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PLANNING CONSEQUENCES OF THE MAXIMUM dB(A) CONCEPT—A PERSPECTIVE

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The maximum noise concept based on the noisiest event represents a new principle to control the effects of an environmental pollutant in the urban area. The report describes these newly developed dose descriptors for the relation between exposure and effects and presents examples for practical actions to control noise exposure.

1. INTRODUCTION

Disturbance by noise is probably the most important environmental impact of the transportation apparatus and affects a large number of people, particularly those living in built-up areas. An increased knowledge about the risks involved and the major acoustical determinants for noise effects on humans are a prerequisite for valid control strategies.

Previous research on the effects of environmental noise has demonstrated that the most common effects are sleep disturbance, interference with activity and rest and recreation [1]. The ensuing summary experience in terms of subjective annoyance is a measure of the exposure effects in a given population and has been widely used in field studies in several countries [2, 3]. The proportion of annoyed persons in an area with similar noise exposure is often used as the appropriate effect measure for the population and can be used to establish dose–response relationships.

The objectives of this presentation are to present a new model for noise control in road traffic noise and present comments on the practical application. The presentation will be based on the maximum noise level concept as will be summarized in the following.

2. THE MAXIMUM NOISE CONCEPT

The exposure to road traffic noise is most commonly expressed as the average value over a certain time period such as 24 h (equivalent noise level 24 h; L_{eq}). It is basically a technical concept that calculates the average amount of energy over a certain time period. This unit has been extensively used as a basis for planning and control purposes.

Conceptually, the application of this principle for noise control purposes is difficult in a specific situation. Should one limit the number of vehicles or the noise emitted from every vehicle?—both actions will reduce the average noise value. In everyday experience, extraordinary events, such as a motorbike without mufflers, can easily be identified as the most disturbing event. An action to decrease the total number of vehicles—most of which are relatively quiet passenger cars—will decease the L_{eq} value, but will not be appreciated by those exposed to the noisy motor cycle.

Experience from a number of studies over the years suggests that the noise exposure can also be expressed as the number of events and the maximum noise levels as separate entities [4–6]. As the control strategies based on this concept are different from those using the average value, it is of importance to assess the possibility to use this principle for road traffic noise control. The maximum noise concept is increasingly used to control other sources of environmental noise, particularly noise from starting or landing aircraft.

A recent Japanese–Swedish study on the extent of annoyance caused by road traffic noise used an improved method to express the noise dose [7]. The noise exposure for each person was calculated based on measurements along the street along which the respondent lived according to the usual method in studies of this kind. Thereafter, the noise level for each individual was adjusted for the distance to the street and the floor level. The extent of annoyance was determined using mailed questionnaires and the proportion of persons who reported that they were very annoyed, was calculated for groups with similar exposures, using the adjusted noise levels.

Figure 1 shows the relationship between the extent of annoyance and various parameters for road traffic noise exposure. There was an almost perfect relation with the L_{eq} level. The improvement in the relation between exposure and the extent of annoyance, as compared to previous studies, is probably due to the higher precision in defining the noise dose. The figure also shows that the number of events was not related to the extent of annoyance. It was suggested that the number had passed the critical threshold suggested previously [6] where the ear no longer discriminates between single events.

Finally, the figure shows the relation between the extent of annoyance and the maximum noise levels, defined as the average of the three noisiest events over a 3-h period. It is seen that the relationship was just as good as that for L_{eq}.

One can thus conclude that the maximum noise level was the major acoustical determinant for the extent of annoyance caused by the road traffic noise exposure. The unit

