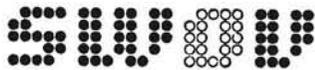


RESEARCH ACTIVITIES 1983

Research activities 1983



INSTITUTE FOR ROAD SAFETY RESEARCH SWOV - THE NETHERLANDS

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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.

How SWOV is organised

The Institute for Road Safety Research SWOV is governed by a board of governors and a director.

In 1983 the board of governors consisted of the following persons:

Chairman:

Th.J.Westerhout

Deputy Chairman:

J.Barkhof, representing the Royal Dutch Touring Club ANWB

Secretary:

J.C.Slagter, representing the Director-general of the Public Works Department

Treasurer:

J.D.J.Idenburg, representing the Netherlands Association for Automobile Insurance NVVA

Members:

P.Allewijn, representing the Minister of Transport

W.F.Haak, representing the Minister of Welfare, Health and Cultural Affairs

W.Hustinx, representing the Netherlands Association of Bicycle and Automobile Industry RAI

A.van 't Laar, representing the SWOV employees

Director of the institute is Prof.E.Asmussen. The institute is organised in the following departments:

- Pre-Crash Research
- Crash and Post-Crash Research
- Methods and Techniques
- Policy Support and Consulting
- Research Services
- Information
- Personnel
- General Affairs

Preface

About a million traffic accidents occur in the Netherlands each year, killing nearly 2000 and injuring more than 50,000 persons. The total economic loss caused by traffic unsafety amounts yearly to about 4 - 5 milliard US dollars.

Thus, 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. As Director of SWOV I have always vigorously contested this opinion, a.o. in my inaugural speech as Professor of Traffic Safety at the Delft University of Technology on 8 November 1983. On that occasion I 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. In this respect traffic unsafety can be compared with a peat-moor fire: as soon as the fire is extinguished on one place, it starts again somewhere else because the fire spreads continuously and unobserved underground.

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 under the auspices of OECD. And to all appearance, not unsuccessfully. It would be highly regrettable, if this favourable trend should be halted by economising on research expenditure. It should be taken into account that the thorough study of all aspects of traffic unsafety and its control may result in important savings, considerably surpassing the costs of research and measures.

It is the task of SWOV to co-ordinate research activities in the field of traffic safety in the Netherlands; to integrate the knowledge supplied by research and to make the research results applicable for policy-making and controlling bodies. The present publication will give ideas about the activities of SWOV carried out for this purpose, of the relationships between various projects and the progress achieved in 1983.

Prof. E. Asmussen
Director SWOV

Introduction

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, engineers and physicians. However, this is not yet 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 simulation methods. This can be illustrated by the following example. In the past, the development of security devices on the road shoulder required extensive collision tests on a large scale. At present it is often sufficient for this purpose to feed data into the computer. The mathematical model will then reveal nearly immediately what will happen if a certain type of vehicle hits at a given speed, for example, a crash barrier. Thus, based on the obtained data, counter-measures can be developed and implemented in a much shorter time.

The advanced techniques furthermore make it possible to increase the effect of traffic safety measures. Thus, for example, after the introduction of a statutory BAC limit in 1974, the police was supplied with breath testers in order to ascertain whether drivers had to undergo a blood test or not. In spite of the breath testers not being completely reliable, the suspected persons could be spotted much more simply. Meanwhile the police can also make use of a more reliable type of breath analysers so that in the near future blood tests may be dispensed with altogether. This will also permit a more efficient tracking-down of drinking drivers and will compel the drivers to observe the regulations more closely.

The research of SWOV can be roughly divided into two categories: basic research and policy-supporting research. In some research activities SWOV closely co-operates with industrial enterprises and scientific bodies in the Netherlands and in other countries. The developments achieved in 1983 in all research areas will be discussed in the following chapters.

Basic research

The basic research of SWOV covers theory formation, collection of data and the development of instruments.

Theory formation

Integration of research, policy and control

In 1983 the most significant activities of SWOV with regard to theory formation were carried out within an international co-operation of an OECD-research group "at high level". OECD entrusted this group with establishing a conceptual framework for the integrated approach to the problems of traffic safety, a framework not only including the co-operation of various scientific disciplines in detecting and analysing critical traffic situations, but also the integration of research, policy and control. This approach is indicated as the system approach to traffic safety.

The research group consists of representatives of most West-European countries, the United States, the World Health Organisation and the European Conference of Ministers of Transport. SWOV acts as a pioneer of the OECD-research group. To start with, SWOV produced a background paper in 1982 which formed the starting point for the group's discussions. In 1983 SWOV designed a theoretical framework for the control of traffic safety. This contribution will form the core of the group's final report, which is expected to be published in 1984 and will be the starting point of future traffic safety research and control in the member states.

Traffic behaviour

Furthermore, in cooperation with some other scientific bodies, SWOV carries out theory-forming research into the behaviour of traffic participants. Up till now, not much is known about the manner in which traffic behaviour develops and over the relationship between traffic behaviour and the causes of accidents. Thus, it cannot be expected that the total research, covering a rather extended and complicated area, will be completed in the near future. However, in order to be able to use the obtained data in the policy-supporting research as soon as possible, the project is divided into several sub-projects, over which intermittent reports are issued.

Until recently research activities were mainly focused on the possibilities of traffic participants, meeting the requirements of the traffic system. At present, however, in agreement with the co-operating institutions, more attention is paid to the decision behaviour of the traffic participants. The first explorative studies in this framework were started in 1983. The principle aim of the research is to find out the manner in and the extent to which the behaviour of traffic participants is affected by the risk, which according to their opinion is involved in their behaviour. The results of this research may be important for traffic education, information campaigns and driving lessons.

