

INTERRELATION AND OPTIMISATION OF ROAD DESIGN ELEMENTS AS RELATED
TO CLASSES OF ROADS

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Institute for Road Safety Research SWOV, The Netherlands

The primary objective of Session V was to interrelate and improve road design elements as related to classes of roads. Most papers concentrated on new principles, new philosophies, new methods. The papers focused in particular on what is behind the standards or what should be behind them. When making road design standards, or considering a road categorisation or classification scheme, it should be realized that this is done for the benefit of the road user.

The road user can be considered on the one hand as the actual user of the road system, and on the other hand (on the operational level), as the most important element of the road-vehicle-man system. In this role he has to perform his manoeuvring tasks, which means that he has to follow the course of the road and he has to avoid crashes with obstacles on the roadside. However, his possibilities to make the right decision e.g. in terms of the speed he chooses, are limited.

Design standards of roads are made by engineers. In the well-known OECD-publication on technological assessment a very relevant description of the nature of the engineer is included. The engineer is described as a person who is trained to create good and, in some cases, new solutions for well-defined problems. However, when he is confronted with problems which are complex or not well defined, he gets into difficulties. As he is not trained to analyse complex problems, he tries to simplify the problem. If, for example, there is a strong interrelation between variables that cannot be described in a simple quantitative way, he tries to ignore this interrelation or he has the tendency to consider variable elements in a first approximation as constants. This is exactly what has happened in the field of geometric design standards for roads. Based on simplified assumptions regarding the properties of the road users e.g. by using only the concept of visibility (which, as we know now, is not very relevant for the perception process) we can define sight distances, like stopping sight-distance, overtaking distance etc. Engineers are satisfied now because they can easily translate the driving task in terms of road characteristics by

straight forward computation. The relevancy of these results for practical driving situations, however, is questionable. Furthermore, it should be stressed that this approach leads primarily to standards regarding individual design elements, and not to standards for roads or road networks.

More recently, a considerable amount of systematic research has been carried out regarding the analysis of the driving task. Based on the results of this research, it has been found that many assumptions are not valid. We have learnt that the limitations and characteristics of the road users are not constant. They depend very much on the task he has to perform, on the external situations, but also on "internal" factors, such as personality variables, the level of alertness, fatigue, etc. His reaction time for a certain signal, and even the fact whether or not he observes the signal, is not primarily dependent on the characteristics of the signal but in the first place on his expectancy. Will he, in other words, be able to predict a situation which includes the signal. Furthermore, in order to be able to meet the requirements set up by the road users, it should be realized that driving is a dynamic process and that the driver is confronted with a succession of information. The sequence of the information is important and the consequence of this is that road and traffic characteristics should therefore be as consistent and as continuous as possible. These requirements are much more important than the absolute value of the sight distance etc. This emphasizes the importance of having standards both for individual road elements as for roads and road networks, as pointed out during the discussion on the paper by Mr. Hamelink.

This is one of the reasons, but not the only one, why there is a strong tendency in many countries to renew or alter the existing standards for the geometry of roads. Due to restrictions in financial resources there is a stronger need to improve the roads on a cost-effectiveness base, while on the other hand there is a change in the priority of objectives. Safety and environmental effects seem to have a higher priority than traffic flow only. It should

not be forgotten that the primary objective of a transportation system is to transport people and goods from one place to the other. Travelling time therefore is a very important economic factor. The mean travelling speed is therefore a very important item for the network. It is, however, impossible to always offer all road users a maximum average travelling speed.

These aspects seem to indicate two distinct approaches to considering the function of a road transportation system. The first one deals with the individual road user who has to perform his task (his manoeuvring task) and relates primarily to safety. The other one deals with the traffic flow as a whole and relates primarily to the economic factors of transportation.

These two approaches to the function of the transportation system lead in my opinion to two approaches to the classification or categorisation of roads. The view-point of the road user suggests a small number of types (or categories) of roads or road sections that can be easily discerned while driving; a certain route may, and usually will, consist of road sections of different types. The viewpoint of the transportation economy, on the other hand, requires that roads or routes be divided into types (or classes) that provide optimal transportation. It should be noted that the terminology used in the literature is rather confusing.

In a number of papers in this session, distinctions of this kind are suggested. The papers of Sweden (Brandberg and Du Rietz) and Germany (Steierwald and Doormann) may serve as examples.

As indicated above, continuity and consistency of roads are the main requirements from the road user's point of view. Consequently the shape of the relevant design elements, and the composition of these elements should be as uniform as possible. The road user has to recognize on what type of road section he is driving and what situations and obstructions he expects. Obviously, this principle does not automatically imply that all roads should have the highest quality from the purely technical point of view. In some cases, the

solutions do not need to be more expensive, but could be cheaper. If the financial resources are limited, a lower service level has to be offered, as pointed out by certain participants.

As we want to use the existing road system, or parts of it, as much as possible the entire system should offer enough flexibility for the designer without, however, restricting the road user's possibility to predict the road conditions ahead. This is a requirement from the point of view of cost-effectiveness as well.

As far as research is concerned, the following remarks seem pertinent. Considering the road user as the actual user of the system, his behaviour has to be predicted as well as possible. Research has to be carried out on trip generation, trip distribution and assignment. Valid prediction models have to be set up.

The assessment of road user behaviour is a complex task and engineers cannot undertake this on their own. They need the behavioural scientists, because they are trained to measure behaviour. Engineers and behavioural scientists have therefore to work in multidisciplinary teams. The remark of Mr. Vakkuri from Finland is pertinent here: "road standards are not goals but only means to achieve our goals". We must therefore be aware of the goals of the society, and the goals have to be formulated in an exact way. When formulating the goals we have to consider that we are building roads today which will still be used in the year 2000. One example in this respect is the expectancy that heavy goods vehicles will play a more important role in the future.

This leads directly to the second area where further research is needed: not only do we have to know more about the characteristics of road users, but also about the transportation characteristics on road networks.