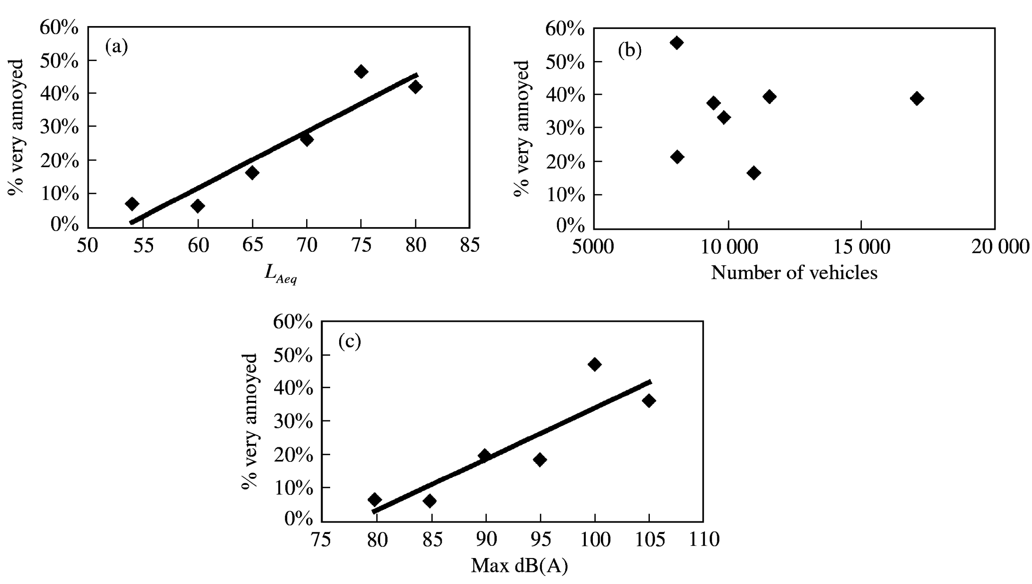

Figure 1. Relation between the extent of annoyance (% very annoyed) and various expressions for noise exposure.

can thus be used as a basis for noise control. The practical consequences of this will be described in the following.

3. ROAD TRAFFIC NOISE CONTROL

To reduce the extent of annoyance in the population, the concept based on the equal energy concept requires measures to reduce the number of vehicles or the noise levels. Both actions would decrease the L_{eq} value, although reducing the noise level would be more efficient (-3 dB $= \frac{1}{2}$ N; half the traffic flow only gives a 3 dB reduction in noise).

If one uses the maximum noise concept, actions should be taken against the noisiest vehicles. This means that measurements should be made of all individual vehicles in the normal traffic flow and those emitting noise levels in excess of a defined level will be intervened. The level at which such an intervention should occur is a standard that should be set by public health authorities. Once decided, the control will be directed against all vehicles with a noise level in excess of this value.

For the practical application, let us consider a scenario where authorities have decided that 75 dB(A), as measured at the façade, is the maximal allowed noise level (MANL) from vehicles in the street. The next step will be to decide for each street, the corresponding level close to the vehicles. The distance, the presence of barriers and unusual formations in the terrain, will determine the difference between this value and the MANL.

Once the street dB(A) level has been determined, this could be sign-posted (Figure 2). Obviously, different values will be obtained for different areas, depending on the distance to the façade, etc. This requires some type of simplification, to create a practical solution. One

Figure 2. Suggestion for road traffic noise sign using the maximum noise level concept.

TABLE 1

Noise levels at façade from different kinds of vehicles.

Proportion of vehicles ⩾ 75 dB(A)	
Street	%
1	0·3
2	0·2
3	0·4
4	0·5
5	1·8
6	0·8
7	0·4
8	2·4

TABLE 2

Types of vehicles emitting above 75 and 80 dBA in city traffic.

dB(A)	Cars	Light lorries	Heavy lorries	Buses
> 75	11	22	5	8
> 80	2	10	1	1

will then prohibit those vehicles emitting a noise exceeding the specific street value to enter the street. Measures of individual vehicles will ascertain that no one breaks the rules and if this happens, follow-up with the appropriate reprisal takes place.

The most important implication of this system is that it is possible to achieve control of individual vehicles. It would also turn the responsibility for noise abatement activities to the manufacturer of the vehicles and to the driver.

At present, there are no extensive data which demonstrate the practical applicability of this system. Preliminary data are available from a limited study in Gothenburg. The results regarding all kinds of vehicles are shown in Table 1.

The proportion of vehicles exceeding the maximum noise level of 75 dB(A) varied between 0·2 and 1·8%. This suggests that for the kind of street and the MANL chosen, the practical implications of the maximum noise concept would be rather limited.

Table 2 shows the results with respect to vehicle types. It is seen that light lorries (small delivery trucks) dominated among the vehicles causing noise levels above the norm. In continued work, it should be possible to identify different types of these delivery trucks and determine if the maximum levels are caused by a particular make of trucks or if they are related to the driving characteristics.

Before the maximum noise concept can be generally applied, additional data from several countries are needed. A research program has been formulated with representatives of several European countries and a request for funding will be made to the European Commission.

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