Data collection

The first requirement for carrying out traffic safety research is that a sufficient amount of basic data should be available and that the quality of these data should be known. In the past years important progress has been made in this field. The recording of traffic accidents has been considerably improved and since 1978 the Central Bureau of Statistics in the Netherlands CBS carries out a systematic National Travel Survey. SWOV vigorously stimulated these developments, because they made it possible to establish the risks various groups of traffic participants are exposed to.

Data on traffic risks

SWOV published its first report on traffic risks in 1983. The report deals with the number of traffic fatalities related to the mileage covered by various groups of traffic participants. The insight into these risks is not only important for the investigators, but it may also contribute to circumscribing areas, which demand the special attention of traffic safety policy on a national level.

The course of traffic accidents

Since the accident recording system does not reveal the manner in which traffic accidents happen, SWOV developed and took into use a coding system of its own. In 1983 a report was published, describing the development of the coding system and its application to fatal accidents. Furthermore, the coding system was also used in



investigating the conditions of collisions between moped riders and cyclists, and motorised fast traffic. The results of this investigation have been applied in a national information campaign for cyclists and moped riders.

The recorded accident data permit no direct assessment of the part, which some vehicle criteria, e.g. form, mass, dimensions, play in the causes and course of accidents. For this reason, SWOV established a test link with the data bank of the Department of Road Transport RDW, in which vehicle data are stored. The test started in 1982 and was successfully completed in 1983. The report on this test will be issued in the course of 1984.

In addition, SWOV gives advice to the Ministry of Transport in a similar test by linking accident data with data referring to injuries, sustained by hospitalised traffic victims. The first preparations for this test link have been carried out in 1983, with utmost precaution to protect the privacy of implicated traffic victims against any kind of intrusion. If this test is also a success, it will be possible in the near future to obtain a more complete picture of the circumstances under which traffic accidents occur and of the injuries sustained.

Push-button system

Since 1980 SWOV has at its disposal a unique system, by which it is possible to produce cross-tables, referring to fatal accidents in a very short time (sometimes even within minutes), on the basis of files which are published by CBS. For this purpose the minicomputer of SWOV is being used. The system comprises a great number of accident, victim, road and vehicle criteria, furthermore data over the time (hour, day, date, month,



and year) when the accident occurred, the conditions of light and weather. This system has been frequently used to provide governmental and local authorities with accident data. In addition, the system plays an important part in investigations into the nature and volume of traffic problems. It contains accident data since 1971 and in 1983 it has been completed with data referring to 1982. Experiments were carried out in 1983 to increase the amount of coded information per accident. In view of the good results obtained by these tests, accidents involving injured persons, who had to be hospitalised, will also be recorded in the system in 1984. The group of characteristics will be extended by data concerning the other parties in the collision and the manoeuvres preceding the collision.

Developments of instruments

In the last decennium there were important changes both in the trends of traffic safety research and traffic safety policy in the Netherlands. For this reason new methods and techniques have been developed for collecting and analysing traffic safety data.

Conflict techniques

Much more than in the past, the attention of Dutch traffic safety policy is now focused on local problems, and especially non-motorised traffic. Obviously, however, a considerably lower number of accidents is available on local level than on the national one. The identification of problems and the evaluation of measures on the basis of accident data will be here much more difficult and sometimes even impossible. On account of this, complementary data had to be found. The choice fell on conflicts ("near-misses") between traffic participants, because one can assume some kind of relationship between conflicts and accidents. Since, as a rule, the number of conflicts is higher than that of accidents, their statistical analysis takes a shorter time. However, the greatest value of conflict analysis is that it provides a great deal of information about the circumstances under which accidents occur, since during the observation of conflicts one is directly confronted with dangerous traffic situations. Thus, conflict techniques are an important aid in detecting and explaining road safety problems.

On international level, various techniques have been developed to evaluate and to analyse conflict situations. In the Netherlands SWOV co-ordinated the research in this field as regards content.

