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DO WE NEED COMBINED NOISE AND VIBRATION INDICES ?

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Introduction

Man, in his environment, can be subjected to noise and vibration in different ways. Noise and vibration can make him feel annoyed or disturbed, or do not disturb him at all. The feelings one get are not simply related to the strenght of the source. Of course, the source is the origin of any complaint, but many other factors are involved as well, both physical and subjective, in people's evaluation of a disturbance. So, the sort of activity one is doing, man's concern to the property and his position in it, are contributive factors to the feeling one can get in his proper environment.

The situation inside a building compared to that outside may be different in that noise will be reduced by 10 to 25 dB but vibration may be felt better inside than outside.

Structural vibration

In its simplest form a house acts as a spring-mass system when it is excited. When the excitation is a random force the system will respond in its different modes. So, for the house as a whole the response will be strongest for the resonance frequency of the soil loaded by the house, and for the structure and each element, e.g. floor, beams, wall, columns, the response will be stressed on the fundamental frequency and higher modes.

Human response to vibration

Much work has been done during the last decade on the investigation of people's reaction to whole body vibration. However, this information is more related to transportation and ride comfort than it is to people's reaction to structural vibration.

A good guide is the German Standard DIN 4150. In this standard the degree of perception is defined by a K-value. K=0.1 is known as the threshold of perception.

Rattle

Rattle has been mentioned as a noise problem by different authors. The phenomenon has been discussed in more detail in a recent report by Kryter about Concorde Aircraft noise. Kryter worked out a 'Vibration Rattle Index' (VRI) based on the energy content of the five 1/3 OBs between 50 and 125 Hz. A VRI-

penalty is then added to the EPNdB or the Peak PNdB level to compensate for the 'vibration-causing energy'.

From the literature it is learned that vibration from traffic, as a physical phenomenon, is not the worst; it will not cause damage to buildings. However, from the physical data it is understood that low frequency noise and vibration can cause rattle. This phenomenon can have the double effect of being annoying for occupants and making occupants aware of existing vibrations. In the latter case subjective effects may interact.

On these grounds it can be stated that low frequency noise and vibration should be taken into account for setting up criteria. Therefore it would be ideal if combined noise and vibration indices could be worked out. The next question is to determine how this can be done.

Combined noise and vibration indices

More research work has to be done before an answer can be given to this question.

Kryter suggested the use of a VRI based on a single 1/3 OB for rating aircraft noise. Other investigators found some correlation between structural vibration and overall sound pressure levels. Though, it is believed that all frequency bands should be taken into account for setting up combined noise and vibration indices.

Conclusion

A general conclusion is that low frequency noise and vibration from traffic may interact with building resonance frequencies and therefore annoy people. Thus, low frequency noise and vibration should not be overlooked when rating a source. Therefore, it is suggested that combined noise and vibration indices for rating transportation noise should be derived.

Research work is going on to answer the question of how this can be done.

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