## DESIGN AND CLASSIFICATION OF ROADS FROM THE VIEWPOINT OF DRIVING TASK ANALYSIS

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R-76-15 S.T.M.C. Janssen Voorburg, 1976 Institute for Road Safety Research SWOV, The Netherlands For every traffic situation in all circumstances the road user ought to make an accurate prediction of both available and required traffic spaces. Accidents may happen when there are limitations in movement space, caused by traffic facilities or by the presence and behaviour of other road users.

Depending on the degree of occurrence of combinations of road and traffic characteristics, the road user has built up a pattern of expectation regarding the relationships between the road characteristics and road user behaviour on the road. Road user behaviour is determined, by the road user's route and manoeuvre selection in his vehicle within the given traffic space. In view of the road user's limited perceptive capacity, an effort must be made to keep route and manoeuvre selection as simple as possible. The question is how road design can help to facilitate these tasks and what standards the road must meet in order to fulfil this function. Two major elements of the traffic system can be distinguished: limitations on movement, and their predictability for the road user. The road plays a major part in movement limitation. Together with traffic characteristics, road characteristics largely influence the effort the road user will have to make in performing his tasks. The road characteristics relevant to driving tasks can be distinguished as: first, permanent and continuous perceptible characteristics of the cross-section, road markings and road surface; secondly, permanent and discontinuous perceptible characteristics of alignment, cross-section, traffic signs and road surface while, in addition to geometrical factors, frequency, density and sequence are important.

The total behaviour of the individual vehicles determines traffic characteristics. By definition, these are not permanently or continuously present or perceptible along a given road section. Traffic characteristics are not only linked closely with vehicle characteristics but are also determined by road users' relevant characteristics. On the basis of the characteristics of the traffic, the vehicles and the road users, functional requirements will be drawn up for road design which should make driving tasks easier and hence ensure greater road safety. In analysing traffic behaviour, a need is assumed to exist for a subdivision of roads into categories based on a hierarchy of manoeuvring effort. It has also been reasonably suggested that road and traffic characteristics may adversely influence traffic behaviour and hence road safety by causing frictions - that is limitations on movement - longitudinally and laterally. It is therefore obvious that, according to the type of road, road and traffic characteristics will have to meet certain standards which aim at reducing longitudinal and lateral friction.

The point of departure for classification is a hierarchy of roads based on manoeuvring effort arising from longitudinal and lateral frictions. An increase in longitudinal friction should be accompanied by a proportional lateral friction.

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Figure 1 shows diagrammatically how road categories can be distinguished.

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The lateral friction is plotted horizontally and the longitudinal friction vertically. The ideal road categories are on the diagonal. A decrease in lateral friction reduces the accessibility (precinct function) of the road and a decrease in longitudinal friction increases the directness of the road (its flow function).

The effectiveness of dividing roads into categories depends on compliance with the four following functional requirements: First, <u>consistency</u> of characteristics within the road category. Design criteria for safety, travelling time and comfort should be the same for all road characteristics and should be attuned to vulnerability, top speed, acceleration and deceleration capacity, directional stability and manoeuvrability of vehicles in the lowest category allowed on the road in question. Secondly, <u>continuity</u> of characteristics within the road category. The information the road user needs on limitations of manoeuvring space longitudinally and laterally, which may, or may not, exist permanently along the entire length of road section in a particular category should be provided by permanent and continuous road characteristics.

Thirdly, <u>little variation</u> within the road category - in other words: uniformity in characteristics. For relationships within the road and traffic characteristics it is assumed that with a corresponding average value - but a difference in distribution a road with more variable characteristics is usually more hazardous. Finally, road categories <u>recognisable</u> by road users. Categories are easier to recognise the fewer they are in number and the easier they can be distinguished from one another. Categories become easier to distinguish if dichotomous characteristics are used, redundant characteristics and clearly perceptible category indications or category-typifying road characteristics.

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Relations between road characteristics themselves and between road and traffic characteristics can be expressed as conditional probabilities based on frequencies of occurrence, per unit of traffic performance - expressed in vehicle kilometres travelled. By reference to these frequencies, road users will build up a pattern of expectations of relationships between characteristics of the road and of traffic on that road. Figure 2 gives an example how road categories can be distinguished complying with all functional requirements. A theoretical approach has to be worked out further and checked in parts against empirical investigations.

In this diagrams from left to right an increase in road-user manoeuvring effort is shown. Vertically the main categories are shown in a hierarchy; from top to bottom there is a decrease in design speed and an increase in the number of permitted vehicle categories:

first a motorway where all motor vehicles are able and allowed to travel faster than, say 70 km/hr; than a "road" for all vehicles except cycles and mopeds etc.; and finally a "street" where all vehicles are allowed. The effective functioning of such a road categorisation depends on the way in which the road characteristics create the correct expectation in the road user, relatively to his own traffic behaviour and that of others.

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Figure 1. Diagrammatic classification of roads based on manoeuvring effort.

	dual carriageway		single carriageway	
	rural	urban	rural	urban
motorway (N)	MI	MII		•••••
design speed	120	100		
"road" (R)		RIII	RIV	
design speed	•	<sup>.</sup> 60	80	
"street" (S)	<b>ani ana</b> .		SV	SVI
design speed			60	40

Fig. 2. An example illustrating categorisation based on total number of safety criteria.

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