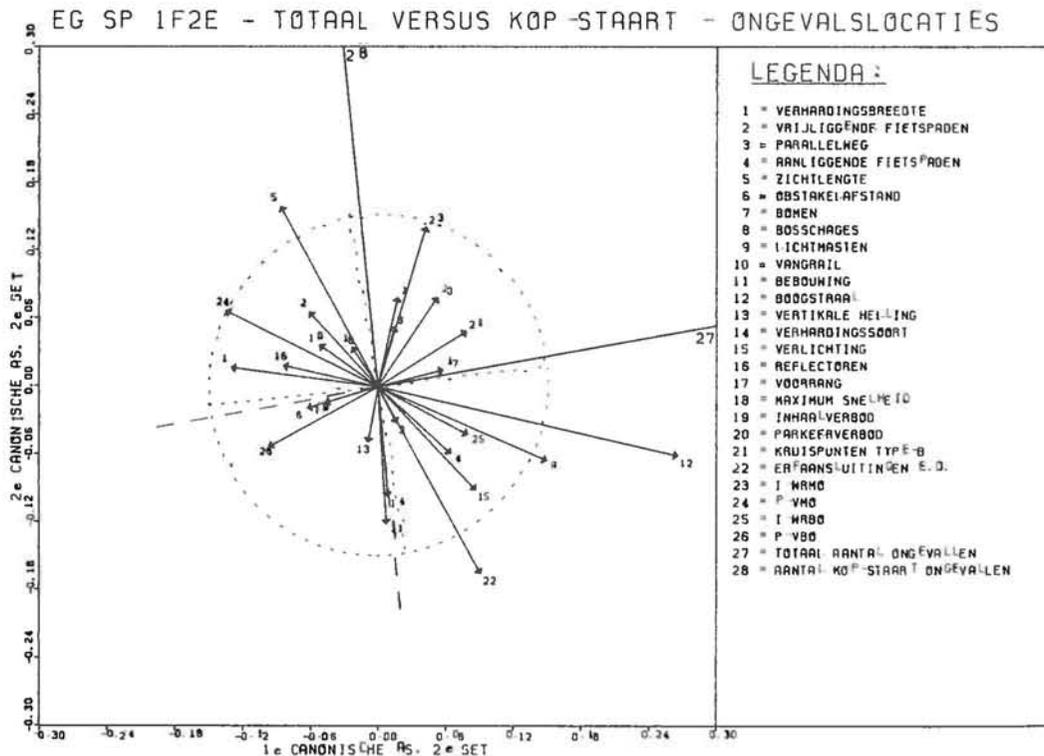
In 1983 the ICTCT (International Committee on Traffic Conflicts Techniques) organised in Malmö an international comparative study meeting of these techniques, in the preparation and execution of which SWOV was closely involved. Among other things SWOV carried out the statistical analyses of the data. Researchers of Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, Finland, France, Great-Britain, the Netherlands, Sweden and the United States of America were present at the Malmö-meeting. The studies proved that the results of six techniques developed in Europe are satisfactorily comparable. Furthermore, the objective criteria, on the basis of which the severity of conflict situations can be evaluated, have been established as well. All these significant achievements opened new avenues for the extended application of conflict techniques. The report on the Malmö-study will be at the disposal of policy makers and researchers of the participating countries in 1984. At the same time they will be provided with a guide book for the application of conflict techniques and with an instruction tape for the training of observers.

Statistical analysis techniques

The detection of "critical situations" in traffic (i.e. of combinations of factors, which may cause accidents) requires highly advanced analysis techniques and related computer programs. Two of such programs, 'Homals' and 'Canals' have already been used on a large scale in the SWOV-research. 'Homals' enables the investigator to reveal the relations between the characteristics of one group (for example road characteristics or accident characteristics) while 'Canals' permits to establish relations between the characteristics of two different groups (for example road characteristics and accident characteristics). Both programs have been developed by Leyden State University and have been adapted by SWOV to application in traffic safety research. SWOV is still carrying out further extensions of the programs and their application.

In 1983 SWOV started with the application of 'Overals', an analysis program destined for establishing relations between more than two groups of characteristics (for example road, vehicle and accident characteristics). There is a close co-operation between SWOV and Leyden State University in the development of 'Overals' as well.

Utrecht State University is developing, with SWOV, exact methods for checking the reliability of results of the statistical analyses of small samples. The usual approximation methods for large samples are not suitable for this purpose. The recently developed methods will be mainly applicable to the evaluation of measures on local level, where researchers are frequently confronted with problems involved in small samples. The program takes into account the specific problems encountered in road safety data. In 1984 the project will result in a computer program and a guide book.

