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PLANNING NEW RESIDENTIAL DEVELOPMENTS TO CONTROL EXTERNAL NOISE

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1 INTRODUCTION

Sites exposed to external environmental noise are often rejected for residential development without a thorough appraisal of the prevailing levels of noise and the available design measures to overcome the noise impact. Very often it is possible to achieve satisfactory internal and external noise levels with design solutions which are acceptable to planning authorities and prospective purchasers. A previous paper (1) discussed the application of noise criteria for new residential developments. This paper deals with the practical measures undertaken to meet noise criteria. Examples involving noise from road traffic, railways, aircraft and industrial sources will be examined.

2 NOISE CRITERIA

The previous paper (1) referred to Department of the Environment Circular 10/73 "Planning and Noise (2)" as the only available source of Government Approved noise criteria. Local Authorities were advised to base their own policies on this circular. The noise criteria in Circular 10/73 were formulated in terms of L_{A10} for road traffic noise, CNL for industrial noise and NNI for aircraft noise. No guidance on railway noise was given. In 1987 British Standard BS8233 (3) gave recommendations for internal noise levels from intrusive external noise as follows:

Living Rooms $L_{Aeq,T}$ = 40 to 45 dB

Bedrooms $L_{Aeq,T}$ = 30 to 40 dB

Advice on assessment of road traffic, aircraft, railway and industrial noise in terms of $L_{Aeq,T}$ is given in BS 8233. In order to properly design a residential development, external noise levels must be considered, in addition to the internal noise levels. BS8233 recommends that gardens should not exceed L_{Aeq} levels of 55 dB. The overall design of new residential developments should take account of the above criteria. It should be noted that there is a considerable range in the recommended internal noise levels. It is usual for most Local Authorities to insist on achieving the lowest internal noise levels and this is not necessary in all situations. The Wilson Committee (4) drew distinction between urban, suburban and rural areas, allowing higher internal noise levels in urban areas, and this seems a satisfactory working principle, rather than sticking to a single inflexible level for all situations.

3 PRINCIPLES OF NOISE REDUCTION

In all noise problems there are three aspects which can receive attention:

a) source
b) transmission path
c) receiver

It is always best to direct attention firstly to the noise source, but in the case of planning new residential developments it is usually impractical to require specific attention to road traffic, railways and aircraft noise. Obviously nothing can be done about road traffic noise at source. It is unlikely that British Rail could be persuaded to use alternative quieter traction sources because of an individual residential development. The change from jointed to long welded track can reduce noise levels. In some circumstances, there may be some scope for a change in flight routes at locations more distant from an airport, but this is unlikely. In the case of industrial noise, there is a real possibility of achieving noise reductions at source, but this relies upon the co-operation of the industrial operator with the developer and this has proved difficult to organise in my experience.

Attention to the transmission path is the next most favourable alternative and involves the use of barriers in the form of earth mounds, fences, or barrier block building. The practical uses of noise barriers in these situations have been discussed by the author (5). The construction of barriers is preferable to measures involving the receiver, as external and internal noise levels are reduced. However, the location of an effective noise barrier may be difficult because of the site topography and the construction of earth mounds can take up considerable areas of the site.

The last resort when attention to source noise and transmission path has not sufficiently reduced external noise levels, is attention to the receiver. Of course this is only possible for internal noise, where noise levels can be reduced by either orientation of quiet rooms facing away from noise sources or by acoustic secondary glazing. It is often difficult to persuade architects to design purpose-built housing to control external noise, but there are now many examples in existence of residential sites which have used this method of noise control. Consumer resistance to acoustic secondary glazing with a wide air gap (at least 100 mm) has been very common.

Recent work by the Building Research Establishment (6) in existing properties has indicated that thermal type double glazing with a narrow air gap can achieve a sound reduction which is effectively as good as secondary glazing with a wide air gap. This is normally more acceptable for housing designers and purchasers. The installation of mechanical ventilation has also brought consumer resistance. The use of passive attenuators instead of mechanical ventilation has previously been referred to (1).

4 EXAMPLES OF RESIDENTIAL DEVELOPMENTS DESIGNED TO CONTROL EXTERNAL NOISE

The following case histories relate to actual sites where special noise reduction measures have been proposed to deal with external noise on residential developments.

