of breath tester and blood test

One of the measures mentioned in the consultative document is replacement of the breath tester and blood tests by more effective breath analysers. SWOV believes this is easily possible.
There are screening devices more reliable than the bag and tube, with which offences can be detected by the roadside. The number of people now going scot-free in drinking checks will then be reduced.
The second test at the police station can be made with a evidential breath analyser. At present evidence collecting is served by the blood test, which is much more drastic and less accurate than is often assumed.
Before introducing new devices there ought to be a discussion on the requirements they have to meet, both for screening offenders and collecting evidence. In 1980, the Ministry of Justice announced that 'Alco control' breath analysers were to be introduced for use alongside the tube tester. However, it is not yet entirely clear what requirements this device has to meet.

Measuring the effects of alcohol

Following research by SWOV into drinking and driving between 1970 and 1977, the authorities called for a study of the road hazards caused by drinking. Besides information on the number of road users who had been drinking, they wanted to know what part this plays in causing accidents and their outcome. They also asked for a method of registrating future trends. SWOV produced an advisory report on the standards such a study should meet.
The ideal would be to have the investigation consist of two parts:
– continuous and systematic measurement of alcohol consumption by all road users involved in accidents;
– recording of drinking by random checks on road users.
Comparison of the results of both investigations would allow it to be calculated how many road accidents are attributable to drinking. In addition, the relationship can be established between the amount of alcohol a person has drunk and his accident risk. But this is a very comprehensive and hence expensive method. A reliable simplification of the first part is possible by taking only a random sample of those involved in accidents instead of complete records, and then also making a selection, for instance accidents at night.
The second part can be simplified by choosing a form in between SWOV's Drinking and Driving research and random police controle (road blocks). The two parts need not always be carried out. The relationship between drinking by all road users and by those involved in accidents can be established once and for all. This would make the role of drinking in road hazards an established fact. After this it will suffice to record the drinking habits of a sample of road-accident victims.

Seat belts

Outside built-up areas about two-thirds of all motorists use seat belts; inside these areas about one-half. These proportions are higher than in 1975 after comsulpory wearing had existed for some months, but then only a little over 80 per cent of cars were fitted with belts. Since it became compulsory in 1971 to equip new cars with belts, they were fitted in practically 100 per cent of all cars by 1979. This explains the increased use of seat belts. No further increase is expected at present. More motorists leave their belts unused in shorter trips than in longer ones. Outside built-up areas the overall wearing rate in 1979 in journeys shorter than 10 kilometres was 58 per cent. For longer journeys it was 74 per cent. Similar differences were found inside built-up areas.

There are also some differences depending on age of the motorist. In the 18 to 25 year group 62 per cent of motorists wore belts outside built-up areas in 1979, in the 25 to 35 year group 67 per cent and in older groups around 70 per cent. No appreciable differences were found between the sexes.

Introduction of compulsory seat belt wearing is estimated to have saved between 1200 and 1500 lives from 1975 to 1977. If **all** car occupants, including rear-seat passengers, had **always** worn seat belts in 1977, there would then probably have been another 400 to 500 fewer deaths.

Road safety at night

The Organisation for Economic Co-operation and Development, OECD, published a report in 1980 called 'Road Safety at Night'. It deals with the problems of nighttime road hazards in fifteen member countries including The Netherlands.

The Dutch contribution was provided by SWOV (See also 'SWOV in 1979').

Besides this stocktaking, the report contains recommendations for dealing with road hazards after dark.

Relatively more, and more serious

At night there are relatively more and especially more serious accidents than during the day. In the member states that provided data, if appeared that on average nearly 50 per cent of all road deaths are caused at night, though traffic densities are much lower than in daytime. The Netherlands, with 'only' 35 per cent, occupies a striking position.

Nighttime accidents are often characterised by alcohol consumption and – to a certain extent – by driver fatigue. They are often single-vehicle accidents.

Most casualties are car occupants, with young drivers relatively more involved even allowing for their big share in road usage at night. But more vulnerable road users such as pedestrians and cyclists are often victims too. Speeding plays a strikingly big part in accidents after dark.

Recommendations

On the basis of existing data it is possible to set up recommendations for getting to grips with nighttime road hazards. For instance, it is advised having road markings even on country roads with little traffic and at dangerous points.

To make it easier to keep on track on wet roads profiled road markings should be used.

