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THE ENVIRONMENTAL IMPACT OF RAILWAY NOISE ON A NEW HOUSING SITE

A. MARSHALL AND J.D. CLEGG

BOLTON METROPOLITAN BOROUGH COUNCIL

Introduction

It is now a normal procedure for the local planning authority to consult the environmental health officer about possible pollution effects on proposed new housing development. Whilst a DOE Circular (Ref. 1) provides some guidance and the literature contains suggested pollution limits in relation to noise this advice must be considered in the context of each locality. As research continues new information on public response to noise increases. At present the eight year old advice of the DOE Planning Circular is being revised to take into account this new information. Although the present Circular gives no guidance on planning and railway noise, action needs to be taken to protect residents of new housing sites from the worst effects of noise caused by trains.

One housing site constructed in Bolton includes a 50m buffer zone incorporating a continuous earth mound and has an environmental noise climate which falls broadly within guidelines published previously (Ref. 2). The absence of complaints by residents of this site about the noise from trains appears to suggest a degree of general public acceptance. However, in order to attempt an objective assessment of the residents' response to railway noise a postal survey of a sample of the occupiers was carried out.

This paper describes the small survey of noise annoyance on this recently constructed housing site near to a busy railway.

Site Description

The housing site used for this survey is situated approximately one third of a mile to the west of Bolton Town Centre and consists of 41 dwellings formed into two culs de sac. The houses were built during 1976 and were first occupied in 1977. Most of the residents are the first occupants of the dwellings and have lived in the community for approximately five years. The site is bounded by industrial and commercial premises to the north and west; a busy main road to the east; and a main railway line to the south. The railway is a main route from Manchester to Preston and carries diesel trains of varying type, purpose and length. There is little freight movement and a 70 m.p.h. speed restriction is placed on traffic using the line. Approximately 189 trains use this line each day, the average train length being 125 metres.

In order to reduce train noise at the dwellings and to provide a visual barrier to the rail track an artificial landscaped earth mound 3 metres high, was constructed along the southern boundary of the site. The mound was built approximately 25 metres from the railway line and 10 metres from the nearest houses. The noise from passing trains was thus reduced by 10 dB(A) at ground level. These noise control measures were thought to be the most appropriate which could be recommended at the time (1975), due to the absence of design criteria and expected public reaction data in relation to new housing to be

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built near a busy railway line.

The Noise Measurements

The equivalent continuous sound level, Leq (24h.) has been shown to correlate best with dissatisfaction due to train noise (Ref. 3), consequently it was decided to use Leq (24h.) as the measurement index. Twenty six measurement positions were chosen to represent the noise exposure of the population and Leq (24h.) was measured in dB(A) at each position, together with the average peak level of train pass-bys. All measurements were made at 1m from the facade of the dwellings. The Leq (24h.) exposure for dwellings on the site ranged from 41 dB(A) to 59 dB(A) depending on distance from the track and other factors such as screening. The average peak level of train pass-bys ranged from 58 dB(A) to 76 dB(A).

The Social Survey

A postal form of social survey was used to measure the community reaction to railway noise. The sample of the population used in the survey was chosen randomly from a recently compiled Electoral Register. The sample contained one person from each dwelling unit on the site. A questionnaire, designed in a similar way to that used by Ludlow (Ref. 4) was addressed to each person in the sample. The questions were intended to obtain the residents' attitude to:-

- (a) The general environment.
- (b) Various local noise sources i.e. industry, railways, road traffic, etc.
- (c) Specific railway noise effects.

Of 41 questionnaires delivered, 34 were returned in a usable form (83%). Those questionnaires not returned were from dwellings evenly distributed throughout the site and it is considered that this caused no weighting to be applied to the results.

Discussion of Results

The main aim of the survey was to determine the suitability of design measures used on this site to minimise noise annoyance. The results obtained indicate that 79% of the residents identified railway noise as the principle noise source affecting their home; also 26% of the respondents reported themselves to be very annoyed by railway noise. These very annoyed residents were exposed to levels ranging from 50 - 59 dB(A) Leq (24h.).

As is usual in this type of survey individual response to a given noise exposure varies greatly and comparison with other studies is difficult. Consequently, average community response to noise exposure has been used in comparisons. The correlation coefficient between noise exposure and average response is usually high and in this survey was 0.82. Fig. 1 shows average annoyance due to train noise. In this survey the community appear to be slightly more annoyed by a given noise exposure level than has been shown in previous collective summaries of social surveys relating effects of noise from various sources. One reason for this may be that the site is new, resulting in several households brought together who previously had probably not been exposed to railway noise. A major

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survey (Ref. 3) found that people in more recently constructed houses also were more annoyed by train noise. It is interesting to note that all those respondents stating that they thought railway noise could be reduced, reported that they were either very annoyed or moderately annoyed by the noise. At least one other survey (Ref. 3) has concluded that the belief that it is feasible to reduce railway noise increases annoyance. Fig. 2 shows the percentage of respondents reporting themselves to be very annoyed at different noise levels. This indicates that the proportion of residents reporting themselves to be very annoyed increases markedly between 55 and 59 dB(A) Leq (24h.). In fact this range of levels is just within the 60 dB(A) Leq (24h.) which is one aspect of the criteria (Ref. 2) used in Bolton since 1978 in relation to the design of new housing near to railway lines.

