

SPEED LIMITS OUTSIDE BUILT-UP AREAS

Summary and Recommendations

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1. INTRODUCTION

This survey has made it possible to collect a large number of data relating mainly to speed measurements and accidents. The present report would be too bulky if it were to set out all the results in detail, so only the more important results will be discussed.

The following data relating to 15 experimental roads and 12 control roads testify to the scope of the survey.

1. Total number of speed measurements, including supplementary studies: about 1 million.
2. Total number of measurements of distance between vehicles: about 250.000.
3. Total number of accidents on which detailed information was collected: about 17.500.

2. SUMMARY OF ROADSIDE RESEARCH

2.1. Behaviour

1. Prescribed speed limits influenced the speeds at which vehicles were driven. The average speed changed very little; in all cases the dispersion of speeds decreased. The average decrease in dispersion was 13 per cent on single-lane roads and 10 per cent on motorways.

2. Speed limits had no unfavourable effect on the average speed. Comment: The average travel time will therefore scarcely change, since it is largely determined by the average speed and only to a lesser extent by the dispersion. In fact the decrease in dispersion even resulted in a slight improvement in average travel time.

3. The effect on the frequency distributions of speeds depends on the levels of speed limitation and police control. A low speed limit and more intensive policing cause a decrease in the dispersion. This holds good for the levels used in this study.

4. On motorways, prescribed limits have slightly more effect on the speed distributions than recommended limits. In this case the recommended limits had very little effect.

2.2. Safety

The results of the speed limits studied do not justify firm conclusions on road safety.

Comment: An analysis of the results does, admittedly, suggest some favourable effect on road safety; but subsequent changes in the method of recording accidents seriously hampers interpretation.

Scientific study of road safety points to the conclusion that, generally speaking, uniformity of traffic and homogeneity of the possibilities of interpreting traffic situations increase road safety. However, the study of the effects of limiting speed does not clearly confirm this theory. But that does not mean that it is

wrong, for the difficulty of confirming the theory may be due to the level of policing and the changes in the recording of accidents.

3. RECOMMENDATIONS

3.1. Measures to be taken

3.1.1. General speed limits

Must speed be limited outside built-up areas in order to increase safety? The answer is "yes" if certain conditions are satisfied and "no" if they are not.

These conditions are set out and explained below on the basis of a systematic analysis of the problem, the survey carried out and general scientific knowledge.

General speed limits, that is to say uniform regulations constantly applicable on all roads in a particular category (type of road) are examined below.

The practical survey carried out by the Institute for Road Safety Research SWOV demonstrated that the dispersion of speed distribution may decrease if speed limits related to the speeds at which vehicles are driven on these roads are prescribed.

General scientific knowledge supports the following logical reasoning: a reduction of the dispersion of speed distribution increases the homogeneity of typical traffic movements; securing the greatest possible homogeneity of such movements is one way of increasing road safety, since homogeneity makes it easier to foresee dangerous moves (such as overtaking) and also reduces their frequency; conclusion: speed limits can increase road safety. This conclusion is justified, however, only if certain conditions relating to general speed limits are satisfied.

Obviously, roads and traffic conditions are highly disparate. A breakdown into categories - both of roads and of traffic situations - is necessary, not only for an overall picture of the problem, but

also, and more especially, because general speed limits should be related to the speeds at which vehicles are driven on the roads in question. A general speed limit for a particular category of roads is only feasible if the speed distributions on the various roads in that category do not differ too widely. Moreover, the various categories must be easily recognizable by road users. The categories may be very different from one another, but each one must be as uniform as possible, especially as regards the characteristics which affect the recognition of categories and the speed limits adopted. It is clear that this cannot be achieved overnight; hence a long-term policy is required, and this is explained below.