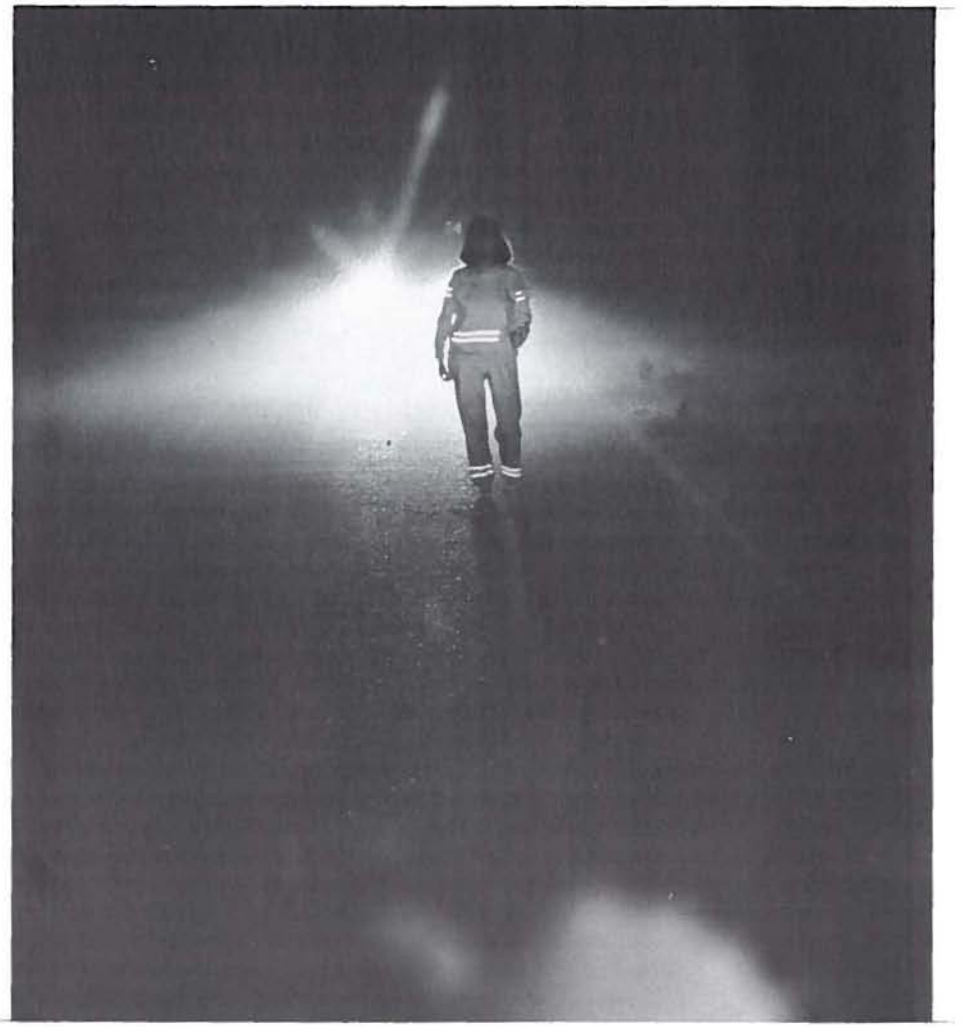
Lighting of main traffic arteries inside and outside built-up areas and of danger points such as pedestrian crossings and busy intersections on rural roads may have a favourable effect. Furthermore, road surfaces should, wherever possible, have a top surface which has high skid resistance and provides drainage. Road markings must also satisfy these requirements. Light coloured road surfaces enhance visibility of roads when lighted.

Signalling lights – rear lights, traffic lights and so on – should be designed in accordance with the recommendations of the International Commission on Illumination, CIE. Electrified fencing will keep wild animals and cattle off the road.

Roadside obstacles must either be removed or made less of a menace to drivers running off the road. The use of retroflecting material by pedestrians and cyclists in rural areas should be encouraged, or if necessary prescribed. If pedestrians face on coming traffic this

Use of retroreflective materials in rural areas can make vulnerable road users safer

can also make for greater safety. The best protection expected for pedestrians and cyclists, however, is footpaths and cycle paths.



Lighting

As regards vehicle lighting much has yet to be done towards further harmonisation and standardisation of regulations. This also applies to the use of bicycle reflectors and the development of good bicycle lights. If new regulations are under consideration, it is advisable to introduce a new system of rear lighting for motor cars permitting the type of vehicle to be recognised. Furthermore, improvement of low-beam headlights, limitation of high beam light intensity of motor-car lamps and reflective material at front, rear and side of mopeds and cycles is also urged.

