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SOME PROBLEMS ENCOUNTERED IN ASSESSING THE NOISE IMPACT OF INDUSTRIAL/COMMERCIAL DEVELOPMENT

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Introduction

The number of complaints in respect of noise received by local authorities is increasing each year, and the use of planning controls to eliminate potential sources of complaint is clearly of great value. However, the identification of possible future problems can be regarded as a mixture of science and art. This paper seeks to explain the role of environmental assessment and some of the practical problems encountered by the Environmental Health Officer (E.H.O.) in connection with planning consultations for new developments.

Changes

Environmental noise can be regarded as being a three part system consisting of SOURCE - PATH - RECEIVER, and annoyance can arise when a change takes place in the system. Examples of changes are:-

SOURCE - industry introduced into a residential district.
- night shift started at existing factory.
- new machinery or plant.

PATH - new windows and/or doors formed in factory walls.
- windows and/or doors kept open in summer for ventilation.

RECEIVER - new houses built near existing industry.

Following the philosophy of "Prevention is better than cure", it is, therefore essential that an assessment of the potential for noise annoyance be carried out before any "changes" take place.

This simple reasoning is fundamental to the increasing involvement of the E.H.O. in the forward planning and development control functions of local authorities, and, accordingly, into the field of acoustics. Of course, not all changes require formal planning permission, nevertheless, the large volume of noise prevention opportunities which present themselves in this fashion must be regarded as an indicator of the considerable environmental benefits to be achieved by planning controls.

Information Problems

To enable the extent and effect of such changes to be properly assessed, a resumé of expected noise levels due to proposed on-site operations is necessary. However, despite the fact that it is now seven years since the Government (Ref. 1) suggested that applicants for planning permission should be required to provide predictions of Corrected Noise Levels at the

boundaries of the site, this information is seldom forthcoming. A brief outline of processes, machinery, traffic flows, hours (and days) of working and predicted noise levels is the kind of information needed by the E.H.O. when forming his initial view of the development proposals, yet, in the majority of cases, applicants provide little information at all, particularly regarding noise emissions. Even in those few cases where some noise data is included, it is often ambiguous or inadequate, in fact, little short of useless. Surprisingly, this statement is just as applicable to industrial developments involving multi-million pound contracts as it is to the local joiner who is moving into a larger workshop on the other side of town. It is ironic that a considerable amount of human effort is expended on many developments to produce buildings which are aesthetically pleasing and masterpieces of architectural design but which do not perform the basic function of providing adequate insulation against internally generated sound. The reason for this, I would suggest, is not that there is a lack of expertise in the field nor that there is a lack of relevant information but simply that despite having given thought to the multiplicity of other design requirements, no thought is given to the generation of noise and its impact on local residents. It is high time, therefore, that industrialists, agents, architects, etc. gave a full appraisal (not necessarily entailing a great deal of work), of the noise impact of every proposed development. Necessary information should be made available to E.H.O's in order that a corporate approach involving all concerned, can be made to ensure that the potential for noise problems arising in the future is minimised. With the improvement of the quality of life as his ideal, the E.H.O. must, at least prevent environmental deterioration, and in striving to this end he is very much a realist, preferring co-operation rather than resistance. As a rule, therefore, no information is forthcoming and the E.H.O. has to manage his own impact study. This can involve obtaining sound level measurements due to the operation of plant, machinery etc., which is of a similar type to that proposed, and estimating attenuation due to intervening structures and due to distance to noise sensitive premises. Bolton is a typical north-western industrial town having traditional terraces of houses standing in close proximity with mills and other industrial/commercial property. For attenuation prediction purposes, distances under consideration are seldom more than 100 metres and usually less than 50 metres.

Problems with Plane Sources

Plane sources are commonly encountered in noise preventive work, and consequently an accurate method for prediction of attenuation due to increase in distance, from such sources is an essential tool for the E.H.O. in his planning role. Examples of plane sources are:-

1) Large areas of glazing at engineering works or social clubs.
2) Loading doors in factories.
3) Louvred openings to plant rooms, boiler rooms, etc.