3.1.1.1. Long-term policy

The first principle derived from the general logical reasoning mentioned in section 3.1.1. - adaptation of the road's characteristics to its traffic function - involves distinguishing a small number of categories of roads having specific functions and drawing up directives on the characteristics of each category. The result of applying these directives systematically is that traffic can move at the same speed on road having the same function. It is then possible to take measurements on the roads of each category, such as maximum speeds and, for some categories, minimum speeds. Uniformity and continuity of the geometric characteristics of the road and of its surface properties are the logical consequence of this first principle. They imply that local speed limits should later be eliminated. The road sections in question would therefore have to be rebuilt and adapted to the function of the road. Of course, it is also possible to build a new replacement road and then place the old one in a lower category. It must not be forgotten that the directives of a given category of road will allow a margin of variation in the characteristics of the road. If the traffic density increases, the problems arising from the consequent irregularities may be temporarily solved by introducing local speed limits pending a final solution. Such limits should, however, be regarded only as a provisional solution.

The second principle derived - homogeneity of movements and other traffic characteristics - can be achieved through uniformity in the performance of vehicles and behaviour of drivers. Here, the application of the first principle may have a favourable effect. The introduction of a legal minimum speed as well as a maximum speed on roads to which this principle is applied may do much to reduce the dispersion of speeds.

As to the standardization of vehicle performance, the most important factors are speed, acceleration and braking power. Although the standardization of all vehicles is neither technically nor economically feasible even in the long term, an attempt could be made to standardize a few categories of vehicles which, as such, would be easily recognizable. However, this form of standardization is not a necessary condition for the introduction of speed limits. The uniformity and coherence of traffic regulations may be regarded as an elaboration of the second principle, aimed at influencing behaviour in traffic. With regard to the standardization of drivers' behaviour, the idea is not only to introduce permanent, invariable speed limits, whether indicated by panels or not, but also variable speed limits depending on traffic or weather conditions and indicated by luminous or panel displays. Thus a long-term policy cannot be based solely on one aspect of traffic problems. Greater road safety can be achieved only by adopting a coherent set of measures. Within the framework of such measures, the classification and improvement of roads must be linked with the introduction of speed limits and adequate policing of their observance.

3.1.1.2. Nature of measures to be taken

Defective road and traffic conditions are indicated in paragraph 2.1.* (see list of abbreviations annexed).

1. T_{vup} : starting from the future situation, i.e. when all roads have been classified in a small number of categories and directives

*This paragraph appears in the complete report (Only in Dutch)

on road characteristics have been issued for each category, it will be possible to prescribe speed limits for each category in order to make the flow of traffic homogeneous.

2. T_{wup} : for those roads (types of road) classified in a given category, but whose characteristics do not correspond to the directives and which should, in fact, be rebuilt, the limits prescribed will have to be lower than those at present valid for the entire category (on the basis of T_{vup}). These conditions conduce to general speed limits.

3.1.1.3. Considerations relating to the setting of general speed limits

General speed limits, as a driving regulation, could be imposed by the panels used to indicate the category (type) of road, e.g. motorways. It would then be unnecessary to erect special panels showing maximum and/or minimum speeds. If it were desired to introduce a general speed limit on roads whose category was not indicated by a panel - on mixed-traffic roads, for instance - speed-limit panels would have to be installed.

Exceptional cases aside, road users will generally adopt as their upper limit a speed which they consider to be just below the danger line, since there would be little sense in going any faster. A maximum speed below the individually-adopted safety limit may be regarded in various ways as, for example:

- (a) a driving rule to be followed;
- (b) a suggestion aimed at changing personal safety standards;
- (c) a senseless limitation of freedom;
- (d) an effective measure for other road users.

Notions (a) and (b) imply that drivers will observe the maximum limits of their own free-will; this is not true of notions (c) or (d).

If observance of the speed limits is not checked, it may be expected that a lowering of the maximum speed will affect all groups and

may reduce the dispersion of speed-distribution, but also that the number of offenders will increase, which may lead to disparegement of this driving regulation.

If observance of the speed limits is checked, offenders may be caught and punished. So long as the risk of being caught is below the level of risk they accept, drivers will not care. As the checks are stepped up, the risk of being caught will rise above the level accepted by an increasing number of drivers. This explains why the dispersion of speed-distribution decreases with strict policing.