Other measures

Speed and effectiveness of assistance after accidents at night should be critically examined. A favourable effect is expected from effective combatting of drinking and driving. This calls primarily for better basic data obtainable with random sampling and determination of the blood alcohol concentration of traffic casualties. Another OECD report

(New Research on Alcohol and Drugs in Road Accidents) goes deeper into this. A plea is also made for better breath analysers and greater scope for breath testing by the police.
Regulations limiting driving time will have to be applied mainly for truck and bus drivers. It is recommended that special training programmes should be developed for driving at night.

The Netherlands' contribution

The Netherlands' contribution to the OECD report 'Road Safety at Night' was based mainly on accident data from 1975 (see also 'SWOV in 1979'). These showed that cyclists were less often victims of fatal accidents at night than other road users. Young people, especially moped riders and motorists, were relatively most involved in nighttime accidents. Accident figures were different during rainfall. It was striking that accident involvement increased with age. And the less 'protection' the road user had the greater was the risk he ran. The number of accidents to cyclists, for instance, thus increased faster than those involving motorists.
Fog also increased nighttime hazards, especially outside built-up areas. Ice and snow, however, caused no more problems at night than they did in daytime.

Alcohol

The proportion of night time accidents in which drinking was established was far higher than in daytime. The peaks were in the small hours of Saturday, Sunday and Monday. This applies to all categories of road users. But in particular the young motorists were often involved in alcohol-related accidents at night. This is obvious, because older people make relatively little use of roads at night. As stated earlier, the effect of the 1974 drinking and driving legislation is wearing off.

Traffic-flow models: scope for road safety research

SWOV has published a series of ten reports giving an idea of present knowledge of traffic-flow models.
Before going into the results of the research on which the reports were based, some notes on the purport of the 'traffic-flow model' and its importance to road safety.

Options

Anyone wishing to move in traffic has to make quite a number of choices. Scientifically, a distinction is made between four groups of individual options forming a hierarchy. This means that a choice from one group cannot be made until the choice from the preceding one is know. Firstly, the road user will have to choose his destination and time of arrival. Next he decides his means of transport and then his itinerary and route. Lastly, he selects the manoeuvres needed to join in the traffic.
The choices made by individual road users in the last group result in vehicle movements. The aggregates of these are called traffic flows. These traffic flows have a variety of features such as volume, average speed, speed distributions, headways and travel times.
These features are to a certain extent

The different road categories must be clearly recognisable in order that road users know what behaviour is expected of them

interrelated. Descriptions dealing with this interrelationship are known as traffic-flow models. With these, it should be possible to determine the mutual influence of the various characteristics. Effective models would then make is possible to predict the effects resulting from a change in one or more characteristics. This can be very valuable in road-safety research. It is therefore important for SWOV to know the models developed so far. This led to a research project that was not simply limited to studying existing models. Information was also catalogued on the possible effects the demand for transportation, vehicle and driver characteristics and conditions such as the weather may have on traffic flows. In addition, much attention was devoted to information on the relationships between traffic flow characteristics and the 'quality aspects' of the traffic process.
These aspects include the degree of safety, traffic circulation and comfort, but also for example the harm to the environment. For SWOV, the emphasis was of course on the safety aspect. If there is adequate information on these relationships it would in principle be possible to predict what action is required to produce a favourable effect on a given quality aspect.

Importance to road safety

Action to counteract traffic hazards requires a knowledge of the traffic process. Traffic-flow models can be of assistance in this, but this is only one approach. Another might be analysis of road users' driving functions or the study of vehicle characteristics. The traffic-flow approach is thus no panacea. But it does increase in importance the more the volume of traffic increases. This still applies in the Netherlands, even if the growth in traffic were to be permanently stabilised. The effort to create traffic and residence areas in both urban and rural territories will still go on increasing traffic volumes on the main arteries. Knowledge of traffic flows is especially important as a basis for action aimed at influencing vehicle movements. Examples of such action are traffic-volume related routing systems, systems for proportioning traffic when volumes are great, speed limits, no-overtaking rules and 'following' rules. Models can also play a part in measures relating to the road network. They can be used to determine the relationships between road function, predicted traffic volume, traffic circulation requirements and safety. Some models can also be used for technical designing. They might conceivably also be used when action is being considered for modifying permanent vehicle characteristics. For example, what consequences would a change in the engine-capacity/vehicle-weight ratio of lorries have on traffic circulation, and hence road safety?