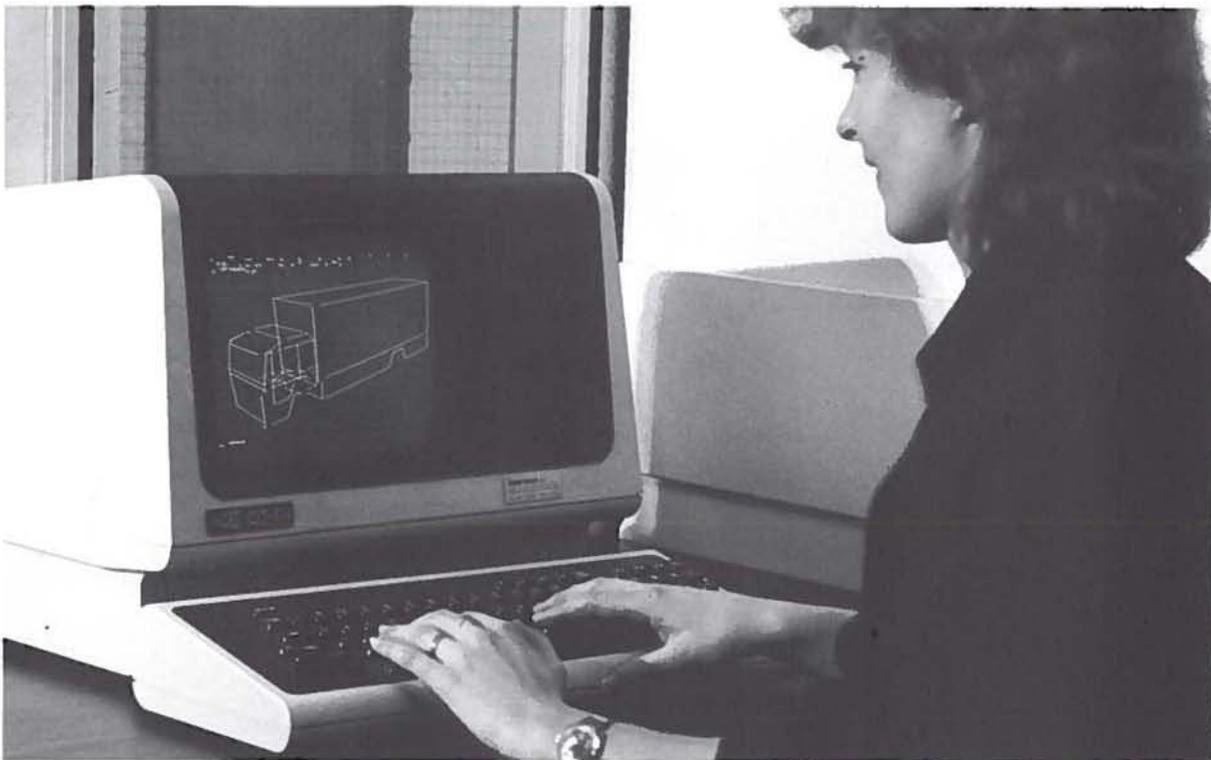


The inclusion of the SWOV research into the current researches carried out by the Leyden and Utrecht Universities, was beneficial to all interested parties: the applications of the programs were thereby extended, while SWOV found solutions, at relatively low costs, for statistical problems encountered in the traffic safety research.

Mathematical models

Mathematical simulation models are an important auxiliary means for predicting the effect of measures. SWOV plays a leading part on international level, mainly in the field of development and adaptation of computer models of the collision process.

In the first place a model has been developed, simulating collisions of vehicles with road structures and collisions between vehicles. This model has been used, for example in designing a viaduct reinforcement in the ring-road system encircling Brussels. However, people were not taken into consideration in this model at all. In the second phase of developing a model, accidents were simulated, wherein people collide with the inside or outside of vehicles. The model is focused on forces, which act on the human tissue during a collision. Based on the experiences gained during developing the aforementioned two models, a new model is now under construction, simulating the collision process, implicating vehicle, man and surrounding as well. These models are expected with great interest, both in the Netherlands and abroad. The series of deterministic models, based on the laws of mechanics, will be completed by SWOV with a mathematical/statistical model. This model will be destined to predict, for a given type of accident, the distribution of injury risks and injury severity over a certain type of population.



A computer model of a truck

The first scenes of a film over the operation and applicability of collision-simulating models were shot in 1983.

In addition to accident process models SWOV is also engaged in developing a mathematical model simulating the entire traffic safety problem area. Thus this model will not only be related to the prevention of injuries but also to the prevention of accidents and to the emergency services. Finally, the model is expected to permit the prediction of trends in traffic safety and in the effects of measures. For the time being the prevention of accidents is emphasised. In 1983 SWOV carried out a pilot study of the possibilities of such a model construction. The study revealed that at present there are not enough reliable data concerning several important factors of influence. However, it seems that the situation will improve, because a special project will supply a part of the required data. For this reason it has been decided to continue the development of this model, but in view of the uncertainties and risks implicated in the project, only on a restricted scale. The main aim of this project is to provide SWOV, as soon as possible, with an instrument for supporting policy-oriented research.

Traffic censuses

In order to establish the traffic volume in certain area, traffic has to be counted. If counting is carried out separately for various modes of traffic, no automatic counting devices can be used for this purpose and counting has to take place visually. However, in greater areas no exact visual counting is possible and for this reason counting takes place on the basis of samples. Still, even the usual "static" random counts are in some cases much too expensive and therefore SWOV developed an alternative "mobile" counting method with a significantly higher output. This method drastically reduces the hours needed for the census. The final report on this new method of random counting is planned to be published in 1984.

Quantitative decision making

In order to make possible for traffic safety policy the prediction of the appropriateness of some measures in concrete situations, SWOV is developing quantitative decision-making procedures. For this purpose quantitative information has been collected in 1983, which is necessary for the application of such procedures. At the end of 1984 a survey will be published of the current procedures and their practical application to traffic safety measures.

Policy-supporting research

Policy-supporting research comprises research into the volume and trend of traffic safety, the factors which influence the occurrence and course of accidents and the effects of measures; in addition, SWOV has also a share in the development of measures.

Research into the volume and trend of traffic safety

Research into traffic safety in general

In order to make possible brisk governmental reactions to changing trends in traffic safety, SWOV analyses quarterly the provisional traffic accident figures, issued by the Central Bureau of Statistics in the Netherlands CBS.

In addition, SWOV contributes every year to the Explanatory Memorandum of the State Budget with a survey of the volume and trend of traffic safety in the two preceding years. Since 1983 this survey analyses not only fatal accidents, but also those involving injured persons, who had to be hospitalised. This important extension was made possible after an investigation by SWOV (in 1982) into the completeness and reliability of the recording of injured traffic victims. Other countries are also interested in the method used for this purpose. For this reason, the report on the investigation has been presented to the journal *Accident Analysis and Prevention* and will be published in 1984. In addition to data over hospitalised persons in 1983, data concerning traffic mileage have also been included in the analysis, thereby considerably improving its importance. The data used were from the CBS-National Travel Survey.

On behalf of the National Plan for Traffic Safety of the Ministry of Transport, SWOV submitted a survey of the trends of traffic safety since 1950, searching for explanations and evaluating the effects of some measures with the aim of assisting the authorities in selecting areas of special interest within the complexity of traffic safety problems.

Research into aspects of traffic safety

The investigation into the volume and trend of traffic safety discussed heretofore covered all aspects of traffic safety on a national level. In addition, SWOV carries out investigations into special safety aspects as well. Thus, e.g. the City Authorities of Amsterdam commissioned SWOV with an investigation into the safety of cyclists in this city. A significant task of this investigation was to collect as much information as possible about the places where many bicycle accidents occur. By comparing such places to those with a low accident frequency, it was possible to establish indications for measures improving the safety of cyclists. The final report on the investigation was presented in 1983.

