

SOME THOUGHTS ON RESEARCH AND ENGINEERING OF LOW-VOLUME ROADS

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DEFINITION OF LOW-VOLUME ROADS

From the outset, it would seem useful to point out what is meant by the term "low-volume roads." As far as this discussion is concerned, it refers to a road that supports traffic of less than 50 heavy vehicles per day (trucks carrying a payload of over 5 metric tons or more per day and per direction.) This figure is obviously not a precise limit but is used to give a clearer picture of the roads under discussion, and to indicate that the important definition criterion is the amount of heavy vehicle traffic that a road carries.

Low-volume roads then, although having very different aspects depending on their context, have a number of characteristics in common:

- Extremely contrasting horizontal alignments, which can be either very sinuous or very straight. However, the longitudinal profile keeps very closely to the natural configuration of the land in order to avoid earthworks wherever possible.

- Narrow-width pavements, which are generally not very thick and do not include bound layers. Generally, they are unpaved or covered with a thin bituminous layer: surface dressing or bituminous mixes less than five, or three centimeters thick. They are generally built in the in-situ soils without improving the natural soil bearing capacity. When this type of pavement fails it is generally due to deformations of the subgrade.

All of these characteristics are justified within a general context of funds insufficient to cope with all building and maintenance requirements for the entire road network. Under these conditions, expenditures must be decided according to priorities, with most of the spending on studies and construction being allocated to high-volume roads.

CONSEQUENCES OF LOW-VOLUME ROADS

The consequences of the eventual deterioration of low-volume roads are considered less damaging to the economy in general, even in terms of level of service rendered to the users. Therefore, when planning for low-volume roads a higher risk of failure is permitted than

for high-volume pavements, and intervention standards are adopted that allow a higher rate of deterioration and the use of "light construction" techniques, which may even be reduced to mere localized interventions.

Risks of Deterioration

The conditions under which studies and construction are carried out may increase the risks of deterioration, in one or more of the ways listed below.

Uncertainties as to Traffic Volume

Usually very little is spent on traffic counts, and it is not possible to measure small and highly variable numbers (weekly variations, for instance) with a great deal of accuracy. Traffic counts are more liable to error in the 10 to 15 heavy vehicles range than the 500 to 1000 range.

Limited Geological and Geotechnical Surveys

These studies are most often carried out as part of earthworks projects. Low-volume roads generally require little earthwork and, therefore, little is known of the long-term bearing capacity of the soil and how to obtain good performance. Rather, calculations are based on the soil bearing capacity found on the construction site. Yet low-volume pavement means that the natural soil is subjected to greater stress than with high-volume roads where soil is frequently improved or replaced with sounder materials.

General Drainage

Drainage can be difficult to achieve since the road is at natural ground level. Drainage depends on the gradient of the natural relief and existing networks. This could be expected to lead to sophisticated solutions since, in addition to the difficulty of realization, drainage is exceedingly important both for the pavement structure and for the soil bearing capacity. But this is not always the case.

Little Control over the Characteristics of the Construction Materials Used

Local materials, whether bound or not (sand, gravel) can, when correctly extracted and implemented, be perfectly satisfactory and suitable for the circumstances. However these reputedly less "noble" materials, compared to those used for high-volume roads which generally include binders, can sometimes be of insufficient quality. In France, based on detailed experience with "rustic" materials, it was realized that, contrary to past practices, just as much care was required in the preparation and utilization of these materials as for the materials used for high-volume roads. Satisfactory results can be obtained only if these efforts are made.

The maintenance conditions of low-volume roads are extremely variable.

- Sometimes unsuitable techniques are used merely because they are the only readily available within the locality. Sometimes the maintenance agents are insufficiently qualified.

- There are situations where frequent "spot" interventions are necessary. The drainage network is often damaged by natural phenomena, and as this type of road is often highly accessible, the frequent traffic passing over it, causes further damage. Damage can spread very quickly and cause interruptions to traffic.

All of these risks are taken to the detriment of the user, with the government making savings at the user's expense, whose traffic costs are higher on low-volume roads than on the roads of other networks.

Although it is probable that in view of funding difficulties low-volume roads will continue to reflect high traffic costs, how to reduce the risk of serious situations

of interruption of traffic, and how to obtain maximum value for money remain important questions.

These questions are all the more important where funds are low. In this context we should note that although the amounts of money involved in providing a lower volume of traffic are lower than for other categories of roads, considerable sums are nevertheless at stake and therefore must be optimized.

SUGGESTED ACTIONS

Seeking to reduce risks of interruption to traffic, and obtain better value for money, two lines of action are suggested:

- Due to the extreme sensitivity of low-volume roads to weather conditions (and their variations), and to the nature of the soils and to the effects of the loads they support, improved performances could be obtained by carrying out far more comprehensive studies than is customary, especially in the field of geotechnics and drainage. In this regard, studies and construction costs for low-volume roads would be higher than for high or very high-volume roads. However, this would lead to a reduction in uncertainties as to the foreseeable performance of this type of road.

- An economic optimum is not solely determined by a trade-off between initial investment and maintenance spending under these conditions. Construction cost inputs should be augmented by realistic investment rates based on average values.

Research is required to determine how such factors as availability and deployment of technology and manpower, for example, affect the economics of investment in low-volume roads.