SCIENCE IN THE SERVICE OF ROAD SAFETY

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Introduction

The Institute for Road Safety Research SWOV has the task of supplying expertise based on scientific research for the selection of measures to promote road safety. SWOV conducts a large part of this research itself, as well as designing much of the scientific road safety research carried out elsewhere in The Netherlands, as set forth in the 1975 Road Safety Policy Plan of the Minister responsible for co-ordinating road safety. Hence SWOV collaborates with many research institutes, some of which carry out research projects at its request. In addition, SWOV acts as The Netherlands representative in important international organisations working on road safety research. The Institute disseminates the expertise gained from its research in the form of reports, advisory reports, articles in periodicals, its own publications, contributions to teaching programmes, and via the mass media.

Since its inception in 1962, SWOV has undergone rapid growth. The Institute includes a.o. the following departments: Research Co-ordination, Research Services, Pre-crash Research, Crash and Post-crash Research, Methods and Techniques, and Information.

Policy-supporting research

It follows from these objectives that much of SWOV's work consists of policy-supporting research. The programme for this is drawn up largely in consultation with the Ministries of Transport and Waterways and of Public Health and Environmental Hygiene.
In recent years there has been growing attention to road safety at the local level. This trend is closely connected with the need to improve the quality of life in residential areas and city centres. Among other things, SWOV carried out research into the road safety effects of measures promoting this quality of life, such as redesigning a residential area into a "woonerf" (mews court). In a "woonerf" cars may proceed only at walking pace, and an effort is made to create the maximum living space for pedestrians and for children at play.

The safety effects are evaluated not only by means of accident analyses, but also with behaviour observations and interviews covering residents' and users' feelings about hazards in traffic. This makes it possible to examine what relationships there are between feelings about hazards, behaviour and road safety. In part, these studies are carried out jointly with the Institute for Perception TNO, Soesterberg, the Netherlands Institute for Preventive Medicine TNO, Leiden, and the Traffic Research Centre of Groningen State University (1).

The search for risk-increasing factors is also an approach to road safety research. This relates both to the origin of accidents and their outcome. A major risk factor is driving after drinking, and SWOV has investigated motorists' drinking and driving habits with the aid of annual random samples (2). It has also analysed the effects of countermeasures aimed at lessening accident injuries, such as protective moped helmets and car seatbelts: for example a study was made why the percentage of moped riders wearing helmets was higher than that of motorists using seatbelts (3).

With a view to indicating means of limiting injury and damage in accidents, SWOV undertakes accident research and impact simulation research. Simulation research consists of investigating the different phases of impacts at a proving ground or with an impact simulator, often with the aid of mathematical models. Such models deal firstly with the relationship between impact speed, angle of impact, and so on, and deceleration of the vehicle (given the mechanical characteristics of vehicle and obstacle), and secondly with the relationship between deceleration of the vehicle and the forces applied to the human body or parts of the body (given the mechanical characteristics of the vehicle interior, the human body and the support of the human body). The results show what standards the characteristics of the vehicle, the obstacles, and the vehicle interior have to meet in order to reduce the risk of injury to a minimum (4). This research is a joint project with the Research Institute for Road Vehicles TNO, Delft.

Basic research

SWOV draws up its own programme of basic research. Such research is needed as a basis for defining the road safety problem, making forecasts, establishing priorities, improving research methods and designing theories for future policy-supporting research. Development of methods and techniques is given a lot of attention, for instance, in seeking methods to track down, analyse and improve situations with a comparatively high accident rate, to examine whether and to what extent traffic conflicts are useful concepts in road safety research. Interest was focussed on the study of traffic conflicts primarily because of the greater attention being given to road safety in built-up areas. Accident-based research in residential areas is difficult because few traffic accidents occur there; moreover, they are spread throughout the area. In many cases, therefore, small-scale accident studies cannot be made in the proper methodical way. The conflicts method can, however, provide many measurements in a short time. It comprises observing and analysing conflicting behaviour, such as near accidents (near misses) and evasive actions. Some disadvantages of the method are: the observations are expensive; objectivity in assessing and scoring the data may present problems; and the concept of a conflict is not always defined in the same way. SWOV is working on research aimed at assessing the value of different conflicts techniques and developing them further (5).
Another basic research approach may be labelled process-descriptive research. For example, in dealing with the driving function, traffic behaviour is analysed in terms of observation, information assimilation, decision and action processes. The object of the research is to find behaviour criteria with which the characteristics of road users, vehicles, roads and surroundings can be compared. In some areas behaviour descriptions have incorporated in a cybernetic model which is used for more detailed analysis of driver/vehicle interaction.
An analysis is also being made of the pedestrian's function in order to develop an education programme for children. This is a

joint project with the Traffic Research Centre of Groningen State University. The aspects of the project are: behaviour observations; research into requirements for the pedestrian's function and children's scope for learning at various levels of development; and research into the most effective training methods to familiarise children with traffic.
Behaviour and function analyses are also used for pinpointing any deficiencies in the skills of new drivers of motor vehicles. This makes it possible to improve driving instruction and the driving test.