In 1983 the Ministry of Transport commissioned SWOV to analyse the trend of the cyclists' traffic safety in relation to the trends of ownership and use of bicycles. This commission was motivated by questions of Members of Parliament concerning the fact that the

number of cyclist fatalities was higher in 1982 than in 1981. The category of cyclists was the only one with such an increase in fatal accidents. SWOV dealt with the request in form of a draft which was presented in 1983.

Since 1970, SWOV regularly investigates the drinking habits of car drivers in the Netherlands. Road-side surveys for this purpose are being carried out on various places throughout the country. In 1983 SWOV published the results of the investigations carried out in 1981. In this period the investigations of SWOV were combined for the first time with enforcement activities of the police. The main purpose was to drastically reduce the number of drivers refusing the test and thereby to limit the work of SWOV and police as well. An investigation into the alcohol consumption by car drivers was also carried out in 1983, the report on which will be completed in 1984.

Research into factors of influence

The research into factors of influence covers three phases of the accident process: events before, during and after a collision. The corresponding aims are: prevention of accidents, prevention of injuries and their recovery.



Prevention of accidents

SWOV investigates in the province of North-Brabant the combinations of road and traffic criteria, which involve a higher risk of accidents. The investigation is concentrated on road sections, intersections and road junctions of considerable length outside built-up areas. For the execution of the investigation a great number of characteristics had to be listed. The existing listing methods were not suitable for this investigation and therefore SWOV co-operated in developing a new methodology, permitting the collection of many data in a very short time. This methodology is not only suitable for the North-Brabant investigation; it can be used elsewhere as well. In addition, it is an important auxiliary means for rational road management. Moreover, neither of the existing analysis techniques was suitable for revealing the complex relationships between road, traffic and accident criteria. This problem was solved by adapting the aforementioned CANALS-technique to this kind of investigation. The greater part of analyses was completed in 1983, however, reporting will still go on in 1984.

Not much is known in the Netherlands about the risks of participating in traffic after the consumption of alcohol or drugs. A project, started in 1982 with the co-operation of SWOV and Utrecht State University, is expected to deliver more information in this respect. The investigation is directed in the first place to traffic victims, hospitalised for clinical treatment. These victims provide on a voluntary basis blood and urine specimens for determining the content of alcohol and/or drugs. The investigation will be finalised in 1984.

In 1983 SWOV completed a research into the relationship between the skidding resistance of road surfaces and accident risk. This relationship was already known for motorways, but not for other road types. The research was mainly concerned with the problem, whether the road surface has to display overall a uniform skidding resistance or whether more resistance is required on road sectors, where many braking and steering manoeuvres are expected, for example in intersections or in bends. The report will be ready in 1984.

Prevention of injuries

In addition to factors affecting the accident risk, SWOV also investigates factors, which influence the risk of sustaining injuries during the accident. More particularly, the investigation is aimed at the prevention of injuries by measures realised on vehicles and the road shoulder.

In the past the search for measures to be implemented in or on the vehicle was only concerned with mitigating the injury risk of vehicle occupants or riders. This search led to the compulsory wearing of seat belts on the front seats of cars, and of crash helmets by moped riders. At present investigations are also being carried out to construct vehicles in such a manner, that there will be less danger for those hit. Special attention is paid to make passenger cars less dangerous for pedestrians and moped riders. For this reason SWOV takes part in work groups of the European Experimental Vehicles Committee (EEVC), which is an advisory body of European car-producing countries, in the field of safety aspects of passenger cars. EEVC provides initiatives for European legislation, some of which were accepted in the Netherlands as well. The Dutch representative in EEVC, the Department of Road Transport RDW appointed SWOV as advisor. The investigation into injury prevention by suitable facilities realised in the vehicle, actually consists of two part-investigations, one of which is concerned with car occupants, while the other one is concerned with pedestrians, cyclists, moped and motor cyclists. The latter one is still a

rather new enterprise, mostly in the phase of literature studies and theory forming. Since literature and contacts with researchers from abroad proved that the crash helmet of the moped rider or motorcyclist comes rather easily loose in case of a collision, SWOV started in 1983 a special investigation to find out if the crash helmet is worn properly fastened.

The research into the safety of road shoulders resulted in providing roadside safety structures along motorways. At present, the research is mainly concentrated on the shoulder of other types of roads, because most accidents occur on such "non-motorways". In 1983 SWOV published a definitive report on an exploratory research into the effect of road shoulder obstacles on the severity of accidents. This study, related to trees along the road, was the first step in establishing the general basic criteria for the safe lay-out of the shoulder of non-motorways. The research took road, traffic and accident criteria into account.

Limitation and recovery of injury and material damage

The factors, which could promote the recovery of injuries and material damage after an accident, have not yet been studied thoroughly and systematically. On behalf of the Ministry of Transport SWOV made an inventory of and gave a structure to this part of the traffic safety policy. In the first place, the area has been defined. Next, it has been established, which damages may be caused by an accident, which kind of emergency (aid) services are available and in which way they operate. The final research report will be submitted in 1984. It can be expected that improved emergency (aid) services may lead to the limitation and a faster recovery of injuries and material damages after a traffic accident.

Research into the effects of measures

The research carried out by SWOV into the effects of measures can be divided into two main groups. Research activities can be aimed at determining the effect of a measure which is already operational or at predicting the effect of a measure which is still in the planning phase.