A general speed limit for conditions T_{vup} must be determined on the basis of a percentage of the speed-distribution on the roads under consideration; for instance, 85 per cent may be chosen, i.e. the speed not exceeded by 85 per cent of road users.

A general speed limit for conditions T_{wup} will be lower than the limit for the category concerned (this limit is valid for a type of road in the overall category whose general speed limit is based on T_{vup} conditions). Considerations of safety will have to decide.

3.1.2. Specific speed limits

By adopting specific speed limits, it is possible to lay down differentiated regulations adapted to place, time and circumstances. Paragraph 2.1.* indicates the road defects, namely:

1. T_{wlp} : denotes sections of road which do not satisfy the directives on characteristics applicable to the category concerned; for example, lack of continuity and uniformity, such as excessively sharp bends and badly planned crossroads. The speed limits on such sections will have to match the defects.

2. T_{wut} : denotes temporary conditions obtaining on one or more categories of road, such as peak traffic hours, high traffic densities at Easter and Whitsun weekends, weather conditions (fog, ice, etc.). Here, temporary speed limits suited to the circumstances are required.

*This paragraph appears in the complete report (Only in Dutch)

3. T_{wlt} : denotes temporary conditions obtaining on short sections of road, such as road-works of short duration, very dense local traffic after football matches, accidents, etc.. In these cases speed limits suited to the time and place must be prescribed. These conditions call for specific speed limits.

Specific speed limits, at dangerous places, for example, may be indicated by fixed panels. It is desirable to show the cause (nature of danger), since the speed limit is related to a specific hazard. Specific speed limits determined by time - for instance, valid from 8 a.m. to 8 p.m. - or by circumstances, such as bad visibility or road-works, can only be indicated by interchangeable or variable signs; the reason for the limit should also be shown.

Temporary difficulties such as bad visibility, peak traffic hours, temporary danger points, road-works, etc., can occur anywhere and at any time. Many of them take road users by surprise. When speed limits based on these difficulties are prescribed, the following conditions must also be satisfied:

- (a) the panel indicating the speed limit must catch the driver's eye;
- (b) it must be possible to change the speed limit according to the conditions;
- (c) the speed limit must be introduced only if the conditions obtain;
- (d) the reason for the limit must always be shown.

Speed limits rendered necessary by permanent danger points or temporary road-works, which are indicated on, beside or near the road, usually apply only to a particular section of road. They may, however, be applicable to a road in a particular category. In this case, too, the reason for the limit, as well as the time and place for which it applies, must be shown. An advance signal panel will often have to be provided.

These specific limits must always be suited to the place, time and

circumstance. The following factors must also be taken into account:

- (a) technical qualities of the road and the vehicle;
- (b) abilities and limitations of the driver;
- (c) weather conditions, etc.

The working out of these factors and the method of determining the limits should lead to the preparation of more detailed directives.

3.1.3. Summary of recommendations on measures to be taken

A system of speed limits may have a favourable effect on road safety provided that it forms part of a coherent set of measures.

First of all, the great difference between roads makes it necessary to classify them in a small number of categories. The rebuilding or adaptation of roads will often be inevitable. The categories must be easily recognizable by road users; the roads in each category must meet the expectations of road users with respect to that category. If they do, an upper speed limit can be prescribed for each category of road; for some categories, a lower limit can also be set. In determining these limits, account must be taken of the speeds at which vehicles are driven and the density of traffic. An adequate amount of data on traffic and roads will there be needed. Adequate checks on the observance of the speed limits are essential.

It will not be possible in practice to introduce the whole set of essential measures on all roads at short notice. Short-term measures will therefore be required, but they must be in keeping with the whole set of (long-term) measures, which are essential for achieving the aim in view, i.e. improving road safety. Consequently no short-term measure must be taken which is likely to hamper the long-term policy.