Results

The series of ten reports give a detailed review of existing traffic-flow models. They show clearly the importance of proper definition of the various traffic-flow characteristics and the need to make sure no differences arise between existing definitions and the practical application of the appropriate concepts. It was furthermore found that many existing traffic-flow models have hardly been tested, if at all, to check their validity in actual traffic. Their use is, of course, conditional upon this.
Most models relate to one-way traffic. Greater attention is needed for development of models for two-lane roads. Nevertheless some types of models are very promising. first of all, the 'macroscopic dynamic' models. These give descriptions of the time-related trend in a traffic flow – the dynamic aspect – based on average values – the macroscopic aspect – of traffic flows. Individual vehicle movements are not, however, described in this model. Anyone wishing to give a realistic description of these has to depend on the microscopic models.

As yet, there has been comparatively little research into the relationship between traffic-flow models and traffic hazards. So far, relationships have been demonstrated between level of service, hourly volume, speed distribution and the number of accidents per distance. Since traffic-flow measurement methods have been greatly improved in recent years, possibilities of traffic-flow investigation have also greatly increased. All of this may have very positive effects on the value of traffic-flow models in road safety research.

Safety criteria for traffic facilities

The SWOV project 'Safety Criteria for Traffic Facilities' is intended to make recommendations for (re)structuring and (re)organisation of the Dutch roads system as a means of promoting road safety. This research is of direct importance to the Committee on Guidelines for Non-Motorway Design, RONA, of the national and provincial Public Works Departments.
A subsidiary project was carried out to prepare an initial cataloguing of the roads system outside built-up areas. Based on the function of a road in the overall road system, it examines the requirements for road design, equipment and the immediate surroundings. Road-user behaviour in combination with the

various types of vehicles' movement potential is regarded as an established fact. The object is to avoid complicated traffic situations as much as possible and to simplify driving functions.
Attention is devoted primarily to road users' expectations of traffic conditions ahead. They base these expectations on direct information and on experience of earlier traffic conditions on their routes.
The following suppositions are tested:
– road safety benefits from road users' proper expectations of driver behaviour;
– traffic conditions in which limitations occur that are difficult for road users to predict should be avoided or eliminated;
– continuity and uniformity of road design and behaviour codes enhance the predictability of the limitations on locomotion;
– traffic conditions that occur frequently and are more widely used are safer because the pattern of expectations is then more in line with the conditions that actually occur;
– traffic hazards can be counteracted by measures aimed at systematic classification of the Dutch road system into road categories based on predictability by road users.
A list is made of variations and interrelationships of road and vehicle characteristics under existing conditions. The variation in these characteristics and interrelationships is next examined in relation to accident characteristics.

Categorisation

A separate discussion document was published on classification of the road system in categories. The system has a ranking of roads. At one end are roads allowing high speeds but limited in the number of entries and exits and the number of vehicle types admitted. At the other end we have roads with optimum accessibility but limiting vehicles' locomotion potential.
The object is to enhance the effectiveness of the classification with respect to road safety, traffic flow and accessibility. A classification becomes functional for road users when it incorporates choice of route and manoeuvre.
Choice of route is determined by driving speed – which depends on the straightness of the road and its longitudinal profile – and its accessibility – i.e. the number of entrances and exits. Greater straightness has to go together with less accessibility.
Choice of manoeuvre is a question of following the road and avoiding collisions. On the whole more choices will have to be made the more complex traffic conditions become. A distinction must be made between longitudinal and lateral complexity. Longitudinally, separation or non-separation of vehicle categories, separation or non-separation in direction of travel and traffic volume are important. Laterally, it is a question of number of intersections and crossings and volume of intersecting and crossing traffic. The above mentioned characteristics should be recognisable and predictable in all circumstances.
The effectiveness of road categories for road users is greater with dichotomous characteristics (there or not) and clear perceptibility of category indications or category-typical characteristics. The latter should be permanent and regular.
From the road-safety aspect, road characteristics within a category should be:
– consistent: design criteria for safety, comfort and efficiency should be interrelated, i.e. geared to the vulnerability and locomotion potential of the vehicles admitted;
– continuous: allowance should be made over the entire road length for given locomotion potentials longitudinally and laterally;
– uniform: driver behaviour predictability increases if there is little variation in characteristics.