Systems approach

The above is a sample taken from SWOV's research programme. The "systems approach" is proving more and more indispensable to this research. Road hazards are a complex social problem. They are an - unwanted - side-effect of the transportation system which is, in fact, a "production system" with the object of locomotion. This object of the transportation system should never be lost sight of in controlling road safety. The endeavour to achieve greater safety is a matter primarily of optimising a complex entity of relationships between road users, vehicles, roads and surroundings, in which disturbances occur. Research into this requires expertise from many scientific disciplines, such as physics, technology, the social sciences, medicine, economics and law.
With the systems approach, expertise from these individual disciplines can be integrated.

Controlling road safety

The control and study of road safety problems requires the entire problem field to be traversed. In recent years, this has been done many times for research purposes and with the aim of solving the road safety problem, with varying degrees of success. On the basis of "Energy-Transfer Analysis", Haddon (6) introduced a number of control strategies which SWOV is now elaborating specifically for

road safety purposes. The assumption is that the built-up energy is the "agent" (the necessary but not sufficient condition) of risk in traffic. Energy-transfer analysis can thus be described as follows. In order to make locomotion possible there must be an energy build-up. But the release of this energy is not always controllable, for example when a vehicle skids. In this case we speak of an incident. If the released energy then comes into contact with dead or living structure, we speak of an accident, which may cause damage or injury. If help is not provided quickly enough the injury may spread.

On the basis of this analysis, road-safety control strategies may intervene in six different phases of this process. Countermeasures may be focussed upon:

Phase 1: Limitation of traffic; but this seriously affects the purpose of the transportation system.

Phase 2: Limitation of energy build-up, for instance by promoting public transport and cycling, by speed limits for motor vehicles and by reducing the distances travelled.

Phase 3: Prevention of the undesired energy release (incident prevention); traffic facilities must be designed and constructed in such a way that the road user does not have to function beyond his capabilities and is moreover not "tempted" to act in an "undesirable" way.

Phase 4: Prevention of contact of released energy with living or dead structure (accident prevention); this can be achieved by segregating the various categories of road users physically or in time (for instance by providing traffic lights and separate lanes for cars, moped/cycles and pedestrians), or by creating space for emergency actions.

Phase 5: Prevention or limitation of injury or damage if energy clashes with living or dead structure (injury and/or damage prevention or limitation); injury is generally regarded as so much more serious than material damage that in practice material is often sacrificed to save human lives (crush zones in cars, roadside safety structures, moped riders' protective helmets, seatbelts).

Phase 6: Prevention or limitation of injury or damage once it has

occurred from spreading further; this necessitates speedy, adequate aid.

In a systems approach to road safety, priority is given to measures having the greatest influence on safety which affect the objective of the transportation system as little as possible. The effect upon this objective is greatest in phase 1; it becomes gradually smaller in the subsequent phases.
In the present state of the art, the principal premise for countermeasures will be adaptation of traffic facilities to man's possibilities and limitations. This relates both to human tolerance (injury limitation) and man's capacity for observation, decision making and action in road traffic (accident and incident prevention) (7).

We have described how traffic hazards come about. But how are we to find a basis for decisions and actions in order to intervene in this process? In other words: What are we going to control? We need a concept giving detailed information on the hazards per road, per traffic situation, per road-user category, and so on. Information on the probability of accidents and the severity of injuries, as related to the part played by traffic. Such a concept is the risk.
In road traffic, as is already the case in many fields, risk analysis and assessment should be made to make the notion of road safety more comprehensible and more manageable. On the assumption that absolute safety is unattainable, the acceptable level of risk will have to be established. Every road user will have to be aware of the risk he runs when making use of traffic facilities in any way. Only then can the individual road user purposefully select an attractive alternative, and be held responsible for his decisions and consequent behaviour.
Publicising risks will also be indispensable for the decisions and actions of policy-making bodies. The development of methods of establishing differentiated risks and their acceptability will have to be given very high priority (8).

Information services

Besides promoting, co-ordinating and carrying out scientific road safety research, SWOV has the objective of widely disseminating research results. The conclusions from policy-supporting research are presented so that users can work with them. By taking part in scientific forums and educational programmes, via joint projects and articles in periodicals, expertise is spread within the scientific community. SWOV endeavours to reach the man in the street with its own information bulletin, a range of brochures and other popular publications and also via the mass media. International exchange of expertise and experience with other scientific researchers takes place primarily within the OECD Road Research Programme. Other international bodies playing a role in SWOV's contacts are the European Community, Committee of European Ministers of Transport, NATO-Committee for Challenges of Modern Society and the World Health Organisation.

For further information contact: Institute for Road Safety Research SWOV, P.O. Box 71, 2270 AB Voorburg, The Netherlands. Phone 070-694121. A list of Reports, publications and articles 1962-1978 is obtainable on request.

Literature

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(7) See 4.

(8) See 4.

*Available only in Dutch