Proceedings

PREPRINTS

PEOPLE
NOISE
and
BUILDINGS

13 MARCH 1980

BUILDING RESEARCH STATION

GARSTON, WATFORD

INSTITUTE OF ACOUSTICS

PROGRAMME

10.00 – 10.30	REGISTRATION AND COFFEE	
10.30	INTRODUCTION	
10.35	Noise and Schools W A Utley and J W Sargent Environmental Design Division BRE	(page 1)
11.05	Party Wall Insulation (performance) E C Sewell Environmental Design Division BRE	(page 5)
	Noise from Neighbours and the Sound Insulation of Party Walls John Langdon and Barbara Buller Environmental Design Division BRE	(page 9)
12.20	Traffic Noise and Sleep R T Wilkinson Psychophysiology Section Applied Psychology Unit MRC, Cambridge	(page 13)
13.00	LUNCH	
14.15	User Response to Noise in some Cellular Offices E C Keighley Environmental Design Division BRE	(page 17)
14.55	The Reliability of Noise Indices I D Griffiths and M A Swan University of Surrey and London Borough of Camden	(page 21)
15.40	Discussion	
16.00	TEA	

Chairman:
W E Scholes – BRE

Proceedings of The Institute of Acoustics

NOISE AND SCHOOLS

W A UTLEY and J W SARGENT

BUILDING RESEARCH ESTABLISHMENT

INTRODUCTION

Much of the research in the last ten years into effects of transportation noise on people in buildings has been concerned with occupants of dwellings(1). Rather less effort has been devoted to assessing the disturbance caused by noise to occupants of other types of building. This paper describes a study which was undertaken to determine the disturbance caused to secondary school teachers by noise, particularly from road traffic. An earlier study by Bruckmayer and Lang(2) had shown that traffic noise could produce serious disturbance in schools facing main roads but covered too few classrooms to enable a quantitative relationship between disturbance and noise level to be established. Crook and Langdon(3) and more recently Ko(4) have shown that high levels of aircraft noise can also cause serious disturbance in schools. Ko was able to establish a high correlation between mean annoyance and aircraft noise exposure expressed in NNI.

SURVEY

The schools in the survey were situated in the Greater London area north of the River Thames and in counties to the north and west of London. The study sample was drawn from an initial sample of 300 schools so as to achieve as far as possible equal numbers of classrooms with traffic noise exposure in 5 dB(A) bands from under 50 dB(A) L_{10} to over 70 dB(A) L_{10}. A control sample of classrooms on the quiet side of each school was also included. When the schools and classrooms had been chosen a questionnaire was completed by the teacher who worked most frequently in each classroom. The final total sample achieved consisted of 999 questionnaires completed by teachers in 73 schools. Since a high proportion of schools refused to take part in the survey, it was not possible to include as many classrooms with the highest noise levels as had been hoped, there being insufficient schools with classrooms exposed to these levels to replace those who refused to take part. The total sample was subdivided for some analyses. One sub-sample (the noisy sample) consisted of the 331 classrooms in which the teacher had a clear view of the road and was used for most of the analyses of response to road traffic noise. All but two of the 73 schools in the final sample were also found to have a measurable aircraft noise exposure. The 971 classrooms in these 71 schools formed the sample which was used for the analyses of response to aircraft noise.

The questionnaire was self-administered and was handed to and collected from each teacher individually. It included questions about the general environment in the classroom in addition to specific questions about noise. The principal question about noise disturbance (Question 7) asked the teachers how much they were bothered by noise from a number of listed sources, during the summer term (ie the period when they completed the questionnaire). The degree of bother was indicated on the four point scale 'not at all', 'a little', 'quite a lot',

'very much'.

After the questionnaires had been returned noise measurements were made during the school holidays for each school in the sample. Noise recordings were made outside and inside each classroom except on facades with many classrooms where external levels for some rooms was obtained by interpolation. The recordings were analysed to yield levels of road traffic noise in terms of L_{10} dB(A) and other descriptors for rooms on the road side of each school and levels of general noise for rooms on the quiet side. The noise recordings were also analysed to give a measure of the aircraft noise exposure for each school in terms of NNI and Leq. Where changes in mode of operation at the airport were likely to influence significantly the measured noise level an attempt was made to measure under conditions of maximum exposure (ie worst mode).

RESULTS

The effects of road traffic noise were examined by considering the response of teachers in the noisy sample to Question 7. Initially, the response was scored by assigning numbers from 1 (not at all bothered) to 4 (very much bothered). When a linear regression line was fitted to the plot of individual bother scores against external road traffic noise level L_{10} a correlation coefficient of 0.66 was obtained. This value of correlation coefficient is somewhat higher than that found for individual responses in transportation noise surveys in dwellings. Possible reasons for this are that both the actual noise exposure and the activity of the respondent are more closely defined in the case of teachers. The mean response in 1 dB(A) noise bands was also plotted against traffic noise level L_{10}. The linear regression line obtained was:

$$\text{mean bother score} = 0.125\, L_{10} - 5.43 \quad (51 < L_{10}\ \text{dB(A)} < 73) \quad r = 0.97$$

A second method used to determine the effects of the noise was to relate the proportion of teachers bothered to the external noise level. This gave a sigmoid shaped curve and probit analysis was used to obtain a statistical fit to the data. Figure 1 shows the proportion of teachers bothered 'quite a lot' or 'very much' at different external road traffic noise levels.