Classification in four categories should be optimal, viz. motorways, other motor roads, roads closed to cyclists/moped riders and pedestrians and all traffic roads. Only roads in the same category or of equivalent rank should link up. The classification has been worked out for design speed, carriageway width, peak intensity and permissible speed margins. Whether this proposal is realisable

in practice will depend among other things on the results of the research into 'Safety Criteria for Traffic Facilities'. This reaearch was started with cata - loguing the main-road network outside built-up areas.

Aquaplaning

When water on the road can no longer be removed by the car-tyre tread, this causes aquaplaning. The tyre then glides, so to speak, over the layer of water between tyre and road surface and the vehicle no longer responds to the driver's operations such as steering or braking. The effect is comparable to that caused by black ice. Aquaplaning therefore helps to make driving on a wet road two or three times as dangerous as on a dry road.
There are two kinds of aquaplaning: viscous and dynamic. The former occurs in drizzle or fog, especially after a long spell of dry weather. The moisture precipitated on the road mixes with dust and oil particles, producing a thin but viscous film of liquid that can destroy the contact between tyre and road surface. If it keeps on raining the film is washed away, but then the risk of dynamic aquaplaning is created. This results from water films several millimetres thick which the tyre can no longer squeeze away. Puddles after a shower can also cause this form of aquaplaning. The tyre, of course, plays a part in counteracting aquaplaning. A good tread form and depth is essential, and so is the correct tyre pressure. In addition, there is a clear correlation between speed and risk of aquaplaning. Dynamic aquaplaning occurs at speeds over 80 km/hr, while viscous aquaplaning can happen at even less than 60 km/hr. But as greater braking and driving forces are applied to the wheels, aquaplaning can occur at lower speeds still. Calm driving should thus be the motorist's motto.
Road design also plays a part. It should not compel the driver to make sudden movements in steering or drastic braking. Road conditions must therefore be easily predictable. Clear boards, warning signs and markings are a help.
The road surface must have a good macro and micro texture. A macrotexture can be obtained by providing the top layer with plenty of rough gravel to allow water to drain away. This reduces the risk of dynamic aquaplaning.
The microtexture of this gravel, however, may be lost through polishing, increasing the danger of viscous aqua - planing. In this respect, setts and paving bricks produce the greatest hazard.
Puddle-forming on the surface can be prevented by good construction and maintenance. The motorist himself can help to ensure good visibility. Switching the lights on during rainy conditions in daytime also makes the car more visible to other road users.

Regional research

Noord Brabant

Some years ago road safety in the Province of Noord-Brabant was in the news owing to questions asked in Parliament.
Arising from this, the Provincial Council and the Ministry of Transport requested SWOV to examine whether it was right to portray this province as the most dangerous (road-safety-wise) in the Netherlands.

First stage

The first result was two reports in 1976 giving an overall description of traffic hazards in the various Dutch provinces (see 'SWOV in 1976' and 1977'). They showed that there were not enough indications to depict Noord-Brabant as the most dangerous province. It was concluded, however, that traffic hazards were great in comparison with other provinces. Arising from this, more detailed research was initiated. This disclosed a number of points on which road safety demonstrably and adversely differed from the rest of the country. A selection was made from these of subjects qualifying for further research. These were rear-end and side collisions, hazards in dusk and darkness, at intersections and on various days of the week and lastly the problems of single-vehicle accidents. This selection was embodied in a third report which also contained a plan for research (see 'SWOV in 1976 and 1977'). Investigations into these subjects are at present under way. In addition, SWOV makes recommendations on the approach to more general problems (see 'SWOV in 1978' and 'SWOV in 1979'). The recommendations are based on existing information from SWOV or other research projects.