Determining the effect of measures already taken

The major part of SWOV's research program consists of evaluating the measures on local and regional level, probably because most of the traffic safety measures have been implemented in those areas in the past. In two Dutch towns: Eindhoven and Rijswijk experimental measures have been introduced in the last years, aimed at improving the living climate without hindering traffic circulation. For this goal both experimental regions have been divided in traffic spaces and residential areas. Various kinds of measures have been implemented in the traffic spaces in order to ensure a safe and smooth through-flow both of slow and fast traffic and to abate noise nuisance and reduce air pollution as far as possible. Various measures have been realised within the residential areas as well, which depending on the aim are in some cases simple and cheap, while in other ones: expensive and sometimes even drastic. There were three possible alternatives:

- to ban through traffic;
- to ban through traffic and to reduce speed of the rest of the traffic;
- to ban through traffic, to reduce the speed of the rest of the traffic and to create an attractive layout of the area concerned.

Before and after studies have to be carried out to make clear the effects of the measures and the differences in the effectiveness of various packages of measures. The aspects to be analysed are: traffic circulation, traffic safety, hygiene of the environment, social-economic issues and the use and experience of public spaces. The research results have to lead to conclusions, which can be applied to all comparable urban areas.

The research into the effects of traffic safety consists of studies of behaviour, experience and accidents. The pretest carried out in 1977 and 1978 yielded a wealth of information on the conflict and "black-spot" studies, which at that time were still new. The posttest took place in 1983 and, similarly to the pretest, on the basis of SWOV's research plan. The results will be issued in 1984.

In 1977 the Ministry of Transport provided a government grant for experiments to be carried out within built-up areas in order to improve the traffic safety of pedestrians and cyclists. These experiments referred to small-scale infra-structural measures. Through accident investigations prior to and after implementation of the measures, SWOV studied their effect on safety. Altogether ten experiment locations were effected, including residential yards ("woonerven"), quiet zones ("dorpseven") and speedreducing measures. The posttest was completed in 1983 and the results will be available in 1984.

The endeavours of the authorities to stimulate the use of bicycles led to an assignment for SWOV to investigate the safety of various kinds of bicycle facilities. After a literature study (1982) the target area of the investigation was established and the actual investigation was started in 1983. On the basis of accident data, the safety of cyclists and moped riders was studied on road sectors with no safety measures for bicycles, unprotected and protected bicycle lanes.



In the context of a demonstration project, measures were taken to improve the "livability".

In 1979 the Public Works Department Rijkswaterstaat commissioned SWOV with research into the relation between traffic safety and public lighting. This research should give a complete survey of all knowledge and information about this problem. In view of the volume of the research area, it was decided to issue reports on various phases of the research. The first report was presented in 1983, dealing with the relationship between accidents and public lighting, based on statistical accident studies. The most important conclusion drawn from this report was that public lighting in busy town streets is likely to reduce the number of nighttime injury accidents by about 30%.

Due to the growing interest in non-compulsory safety devices in passenger cars, SWOV organised an inquiry in the autumn of 1983. The inquiry's aim was to get information about the use of safety devices for children and seat belts on the rear seats in passenger cars. The inquiry data showed that 20% of the cars is provided with one or more rear seat belts, while in 16% there is some kind of a safety device for children. A report published in 1983 on the effect of head restraints proves that these undoubtedly lower risk of injuries in case of a collision.

Since 1978, when a general speed limit of 100 k.p.h. was established for motorways and carriageways, the speed limit was incessantly the subject of lively discussions, mainly with regard to motorways. In 1983 the Ministry of Transport ordered an evaluation of the present situation as regards speed limits. The investigation into this problem was carried out by the Public Works Department Rijkswaterstaat, Groningen State University and SWOV. SWOV's task was to study the effects of the present measures and of possible alternatives on driving speed and traffic safety. The study included various problems like



the extent of unsafety on motorways, the relationship between speed limits, actual speeds, the risk and the severity of injuries. The report will be finalised in 1984.

Prediction of the effects of measures

The ever increasing concern about environmental problems induced the government to present in 1980 in the Lower House a bill for the amendment of Art. 2 of the Road Traffic Law. This article contains the motives for taking traffic measures. The motives referred exclusively to the course and the safety of traffic. The proposed amendment extends the aforementioned motives by adding environmental requirements. This realises activities on a national level for bringing into harmony the requirements of traffic with those of the environment. The Public Works Department Rijkswaterstaat prepares guidelines for the road controlling authorities, how to apply the amended Road Traffic Law. A basic principle is of course that environmental measures can in no way affect traffic safety. For this reason the Department in question entrusted SWOV with finding out the effects of the amended Art. 2 on traffic safety. A draft report on this subject, completed in 1983, describes, on the basis of literature data, the trend and the type of effects on traffic safety as far as possible. In addition, the report contains suggestions for the integration of environmental and traffic safety requirements. Furthermore, SWOV presents a method for evaluating the effect of some measures, using in this method the information obtained from the current SWOV research into safety criteria for traffic facilities. The final report will be submitted in 1984. The draft report led to two further orders for SWOV. In the first place, a decision-making procedure will be developed for taking measures on the basis of Art. 2, essentially for enabling the road-managing authorities to predict the behavioural changes which will be caused by a measure and the effect such changes are likely to have on traffic safety. In the second place, criteria will be collected, which are necessary for the quantification of effects on safety and which will play an important role in decision making.

Early in 1983 the Ministry of Transport commissioned SWOV to carry out a literature study in order to find possibilities of how police surveillance could promote the observance of traffic regulations. The report on this study, which was presented to the Ministry in the autumn of 1983, describes the present state, points out insufficiencies and gives suggestions for further studies.