The figure also shows the 95% fiducial limits which indicate the confidence which can be placed in the fitted curve. Sigmoid curves were also fitted to the data for other degrees of bother and these showed for example, that at an external traffic noise level of 60 dB(A) L_{10}, 9% of teachers are bothered very much, 20% are bothered quite a lot and 32% are bothered a little. It was found that above a certain value the level of road traffic noise appeared to influence the response to a number of questions not specifically related to traffic noise. Figure 2 shows this effect on the response to the following four questions: question 2(C), in general, how would you rate this room as a place to work in? (satisfactory or unsatisfactory); question 3, please tick any of the following items which you think generally describes the room at this time of year (20 descriptors of the classroom environment); question 5, during the summer term how often do you find your room to be too noisy? (rarely, sometimes or often); question 6, in general during the summer term are you more disturbed by noise originating within the building, or by noise entering the building from outside? (within, from outside or no difference).

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The distribution of aircraft noise exposure was not controlled and therefore was not an ideal one for studying the disturbance caused by noise. Nevertheless an analysis of the data seemed worthwhile since it would provide a unique opportunity to compare the disturbance caused by road traffic noise with that caused by aircraft noise. The data from question 7 relating to aircraft noise was analysed in the same two ways as that for road traffic noise although the data was not strictly suitable for linear regression analysis in view of the large amount of data at lower values of noise exposure. In order to relate the proportion of teachers bothered to the noise exposure the data was grouped in 5 dB(A) bands (Leq). A curve was fitted for a response of quite a lot or very much bothered using probit analysis. When this curve was compared with the response curve for road traffic noise (also for noise exposure expressed in terms of Leq) it was found that there was no significant difference, the traffic noise curve lying within the 95% fiducial limits of the aircraft noise curve. A comparison of the response curves for a response of very much bothered also indicated little difference in the response of teachers to equal levels of noise from road traffic and aircraft. However, when these curves were compared with the response curve derived by Schultz(1) from a number of transportation noise surveys in dwellings it was found that high levels of noise caused a greater disturbance to teachers than to occupants of dwellings.

Teachers were also asked how bothered they were by a range of noise sources within the school although no measurements of noise levels were made for these sources. They were most bothered by noise from children in passages and on stairs and below an external traffic noise level L_{10} of about 60 dB(A) more teachers were bothered by noise from this source than noise from road traffic.

REFERENCES

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3 M A CROOK and J F LANGDON, 1974. J Sound Vib 34, 221-232. The effects of aircraft noise in schools around London airport.

4 N W M KO, 1979. J Sound Vib 62, 277-292. Responses of teachers to aircraft noise.

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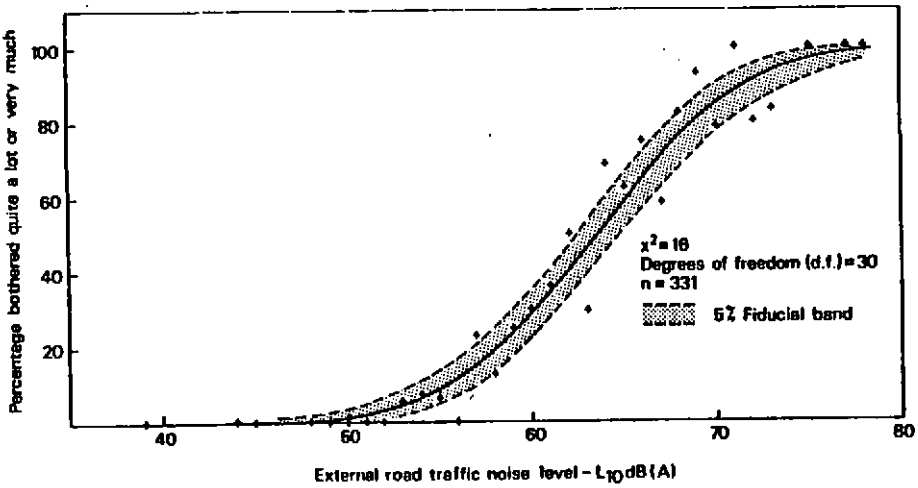

Figure 1 Percentage of teachers bothered 'quite a lot' or 'very much' at different external road traffic noise levels L_{10}

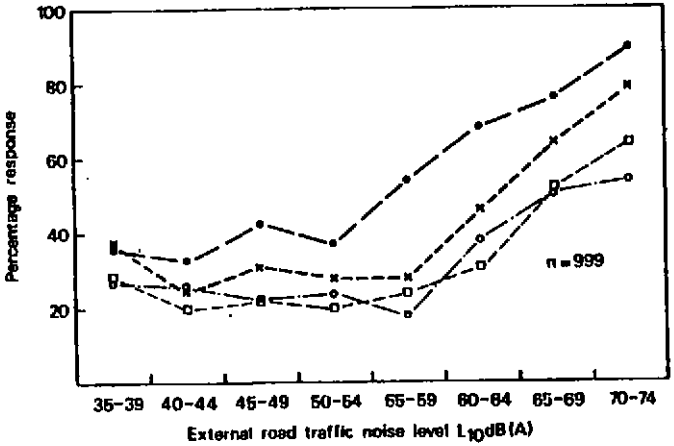

Figure 2 Responses to four questions plotted against external traffic noise level o——·——o response 'unsatisfactory' to question 2(e), x— — — —x response 'noisy' to question 3, □— - - -□ response 'often' to question 5 and ●—— ——● response 'from outside' to question 6