Second stage

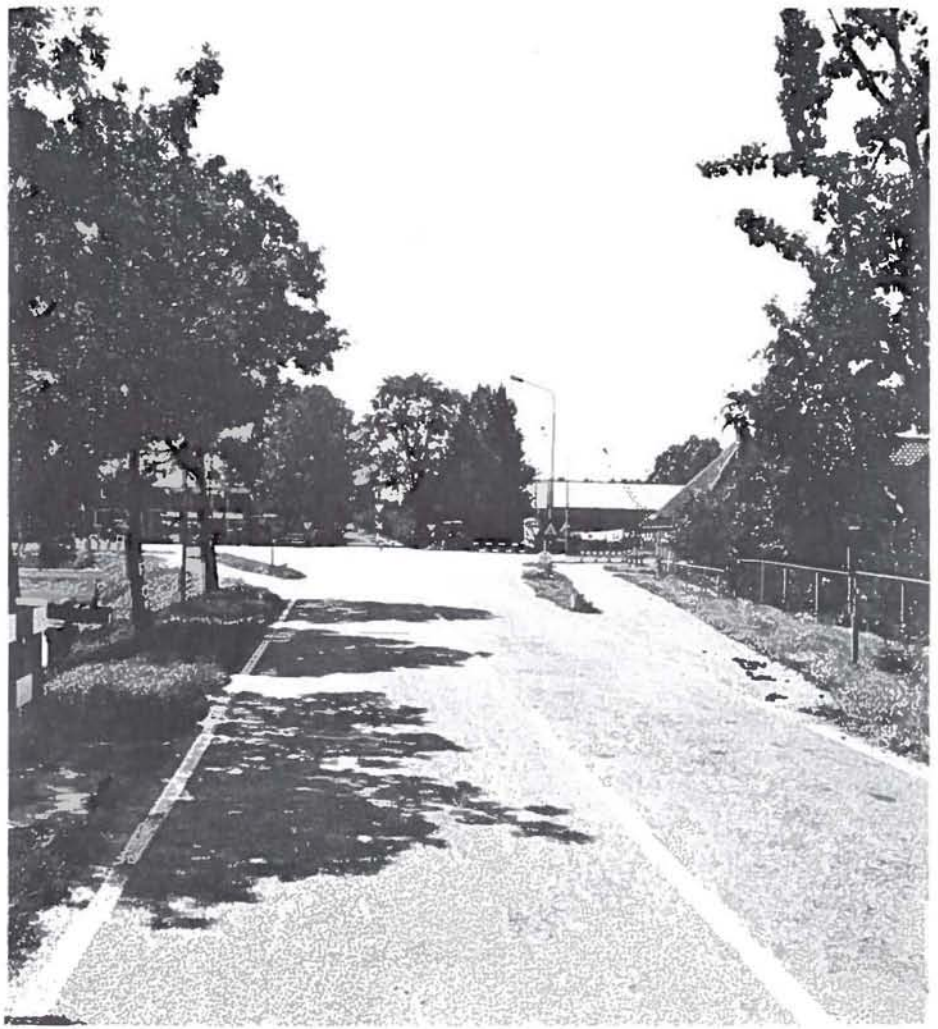
After complition of the research plan, actual research (Stage 2) was started. Meanwhile the first part of the ninth research report has appeared, its subject being a new method of information collection.
In order to conduct the Noord-Brabant research, an exceptional amount of information was needed on roads and traffic outside built-up areas. Many more data than customary so far. They related to basic material for a whole series of research projects. Moreover, the Provincial Public Works Department of Noord-Brabant wanted some data for roads management. DHV Engineering Consultants developed a method for general use based on SWOV's list of requirements and in close collaboration with the road authorities. The report 'Road Safety in the Province of Noord-Brabant IX A' describes this method in detail. Briefly, it means that the road characteristics are noted at every hectometre post – a kind of cross-section of the road – on a form specially designed for computer processing. The same is done with the characteristics of the hundred metres of road from this to the next post. Furthermore, accidents occurring there are recorded, together with traffic counts. The pole boundary is indicated with a shipping term 'raai' (direction line), the areas in between with 'raaivak' (line area). This 'raai' method has the big advantage that new data can be added at any time and existing data altered. It also gives a more complete picture of the listed roads than other methods. These had been focused on specific questions and consequent road characteristics. If the characteristics did not exist they were not listed and research concerning the entire road was made difficult. Practice has shown the 'raai' method to be excellent for systematic collection of a large amount of information. The method is easy to use elsewhere, and questions can always be omitted or added.

Road characteristics

The report 'Road Safety in the Province of Noord-Brabant VII A' examined whether roads in this province had

At intersections in Beemster where countermeasures have been taken there has been a big decrease in the number of serious accidents

characteristics differing from the rest of the country. The data for Noord-Brabant and the other provinces except Limburg came from research by the Working Party on Cycle Traffic of the Committee on Guidelines for Non-Motorway Design (RONA).
The SWOV research disclosed that major roads outside built-up areas in Noord-Brabant are generally busier and of better quality, reflected for example in fewer narrowings and better visibility relating to road characteristics. But Noord-Brabant has fewer cycle paths and more obstacles, such as trees, along these roads.