To determine the long-term policy it is necessary:

1. To make an inventory of roads according to road and traffic characteristics;

- 2.(a) To analyse the data on this inventory;
- 2.(b) To adopt criteria for classifying the roads;
3. To adopt standards for each category of road;
4. To work out a system of identification by which road users can recognize and distinguish a given category of road;
5. To adopt, for each road category, measures designed to make traffic homogeneous, such as speed limits, police checks, electronic signalling and any necessary rebuilding work.

The inventory (see 1. above) is of vital importance for a long-term policy centred on road safety; for unless the characteristics of the roads and traffic are known, it will be impossible subsequently to verify the effect of certain measures such as speed limits. It would also appear to be impossible to take effective short-term measures.

3.2. Recommendations for the survey

3.2.1. Fuller roadside survey

The effect of both maximum and minimum legal speed limits should be studied, with different limits and different degrees of policing on the various categories of road.

3.3.3. Purpose and making of a fuller roadside survey

1. The survey of the effect of speed limits should satisfy the following conditions:

1.1. Steps should be taken to ensure that during the survey there will be no disturbances calculated to make it particularly difficult or impossible to analyse the results.

1.2. The degree of sampling on roads depends on the minimum change in safety level (expressed in numbers of accidents) which should be statistically significant. The size and significance threshold of this change should be determined in advance.

1.3. The measuring systems used must make it possible to establish

with sufficient accuracy the speed distributions, the number of overtakings and the distribution of distances between vehicles. This work takes a fairly long time to prepare, particularly if new systems and/or equipment are to be used.

1.4. The level of recording on experimental and control roads must be both known and constant.

1.5. The degree of policing throughout the period of the survey must be known exactly.

2. Contacts should be made at the international level, with a view to standardizing survey and measuring methods, so that the results may be comparable.

LIST OF ABBREVIATIONS USED

Defects

- T_{wup} : Imperfect road conditions, universal, permanent
T_{wlp} : Imperfect road conditions, local, permanent
T_{wut} : Imperfect road conditions, universal, temporary
T_{wlt} : Imperfect road conditions, local, temporary
T_{vup} : Imperfect traffic conditons, universal, permanent

Categories of road

- W_{sto} : Road, heavy traffic, two lanes^{*}, intersections at different levels:
motorways
W_{stg} : Road, heavy traffic, two lanes, intersections at the same level:
national highways
W_{seo} : Road, heavy traffic, single lane, intersections at different levels:
national highways
W_{seg} : Road, heavy traffic, single lane, intersections at the same level:
national highways
W_{gto} : Road, mixed traffic, two lanes, intersections at different levels
W_{gtg} : Road, mixed traffic, two lanes, intersections at the same level
W_{geo} : Road, mixed traffic, single lane, intersections at different levels
W_{geg} : Road, mixed traffic, single lane, intersections at the same level

Types of speed limit

- S_{wmav} : Speed limit, legal, maximum, permanent
S_{wmap} : Speed limit, legal, maximum, periodic
S_{wmai} : Speed limit, legal, maximum, occasional

* carriageways

S_{wmmv}: Speed limit, legal, maximum/minimum, permanent
S_{wmmp}: Speed limit, legal, maximum/minimum, periodic
S_{wmmi}: Speed limit, legal, maximum/minimum, occasional
S_{wmiv}: Speed limit, legal, minimum, permanent
S_{wmip}: Speed limit, legal, minimum, periodic
S_{wmii}: Speed limit, legal, minimum, occasional
S_{amav}: Speed limit, recommended, maximum, permanent
S_{amap}: Speed limit, recommended, maximum, periodic
S_{amai}: Speed limit, recommended, maximum, occasional
S_{ammv}: Speed limit, recommended, maximum/minimum, permanent
S_{ammp}: Speed limit, recommended, maximum/minimum, periodic
S_{ammi}: Speed limit, recommended, maximum/minimum, occasional
S_{amiv}: Speed limit, recommended, minimum, permanent
S_{amip}: Speed limit, recommended, minimum, periodic
S_{ammi}: Speed limit, recommended, minimum, occasional