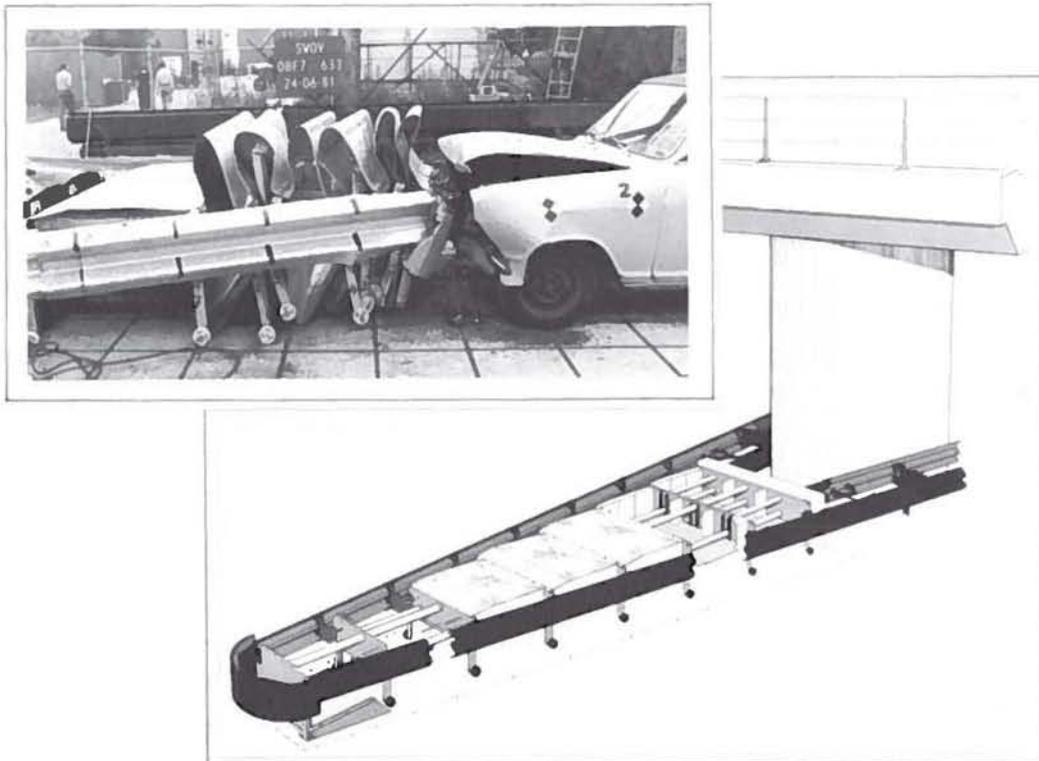
Since 1983 SWOV investigates the effect, which periodical inspection of passenger cars would have on traffic safety. On the basis of theoretical considerations and practical research it will be possible to establish the relationship between the inspection, the state of maintenance of vehicles, and traffic safety. Furthermore, attention will be given to establish the optimum conditions of inspection, the norms of failure and the control of inspection stations, with appropriate sanctions.

Finally, in 1983, SWOV studied the safety effects, which could be achieved if the wearing of seat belts on the back seats of passenger cars were to be compulsory. A draft report on this issue was finalised in 1983.

Development research

RIMOB

If along the motorway, close to the route of the travelling cars, a rigid obstacle is placed, which is not screened by a roadside safety structure, that obstacle may expose a car driver, straying off from his course, to great danger. Such obstacles, e.g. a bridge pillar, the post of a signboard support or the meeting point of two safety structures, have to be individually shielded. Since there were no devices for screening such obstacles, not even at high prices, which could be adapted to various situations, the Public Works Department Rijkswaterstaat commissioned SWOV to design a suitable all-purpose screening device. The co-operation between Rijkswaterstaat, Dutch industrial enterprises and SWOV resulted in a "crumple tube impact attenuator", abbreviated as RIMOB, which has been introduced in 1982. The external side of this V- or U-shaped protective device consists of elements of guard rail, which can shift along one another. In between box-like elements are arranged, comprising aluminium tubes (crumple tubes), which are pushed together under the impact of a collision. On collision, RIMOB brings passenger cars and delivery vans to a halt, in such a manner that passengers, wearing a seat belt will only sustain slight injuries or no injuries at all. The new obstacle protective device can be applied on the roadside shoulder or median or even on places where road works are being carried out. All this is possible by the various embodiments of RIMOB, which can be adapted to the dimensions of the obstacle, the available space and the amount of kinetic energy which has to be absorbed. This last factor depends to a great extent on the weight of the vehicle and the speed at which the vehicle hits the obstacle. In 1983, SWOV developed two computer models for enabling the road-managing authorities to determine independently,