Beemster

At the request of the Minister of Transport, SWOV is carrying out research into traffic hazards in the Beemster polder, as part of the work of the Steering Group on 'Road Safety in Beemster'. The reason for this research was a sudden increase in the number of road deaths in 1972 to 23, twice as many as in previous years.
First, the trend in road safety was analysed from 1968 to May 1973. The number of accidents in Beemster was, among other things, compared with other rural communities having a similar road system. The comparison showed that in Beemster there were more

accidents with casualties in relation to number of inhabitants and length of roads.
The Steering Group thereupon proposed that traffic on roads in the municipality should be routed as far as possible to several main roads where safety can generally be better safeguarded. The narrower, mixed traffic roads could then be relieved. In the first instance, seven possible solutions were put forward; two more were added later. With the aid of traffic counts, the Noord-Holland Provincial Public Works Department drew up a forecast of traffic volumes in 1977. From this, SWOV calculated the consequences every variant might have on road safety in Beemster. On the basis of these forecasts, the Steering Group made recommendations to the Minister. The most important recommendations have not yet been put into effect and evaluation is not yet possible.

Decrease

Meanwhile the accident trend continued to be noted. SWOV made an interim report for the period May 1973 to June 1978. During these years there was a decline in traffic hazards throughout the Netherlands. In Beemster the decrease proved to be greater than in the rest of the country, and even greater than in comparable rural communities. The decrease in Beemster does not relate to the absolute number of accidents including material damage, but the number of casualties. If the increase in traffic load is allowed for, the decrease in number of accidents is 30 per cent and in number of casualties 60 per cent. The number of fatal accidents also decreased. It should be noted that it is difficult to draw any conclusions from these comparisons because a municipality like Beemster is a comparatively small area. This applies particularly if only the number of fatal accidents is considered.

Coincidence may have played a greater part; in other words there is a greater chance of an increase of decrease being only temporary, without any obvious causes.
As no structural measures were taken in the period 1973 to 1978 to improve road safety, SWOV examined whether less extensive measures on road sections and intersections might have had an effect. It was found that at intersections where action had been taken there was a greater overall decrease in the number of accidents involving casualties than at intersections where no action had been taken. Road sections where action had been taken showed no obviously different trend than sections where no action had been taken.

Long term

As already stated, SWOV is conducting long-term research into structural road safety on the roads. It is known as 'Safety Criteria for Traffic Facilities' (see page 22). In the Committee referred to therein, on Guidelines for Non-Motorway Design, RONA of the Public Works Department a working party is already active with regard to rural roads.

Black-spot studies

In 1979 a 'Manual for Dealing with Road Acc'dent Concentrations' was comple'ed. The Ministry of Transport issued this manual for the use of road authorities. It summarised existing informaton on research into locations with many acc'dents either relatively or absolutely, known as black spots.
Four aspects of this research can be defined :
– tracing black spots;
– analysing in o rder to detect the causes;
– taking countermeasures to eliminate them;
– evaluating these countermeasures.

Methods of tracing black spots based on observed number of acc'dents have several fixed po'nts of departure. But find'ng the causes of black spots re - qu'res objectivation of methods . I norder to develop more objective me thods to investigate the causes of black spots, SWOV undertook some field research for this purpose . The question is whether black spots are unsafe because of their specific combination of road charac - teristics. Differences in the traffic process must be taken into account in establishing this. The mode of road usage and traffic flows are the principal ones .
Norms must therefore be set for traffic in order to be able to make comparisons between locations and so to establish the dangers of the combination of road characteristics.

This field research was carried out at intersections. Encounters between road users seem a very useful norm at such locations. One of the main problems involved is how far one should take the detailing of road-traffic data in order to obtain a fair estimate of the number of encounters. The research assumed that information on traffic flows subdivided by modes of road usage would provide an adequate basis for finding a suitable standard.
Three groups of traffic data were used to examine the relationship between traffic flows and hazards. The first group was derived directly from traffic flows on the intersection branches. The second group is concerned with manoeuvres: traffic turning left or right or straight on. The third group concerns conflicting traffic flows .
The relationship with hazards was investigated for each group separately for locations inside and outside built up areas. There is a close interrelationship between the data of each group . Those from all groups were found to be useful for both groups of intersections . On the whole the conflicting traffic flow groups showed better accident relationships than the other measurements but there was a distinctly better relationship in only one situation, i e. in the case of accidents between slow and fast traffic outside built up areas. Lastly, i t was examined in a preliminary project what influence the length of the measurement period and the spreading of measurements over the day had on the reliability of the traffic data. The report contains a number of practica l conclu - sions with regard to the collection of data.