Officers at Bolton Environmental Health Department tried the classical approach of Equation 1 in plane source prediction calculations, but this method over-estimated attenuation, resulting in higher noise levels at the receiver than as predicted.

$$L_2 = L_1 + 10 \log S - 20 \log r - 8 \quad \ldots \text{ Equation 1}$$

L_1 is the sound level at distance r.
L_2 is the sound level at a small distance from the source.
S is the area of the radiating surface (m^2).
r is the distance from source to receiver (m).

Therefore an alternative method was sought, and experience has shown that, in Bolton, and at the distances mentioned above, the formula (Equation 2) as proposed by R.W. Fearn (Ref. 2) is most useful for planning prediction purposes.

$$L_2 = L_1 + 10 \log S - 20 \log (r + \sqrt{S}) \quad \ldots \text{ Equation 2}$$

Symbols as above

The latter method proved more successful in that not only does it appear to be more accurate, but also in that inaccuracies which do occur tend to be under-estimations of actual attenuation, which allows a 'margin of safety' for the planner. Unfortunately, the close agreement of predicted and measured attenuation is maintained only along the normal axis and where bearing angles are not more than 20°. Often in practice, the receiver is not on the normal axis and therefore, a prediction method to give accurate results at given distances in any direction, would be of great benefit to the E.H.O.

Problems with Entertainment Noise

Noise due to discos and other social functions is increasingly giving rise to complaints. An assessment of potential sources of entertainment noise will involve determining the level of emitted sound which will not cause annoyance to nearby residents, and any such assessment will usually involve consideration of the following factors which have been found to have some significance as to whether or not a complaint arises:-

1) The sound level within the club is high - usually around 100 dB(A).
2) Modern lightweight structures usually provide poor low frequency insulation.
3) The "beat" or rhythm of the music probably makes it more annoying than if it was a continuous sound. As a result, even very low sound levels can be annoying.
4) Windows and doors at clubs are often opened as fresh air requirements increase due to smoking, dancing, etc. - the sound insulation properties of the structure being reduced to a minimum.
5) Background levels in the neighbourhood can be very low as clubs often operate late at night and/or in the early hours of the morning.
6) Local residents, trying to sleep, possibly with house windows open are likely to be more noise sensitive than at any other time of the day.
7) Not only social clubs are used for musical entertainment, but also public houses, school halls, church halls, parish halls, youth clubs, cricket clubs, tennis clubs, community centres, social centres, sports centres, etc., which means that the potential for noise annoyance due to entertainment held at these premises, also needs to be assessed.
8) The dual-use nature of the premises may provide poor sound insulation, such as a cricket club having a large area of windows for viewing matches.

9) Distance attenuation is often small due to the social make-up of the area, i.e. entertainment centre in close proximity to housing.

Consequently, it may be concluded that the club structure should provide sufficient insulation to ensure that music is inaudible in nearby dwellings, even with house windows open. Furthermore, it is considered that if a building is constructed primarily for the purposes of (say) a tennis club, it should be built so that the "occasional" social function will not cause annoyance to local residents. The practical implications are that window openings should have acoustic double glazing, i.e. with 150 mm gap and reveals lined with absorbent material, to provide sufficient insulation at low frequencies. Concert rooms with doors to the exterior should have lobby arrangements, to improve insulation, and attenuated ventilation systems to overcome the problem of open windows.

Conclusions

The involvement of the E.H.O. in the planning process is of great importance, not only in that the potential for noise annoyance from industrial etc., developments is reduced, but also in that any necessary alterations can be made before construction takes place; such alterations are likely to be far cheaper at that stage than after the factory is built.
At a time when local authorities are under great pressure to speed up the planning process, consultations are hampered due to the lack of information, particularly regarding predicted noise levels. It is evident that matters can be dealt with more quickly when applications contain a full account of the necessary information, and it is hoped that the revised Circular 10/73 (Ref. 1) will clearly state that adequate details of the proposal should be included with applications for planning permission.
The E.H.O's need for simple, accurate methods for assessing noise impact is obvious, and necessity being the mother of invention, it is hoped that research will develop the tools of the trade for the E.H.O.

References

1. DEPARTMENT OF THE ENVIRONMENT 1973 Circular 10/73 - Planning and Noise H.M.S.O.
2. R.W. FEARN The Spread of Noise from Boiler Rooms - Heating and Ventilation Engineer, March, 1971.