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INVESTIGATION OF THE POSSIBILITIES FOR ESTIMATING VIBRATIONS CAUSED BY TRAFFIC

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1. Introduction

According to Hungarian code on protection against noise and vibration, a vibration prevention plan has to be made for new road projects in order to verify that prevention requirements will be met. In this plan vibration loads in living rooms of roadside residential buildings have to be predicted for expectable future traffic data.

In many instances the above planning can be accomplished with comparative studies, but in other cases some kind of prediction method has to be applied. However, there is no readily applicable prediction model comprising the parameters of the source, spread path and the immision site, and most publications are focused on particular problems (2,3).

The paper presents the results of a new method for the prediction of vibration immission from the traffic. The method is under development, the presented results came from experimental use.

2. Vibration prediction method

The new prediction method has the following features: parameters influencing the immission can be measured at the site, thus the immission on the road slab and in its vicinity can be established by different measurements carried out beside the existing road. Another measurement, using the impulse excitation method, is made for the determination of the transfer function between the sites of immission and the planned road slab. The predicted vibration immission is obtained by multiplying the two functions.

Applicability of the method is demonstrated by the example below.

3. Verification of the prediction method by site measurements

According to the method the transfer function of the system is to be determined by impulse excitation method. In order to verify the method we carried out measurements beside existing roads. First the transfer functions obtained from the actual traffic and from the impulse excitation method were compared, then the autospectra obtained from prediction and measurements.

According to Szendrei and Freeme (1) impulse excitation may be used for the simulation of passing by vehicles only if a sufficient number of excitations are applied. This was done by applying a sufficient number of integration in the evaluation of the test results.

Autospectra and coherence functions were examined at different distances from the road and at different speed of the passing by vehicles. Coherence functions were used for checking the acceptibility of the measurements. When evaluating the autospectra the ESD functions were examined, since former experiences (4) showed that this function is most applicable for characterising the transfer of vibration energy in the ground.

From the same study (4) it was also concluded that it is sufficient to restrict the evaluation to the 0-50 Hz frequency band, since, because of dumping properties of the soil, the information content of any signal over 50 Hz is negligible. From the measurements it was found that the main wave path is the shortest straight line between the points of excitation and immission if impulse excitation is applied. In case of passing-by vehicles there are multiple wave paths among which it is not sure that the shortest is the main one. This is explained by inhomogenities of the road surface.

If those measurements are examined, that show a good coherence, (e.g. Fig.1.), comparison of transfer functions from impulse and truck excitations show similarity. This means that if emission function from truck measurement are multiplied by the transfer function from impulse excitation the result should be equal to the measured immission function.

Fig. 2 and 3 show functions measured at impulse and truck excitations, respectively. Comparing the two functions point by point good agreement is found.

It may be concluded from these measurements that the suggested prediction method is applicable for good quality homogenious road surfaces. The locaton of the measurement of the emission function requires further investigations.

References:

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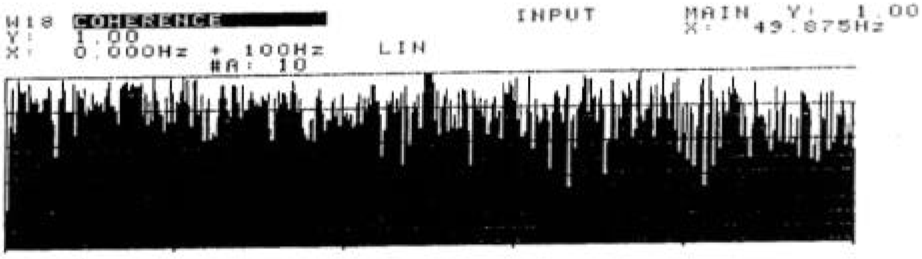

Fig 1.

Coherence from truck (50 km/h) excitations

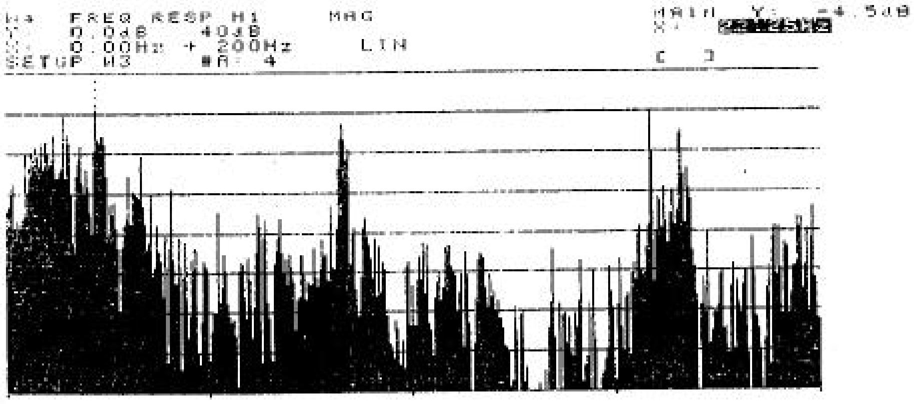

Fig 2.
Transfer function from truck excitation
(50 km/h)

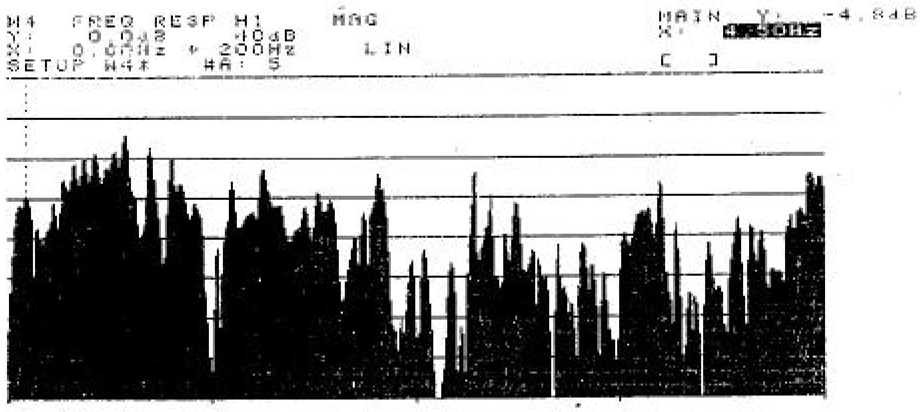

Fig 3.
Transfer function from impulse excitation