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NOISE NUISANCE ASSESSMENT

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CONTENTS

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ASSESSMENT OF NOISE NUISANCE IN THE UK COMPARED WITH AUSTRALIA, DENMARK, FRANCE, GERMANY AND HUNGARY. (AS AT 15.1.1982)

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SUMMARY

A brief survey will be made of the scientific standards in use (as at January 15 1982) in Australia, Denmark, France, Germany and Hungary. In particular the adjustments for impulsiveness and tonal components, allowed by the national standards, will be examined.

The issue of whether the national standard offers any advice as to whether complaints may be expected when the noise exceeds the pre-existing background noise level by a certain margin will also be examined.

Proceedings of The Institute of Acoustics

NOISE RATING BY MEASURES OF INTRUSION OR ANNOYANCE

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The terms intrusion, annoyance and background noise can mean different things to different people. For the purposes of this paper *intrusion* is taken to mean 'entering into a person's perceived world'; *annoyance* is taken to mean a general adverse response to any noise once it has intruded and *background noise* is what ever is left when an intruding noise source is removed. The preferred measure of background noise is the pre-existing ambient noise (L_{Aeq}) but the L_{90} level is often quoted as a measure of the steady background noise. This paper questions the relevance of the L_{90} level.

There is a long tradition of assuming that the acceptability of a noise depends upon the extent to which the steady background level is exceeded. This determines the degree of acoustical intrusion of the noise. BS4142 (1) (Method of rating industrial noise affecting mixed residential and industrial areas) associates the degree of intrusion with liability to provoke complaints. The similar ISO Recommendation R1996 (2) (Assessment of noise with respect to community response) makes the same association. However, noise intrusion is only a necessary but not a sufficient condition for general community annoyance to occur. Current research is showing that general community annoyance depends far more on the absolute noise level than on the margin of exceedance above the steady background level. The likelihood of complaints depends far more on attitudinal and situational variables than on noise levels alone and is not now thought to be a particularly valuable indicator of response, except in particular and specific circumstances.

Recent field studies of train noise annoyance (3), aircraft noise annoyance (4) and road traffic noise annoyance in rural environments (5) support the notion that the ambient noise, or the steady background level, does not influence source specific annoyance. In fact, Walker and Fields (3), found that train noise annoyance tends to be less in low ambient noise situations, where the degree of intrusion is presumably greater. These results support the hypothesis that when people are asked specifically about their reactions to a particular noise source, they consider only the noise level of that source, and not how prominent the noise is in relation to other background noise sources. Further, their reactions may be influenced by the overall noise level such that people might be more annoyed by specific noise sources if their environment is generally noisy. People in quiet environments do not expect cars, lorries, trains or aircraft, etc., to be intrinsically quieter than in noisy environments and there is no reason for there to be greater annoyance in the quiet environment.

There are trends towards considering people's overall annoyance reactions to the overall noise environment (6). This approach can give greater insight into the importance of source specific annoyances in an overall context. For example, aircraft noise may well be annoying when it occurs, but it may nevertheless be of less importance in an overall context than lower levels of road

traffic noise. The only relevant research which has concentrated on overall annoyance reactions are two recent laboratory studies (6) and (7). The British Airports Authority commissioned a laboratory study to investigate mean reported annoyance ratings for a range of simulated noise environments that were representative of the area around a developed 15 million passengers per annum airport at Stansted in 1992. A single function was derived relating mean reported annoyance ratings to corrected overall L_{Aeq} (corrections to the aircraft noise L_{Aeq}'s in relation to road traffic and airport ground noise L_{Aeq}'s). Figure 1 illustrates how, at constant aircraft L_{Aeq}'s, overall annoyance reduces as aircraft noise intrusion increases. The range of steady background levels (L_{90}) was from 43 to 63 dB(A). It is apparent that not only is the type of assessment methodology adopted by BS4142 and ISO R1996 not supported by the data, it actually gives opposite predictions. The correlation coefficients between mean annoyance ratings and noise exposure measures were $r = 0.917$ for corrected overall L_{Aeq} and $r = 0.273$ for aircraft $L_{Aeq} - L_{90}$ ($n = 24$).

Figure 2 illustrates a similar result obtained in a laboratory study of road traffic and railway noise (6). Again, at constant railway L_{Aeq}'s, overall annoyance reduces as railway noise intrusion increases. The range of steady background levels (L_{90}) was from 55 to 69 dB(A). The correlation coefficients between mean annoyance ratings and noise exposure measures were $r = 0.969$ for corrected overall L_{Aeq} and $r = -0.051$ for railway $L_{Aeq} - L_{90}$ ($n = 25$).