4.1 FORMER INDUSTRIAL SITE NEXT TO MAIN LINE RAILWAY AND METAL FABRICATION WORKS

This site is affected by railway noise from high speed trains and other rail traffic on one boundary. Another boundary faces a metal fabrication factory where power tools are used in the open air on an assembly area facing the residential site. In order to satisfy the Local Authority, the most stringent design level of Circular 10/73 was adopted with an internal noise level of 35 dB CNL at night. It was necessary to assume that the noisiest power tool available would be used outside the works at night. This was a pneumatic impact wrench and the noise level of 90 dBL_A would have brought complaints from nearby existing residential occupiers if used at night. The measures which had to be adopted to satisfy the Local Authority were a 3.8m boundary noise barrier and purpose-built flats on upper floors with living rooms and bedrooms facing away from the metal fabricating factory. No special measures to cope with railway noise at 60 dBL_{Aeq} (24 hr) were recommended, and none were required by the Local Authority.

4.2 RESIDENTIAL SITE NEXT TO MOTORWAY IN CUTTING

A residential development was planned on an open site next to a motorway in cutting, approximately 5m below site level. The Local Authority insisted that no dwellings could be constructed where external facade noise levels exceeded 68 dBL_{A10}(18 hr) and that internal noise levels should be 40 dBL_{A10}(18 hr) in all rooms. Noise barriers in the form of wooden fences or brick walls were not acceptable to the Local Authority on visual and maintenance grounds; only earth mounds would be satisfactory.

Even a facade with no windows had to be below 68 dBL_{A10}(18 hr). The architect's design location ofbuildings was inflexible, and the height of the mound on the boundary had to be raised so that 68 dBL_{A10}(18 hr) was not exceeded. The design was finally approved by the Local Authority after they inspected the traffic noise calculations using the accepted procedure (7).

4.3 SITE AFFECTED BY RAILWAY NOISE

A residential development was planned on a site overlooking a main line railway with the site boundary 30m from the nearest tracks. A noise survey established that railway noise was 65 to 70 dBL_{Aeq}(24 hr) at the nearest properties. A boundary noise barrier was proposed in order to attenuate railway noise for gardens and ground floors. The barrier was most effective as most of the rail traffic was electric multiple units, so the only noise source was at rail level. Bedrooms looking over the top of the barrier above 65dBL_{Aeq}(24 hr) were recommended to have acoustic secondary glazing. The combination of a noise barrier and secondary glazing produces a satisfactory internal and external acoustic environment for the residents.

4.4 SITE AFFECTED BY AIRCRAFT NOISE

A residential development was planned in an area affected by noise from aircraft using London Heathrow Airport. The Local Authority assessed aircraft noise on the basis of the latest NNI contours available at the time that the planning application was made. Although a reducton of 5 NNI was expected to occur in future years, resulting in a level less than 45 NNI, the site had to be assessed on the earlier out of date figures. Sound insulation had to be provided to meet an average sound reduction of 25 dB (100 Hz to 3150 Hz) and the Local Authority advised that this could be met with acoustic secondary glazing and mechanical ventilation. Attention to the roof and wall design was necessary to ensure that minimum values of surface density were achieved. All windows of habitable rooms had to be treated even though the development was not directly overflown and was most affected by noise from aircraft at low altitudes to the North when rooms facing South were exposed to much lower noise levels. The scheme was designed according to the full requirements of the Local Authority even though the 25 dB (100 Hz to 3150 Hz) criterion could have been met with any closed single window.

5 SUMMARY

The above examples have briefly shown examples of noise control measures for different types of external noise. If a more flexible approach to meeting criteria was adopted it would be easier to design for acceptable acoustic conditions.

CIRIA report 114 (8) gives a thorough check list for designing buildings against noise from both external and internal sources and is to be recommended for those who are unfamiliar with the techniques to be adopted. CIRIA report 115 (9) gives further advice and detailed examples of calculations of noise levels for design purposes, and is a good procedure manual for calculating design noise levels for proposed residential sites.

REFERENCES

1 W Stubbs, May 1988 "The Effectiveness of Noise Criteria in Planning for New Residential Developments" Proceedings of Institute of Acoustics

2 Department of the Environment, Circular 10/73 "Planning and Noise".

3 British Standard BS 8233 : 1987, "Sound Insulation and Noise Reduction for Buildings"

4 Noise, Final Report (The Wilson Report) 1963 Cmnd 2056.

5 W Stubbs "Practical Uses of Noise Barriers" Noise and Vibration Control Worldwide July 1986

6 W A Utley and J W Sargent "Noise Reduction of Dwellings Against Traffic Noise", Building Research Establishment, Proceedings of Institute of Acoustics Vol 8 Part 4 (1986)

7 Calculation of Road Traffic Noise, Department of the Environment 1988.

8 J Miller, 1986 "Sound Control for Homes - A Design Manual" CIRIA Report 114.

9 R H Clough, J M Miller 1987 "Sound Control for Homes Worked Examples" CIRIA Report 115.