A number of authors have gathered information from various field work surveys of noise annoyance. Examples of these are given in Refs. 5 and 6. The results of the Bolton railway noise survey are similar to these intercomparisons in terms of percentage highly annoyed at given sound levels. For example, the results of a study by Schultz (Ref. 7), of a number of noise annoyance social surveys, are in general accordance with those of the Bolton Study. Schultz showed that below an outdoor level of 45 dB(A) Leq almost nobody is highly annoyed; around 10% are highly annoyed at a level of 55 dB(A) Leq and over 25% of the population are highly annoyed at 65 dB(A) Leq.

Conclusions and Comment

The results of this small survey suggest that the measures used to protect residents of the site from the worst effects of railway noise appear to have been successful. The current guidance criteria used by Bolton MBC seems to be justified and it is clear that this criteria could be used again with some confidence where new housing is to be constructed near a railway line.

With an increasing demand for and a diminishing availability of suitable housing land in towns and inner cities it is likely that many sites affected by noise from various sources might now be considered for housing development. Clearly development criteria intended to limit noise exposure on these sites will be applied. In future it would seem to be reasonable to assess the appropriateness and effectiveness of these noise control criteria on a similar basis to that used above. Eventually this should ensure that the most efficient use is made of land resources and noise annoyance of the population is kept to a minimum.

References

1. DEPARTMENT OF THE ENVIRONMENT 1973 Circular 10/73 - Planning and Noise.
2. CLEGG J.D. 1980 Proceedings of Institute of Acoustics Spring Conference - Acoustics '80, 81 - 84, Urban Railway Noise and New Housing.
3. FIELDS J.M. AND WALKER J.G. 1980 Reactions to Railway Noise; A Survey Near Railway Lines in Great Britain. I.S.V.R. Technical Report No. 102.
4. LUDLOW J.E. 1976 Assessment and prediction of noise from construction sites, Ph.D. Thesis, University of Southampton.
5. WORLD HEALTH ORGANISATION 1980 Environmental Health Criteria - 12 Noise
6. COMMISSION OF EUROPEAN COMMUNITIES 1975 Damage and annoyance caused by noise.
7. SCHULTZ T.J. 1978 Synthesis of social surveys on noise annoyance
J. Acoust. Soc. Am. 64(2)

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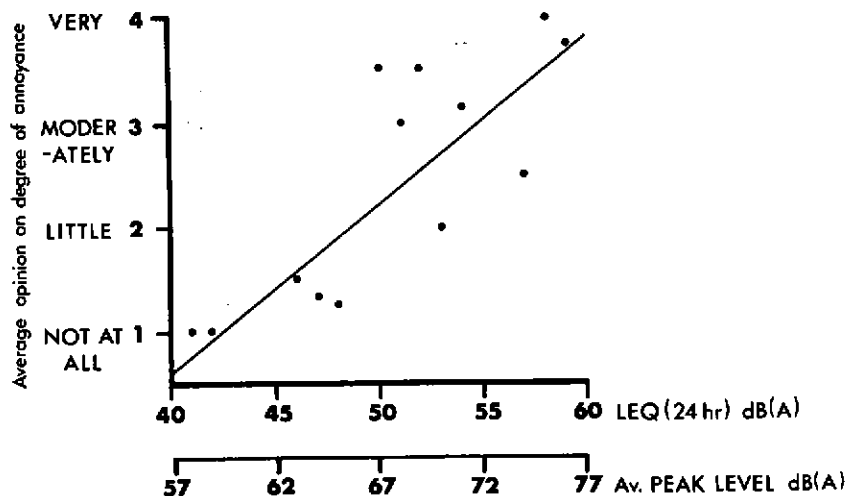


Fig.1. Average annoyance as a function of $Leq(24hr)dB(A)$ and average peak level $dB(A)$.

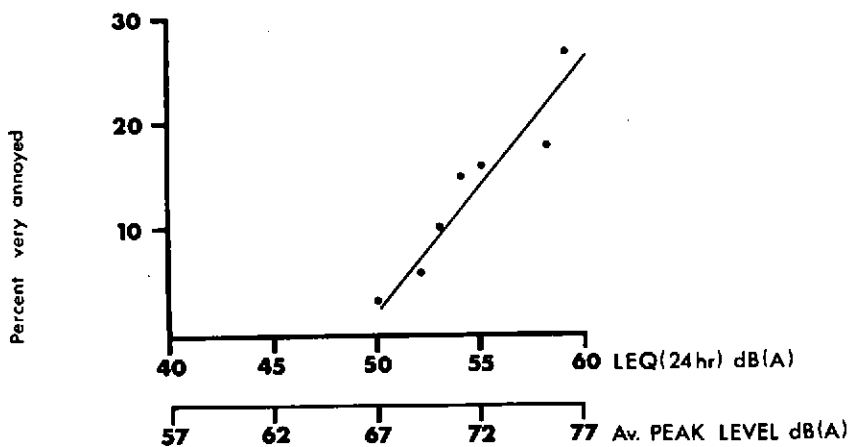


Fig.2. Percent very annoyed as a function of $Leq(24hr)dB(A)$ and average peak level $dB(A)$.