Finally, the data published by Langdon and Buller (8) concerning road traffic noise dissatisfaction, is of interest. Figure 3 illustrates that there was no relationship between median dissatisfaction and $L_{Aeq} - L_{90}$ at either the congested or free flow traffic sites.

Conclusions

Reducing the ambient noise or the steady background level, when the absolute level of a specific noise source is held constant, reduces overall annoyance. This is despite the fact that the intrusion of that noise source is increased by the reduction in ambient noise or steady background level. There is even a trend for source specific annoyance to reduce as intrusion is increased (3). These results cast doubts on the validity of the assessment methodology based on the concept of intrusion and adopted by BS4142 and ISO R1996.

References

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Figure 1 Aircraft noise intrusion and overall annoyance

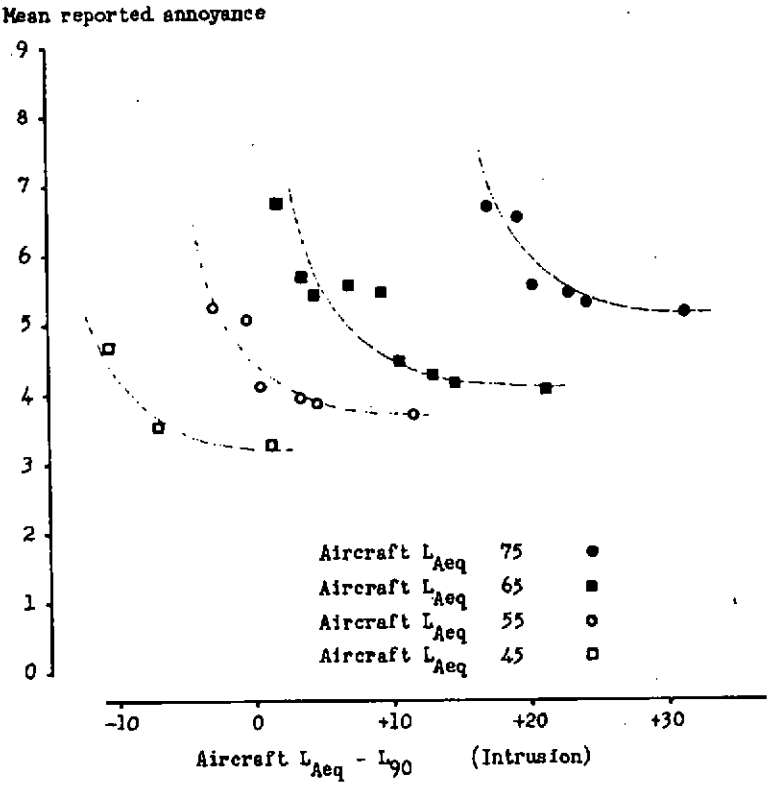

Figure 2 Railway noise intrusion and overall annoyance

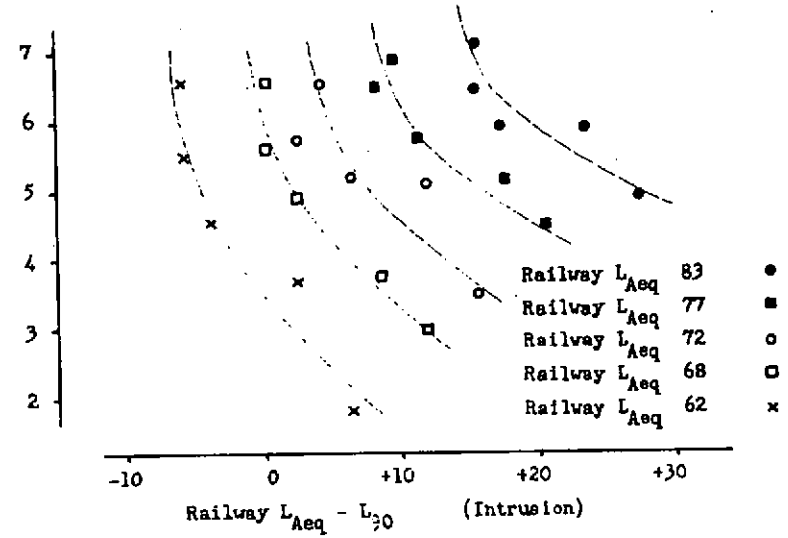

Figure 3 Road traffic noise and median dissatisfaction