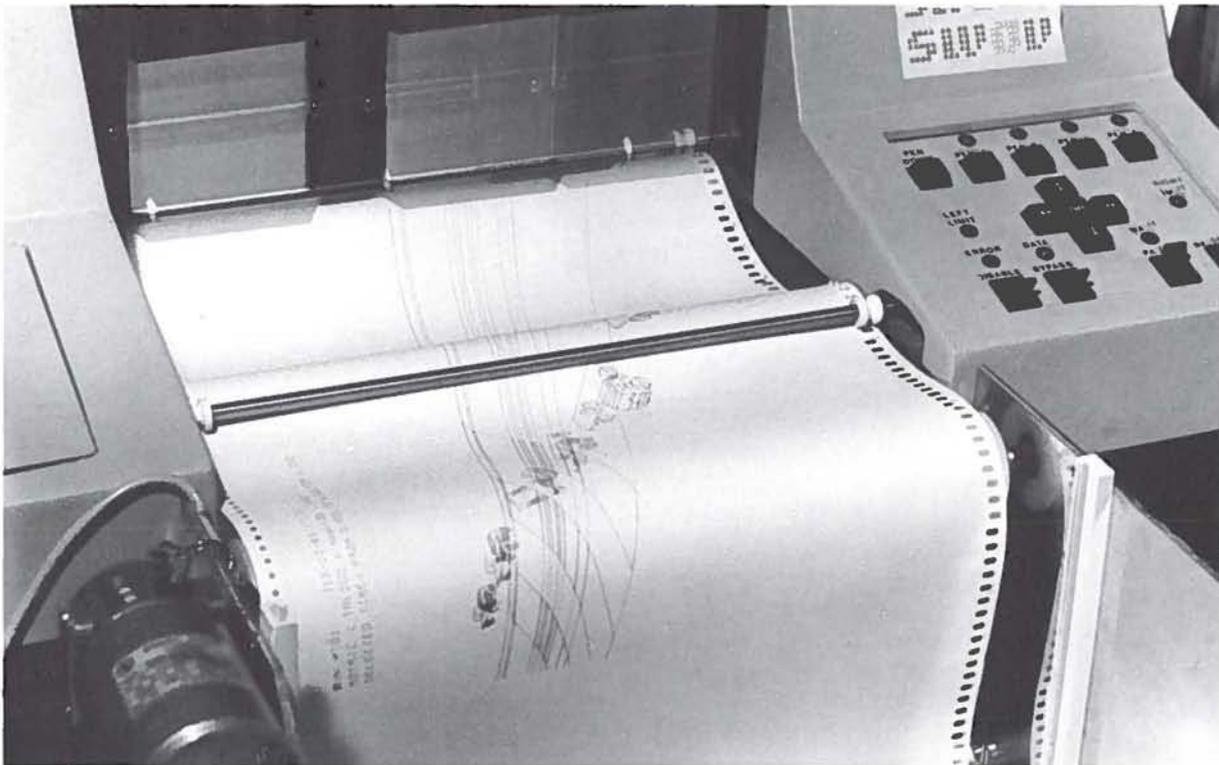
whether RIMOB is applicable to specific situations and in which form. One of the models refers to the energy absorption capacity in longitudinal direction, while the other one refers to crosswise stability.

There is much interest in RIMOB in other countries as well. There were negotiations with US authorities about the adaptation of RIMOB for application along American roads. The Federal Republic of Germany is considering including RIMOB in the official recommendations for road shoulder constructions, while in Canada plans to fabricate RIMOB under license, are already in an advanced stage.

Safe road shoulders

In 1983 SWOV started with the development of roadside safety structures for non-motorways, because on the shoulders of such roads occurs the greatest number of accidents. Roadside safety structures, designed for motorways, display some drawbacks when applied on non-motorways. With regard to traffic safety aforementioned drawbacks include the visual narrowing of the road, a restricted view of intersections and bends, the danger of rebounding into oncoming cars. The aforementioned mathematical simulation model can play a vital part in this research, which is at present in the phase of the practical testing of various constructions on a small scale.

Mathematical simulation models already play a role in a SWOV research into slopes, which are stable and safe enough not to be screened. The first phase of this research has already been completed, dealing with the determination of the relationship between the shape of the slope (gradient, height, round-off radii), the speed and drive-in



"Talud"-accidents are simulated with the help of a computer

angle of the car and the risk of injuries the car passengers are exposed to. The second phase of the research, which started in 1982, is concerned with the integration of the slope into the entire road shoulder.

Wind disturbance

Under the effect of strong gusts of wind road users often suddenly change their course, thereby endangering the safety of traffic. This phenomenon causes the most acute problems on dikes, dams and bridges. In order to reduce wind disturbances on the future road over the Oosterscheldedam (which forms a part of the Delta Plan), SWOV developed, on behalf of the Public Works Department Rijkswaterstaat, a half-open windbreak structure. Such a structure is based on the principle that wind passing through it neutralises the whirling of the wind forced over and behind. Thus the wind speed behind the structure is gradually reduced; more so than if the structure is solid. In 1982 SWOV established a plan for this development research, whereby the results of wind tunnel measurements and computer simulations of man-machine-systems were put into relationship. The order to carry out the actual research is expected in 1984.

Safety criteria for traffic provisions

At the end of the seventies SWOV made a beginning with a research into criteria for the safe layout of the entire Netherlands road net inside and outside the built-up area. The analysis of road, traffic and accident criteria must explain the differences in traffic safety, which, in turn, must lead to advice for an optimum adaptation of layout to various types of roads. Due to the enormous volume and complexity of this research, it has been divided into a number of subprojects. In order to promote efficiency, endeavours are being made to correlate this research with other current research activities in the Netherlands. In the mean time the required data for a part of the road net (i.e. main roads outside built-up areas) have already been listed and analysed.

Miscellaneous

On behalf of research into detection of alcohol consumption in traffic, SWOV is developing and testing breath-analyser devices. In 1983 SWOV began with a survey of the available information over devices, which could replace blood tests.

A long-term project for developing a program for the traffic education of children was nearly completed in 1983. The project had been worked out by Groningen State University with the assistance of SWOV. At present the practical application of the program is being studied. The importance of traffic education of children becomes evident from the fact that traffic accidents are the greatest cause of death among children.

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(Recommended speeds. IRRD No. 269543)

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