The role of hazard and exposure data

Traffic hazards can only be dealt with effectively if we can find out what situations are dangerous to which road users and why. This means we must possess two kinds of information: on the extent of the hazards and on 'exposure'. The latter is defined as the frequency with which traffic situations occur that embody an accident risk. SWOV dealth exhaustively in an article with the present possibilities of utilising such information, specially for the use of slow traffic: pedestrians, cyclists and moped riders.

Road-safety data

The most suitable safety data are those on the number and severity of accidents. In scientific research practice the scope for using them is often limited however. First, because only fatal accidents are reliable and fully recorded. Second, because large numbers of accidents are needed for analysis. The latter factor means that it sometimes takes years to collect enough accident data, especially when there is only a small area or a small category of road users. Hence, there is a constant search for alternative information, for instance conflicts or near-hits. Since conflicts are far more common than accidents, enough data for statistical processing can soon be collected. But conflicts cannot simply be used as safety data. In one situation a specific number of conflicts will lead to more accidents than in another. Before large-scale use can be made of conflict analyses it will have to be ascertained what the conflict/accident ratio is in different situations. Apart from this, the collection of conflict data by traffic observation will require a lot of manpower, making it an expensive method.
Attempts are also made to use feelings of safety and driver behaviour instead of accidents. The relationship between feelings of safety (the subjective safety) and accidents, however, is not very clear so far.
Observations of driver behaviour are of limited value, i.e. only when it can be assumed that the observed behaviour is related to safety.

Exposure data

The more a road user gets into more dangerous situations the greater his accident risk will be. In seeking an explanation for accidents, we shall therefore first have to know how many dangerous situations road users have been exposed to. But this exposure can hardly ever be determined directly; rough exposure standards are mostly used such as: number of kilometres driven, time spent on the road, road length, number of inhabitants. A further explanation can be sought for the difference in hazards remaining after adjustment for exposure.

In recent years, researchers in the Netherlands and abroad have used many different exposure standards to describe and explain the dangers to slow traffic.
Often, defective information had to suffice, simply because nothing better was available. Research into the possibilities of improving the quality of such information is proceeding.
Often, in fact, it is not known how suitable certain exposure data are in specific situations. Further research in this direction is necessary.
Policy-makers also use exposure data. They associate safety and exposure data to make comparisons between the hazards affecting various categories of road users, various traffic regions and various periods. The choice of exposure standard largely determines the outcome of such comparisons. For example: the danger to pedestrians as against motorists will be much greater if the number of kilometres travelled is the exposure standard than if the time spent on the road is taken. In the same space of time a motorist covers a much greater distance than a pedestrian. The choice of exposure standard therefore plays an important part in setting policy priorities.

Education

SWOV provides education and guides graduation projects for students at universities, colleges and in higher professional and vocational training, and for students completing higher educations.

Doctorate students, mainly at the Faculty of Civil Engineering of the Delft University of Technology, can select a main or subsidiary subject in road safety as a graduation project under the guidance of E Asmussen who deals with the subject of Road Safety as Crown Tutor.
A graduation project comprises a problem analysis and a literature study; following this, two directions are possible: research planning and execution and study and elaboration of possible measures. A traffic engineering or traffic-economy subsidiary subject is often taken as well.

Fifth-year Civil Engineering and Electrical Engineering students at Delft can attend lectures on 'Introduction to Road Safety'. These cover:
1. definition and location of traffic safety as part of a systematic approach;
2. approach, significance and possible applications of scientific road safety research;
3. assumptions and basic principles for measures for prevention of accidents or (permanent) injury through accidents.

The Foundation for Postgraduate Training in Traffic Engineering in Delft organises a Road Safety course for traffic engineering graduates, graduates working in road traffic engineering and non-graduates in positions of responsibility regularly concerned with traffic problems. This course is largely provided by SWOV.

SWOV provides a lecture for physicians attending the basic course in Social Medicine (at various institutes and universities). This deals with the approach to research and policy-making assistance with respect to road safety.

In the correspondence course organised by ANWB-PBNA in Traffic Engineering a number of lessons are contributed by SWOV. The course is intended for persons who have completed their higher professional training in Civil Engineering.

Students who have completed their Higher Technical School in Civil Engineering at The Hague are given guest lectures on Road Safety as part of an application course in Traffic Engineering. It deals with the safety aspects of road design.

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