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SYSTEMS NOISE IN BUILDINGS
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CRITERIA FOR SYSTEMS NOISE IN BUILDINGS by W.E. SCHOLES

1. INTRODUCTION

The existence of criteria to specify noise conditions within buildings implies that we need to keep noise levels within certain maximum limits. At first sight, the reasons for this are obvious. Noise is unwanted sound and so the lower the noise levels within a building the better. But this is not always necessarily true. In recent years there has been a move to introduce deliberately one type of noise, in a carefully controlled manner, to make another, unavoidable noise, more acceptable to the occupants of the building.

The phrase 'acceptable to the occupants' brings in the complexities of psycho-acoustics; how people respond to different noises, how noise affects their general well-being and comfort. It is not easy to measure directly the effects of noise on people. Attempts at such measurements tend to be limited to the effect of noise on one specific activity, such as using the telephone or the ability to converse. These sort of tests are really objective tests and the ability to converse can be put on a numerical scale by using standard test words. Measuring how people feel about noise calls for social survey techniques in which people are asked to indicate their response to noise by using a scale of annoyance or a limited choice of descriptions. It is quite clear from common

experience - and social survey results show this too - that there is a wide range of noise tolerance between different individuals. Furthermore, the noise levels, acceptable to a given individual, vary from time to time, depending on his mood and on what he is trying to do.

As noise control usually costs money, it is unlikely that any practical criterion for noise control will make conditions acceptable to the least tolerant person. The setting of criteria is a compromise between cost and amenity and criterion levels tend to be set to make conditions acceptable to people with average tolerance to noise.

Current criteria are largely based upon limited surveys of people's reactions, and upon the effects of noise on speech communication, together with the experience of experts in noise control. Criteria drawn up on this basis have been in use for several years and are invaluable. The tendency in the future will be to adopt more complex methods for specifying the noise so that there is a good and proven correlation between the noise levels and subjective ratings of the noise. A further worthwhile development will be the valuation of amenity in monetary terms so that rational decisions can be taken on the worth of noise control measures.

2. CRITERIA

The unit used to specify the noise exposure has undergone changes over the years. For example in 1949 Knudsen[1] used dB(A) to specify his recommended noise levels for different situations. Beranek[2] put forward the concept of speech interference level (SIL) in 1950, for the same purpose. SIL is based on the noise levels in the 3 octave bands covering the frequency range

600 to 4800 Hz and was intended to deal with noises typically found in offices. For more general noises, in particular those containing appreciable low frequency components, Beranek found it necessary to specify the noise over the whole frequency band by means of the SC curves.

In a subsequent social survey, 300 office workers were questioned about noise and Beranek used these results together with associated noise measurements to put forward the NC curves[3] which take into account both the speech interference effects of the noise and also the loudness. The NC system of rating noise has been in wide use for more than 10 years and has been most useful. Recommendations have been made for acceptable noise exposures in a wide range of rooms, based on the NC rating system.

The noise rating, (NR) curves put forward in 1962 by Kosten and Van Os[4] are similar to the NC curves but the NR curves are the basis of a more comprehensive system of rating the likely effects of noise than is provided by the NC curves. The NR system besides rating the noise spectrum, using the NR curves, requires the adjustment of the criterion level to allow for such factors as pure tones in the noise, the duration and time of occurrence of the noise and economic link between the noise and the recipient.

3. RECENT DEVELOPMENTS

More recent research by Keighley into the effects of office noise[5] and of traffic noise by Griffiths and Langdon[6], for example, have emphasised the importance of the variability of the noise - within limits people tend to be dissatisfied with change in noise level as well as with the more continuous noise level.

While SIL, the SC curves, the NC curves and the NR system were being developed and applied, the dB(A) as a unit for specifying the noise level has been used widely as second best initially, but more recently, as the chosen unit. In 1964, Young[7] took Beranek's data, on which the NC curves were based and showed that the noise levels in dB(A) correlated just as well with the subjective data as the NC rating did.

This kind of result brings us almost full circle back to the dBA as a unit on which to base criteria for noise control - although remedial noise reducing measures will still often require band analysis of the noise.

It is suggested that in the future, criteria for noise control applicable to systems noise in buildings will be based on the dBA as the unit with some allowance for the variability of the noise.

4. REFERENCES

1. Knudsen, V.O., Journ. Ac. Soc. Am. 21, 296 (1949).
2. Beranek, L.L. and R.B. Newman, Journ. Ac. Soc. Am. 22, 671 (1950).
3. Beranek, L.L., Noise Control, 3, 19 (1957).
4. Kosten, C.W. and G.J. Van Os, N.P.L. Symposium No. 12, The Control of Noise, H.M.S.O., 1961.
5. Keighley, E.C., Journ. Sound Vib., 4, 73 (1966).
6. Griffiths, I.D. and F.J. Langdon, Journ. Sound Vib., 8, 16, (1968).
7. Young, R.W., Journ. Ac. Soc. Am. 36, 289 (1964).