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PARTY WALL INSULATION - PERFORMANCE

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INTRODUCTION

Since 1970, the Building Research Establishment has been conducting a survey of sound insulation between modern dwellings. This summary is restricted to party wall insulation. Measurements were made between completion and occupation; no data obtained while investigating complaints are included. To get a representative picture of overall performance, there was no deliberate selection of types of construction to be measured before 1975. Selection was then introduced to enlarge samples for certain individual types.

METHOD OF ASSESSMENT

Single-figure ratings of performance have been based on aggregate adverse deviations (AADs: the sum of differences between reference and measured values in those of the standard sixteen third-octave bands where the measured value is the lower) with respect to the Party Wall Grade reference values which provide the basis for a deemed-to-satisfy provision in the Building Regulations(1). Here the performances of individual walls are considered instead of the average performances of sets of four walls as stipulated for Regulation purposes; this makes little difference to the general picture. By definition(1), the performance standard is achieved if the relevant AAD does not exceed 23 dB. In an earlier paper on the survey(2) an AAD of 80 dB was used as a criterion of 'very poor insulation' because it is roughly equivalent to the Grade II level at which a social survey(3) in the 1950s found many people considered sound insulation to be the worst feature of their homes. However, for a general appreciation and for the purposes of the current BRE social survey in the previously tested houses, it is convenient to classify performance in a few broad bands; if the best performance band is to include walls which achieve the performance standard (AAD $\leqslant$ 23 dB), the most convenient width for each band is 24 dB, and this entails taking 72 dB instead of 80 dB as the lower limit of the fourth band.

OVERALL PERFORMANCE

The distribution of performance found while measurements were made unselectively is shown in Figure 1. The performance standard was attained in 45% of the dwellings tested; for 6% insulation was in the worst band (AAD > 96 dB). The poor performance of about 70% of the dwellings in the worst band was probably due to features other than the types of party (and possibly flanking) wall used. The commonest special feature, affecting 30% of all dwellings with performances in this band, was the use of lightweight plastics ceilings to upper floor rooms. Other features tentatively identified as responsible for performances in the worst band are: air paths; strip ties or foam filling in party walls; bridging cavity walls near upper ceiling level to support single-leaf continuations between lofts; and flanking paths round the ends of party walls. Special features were also probably responsible in about 35% of cases where insulation was in the 72-95 dB AAD band.

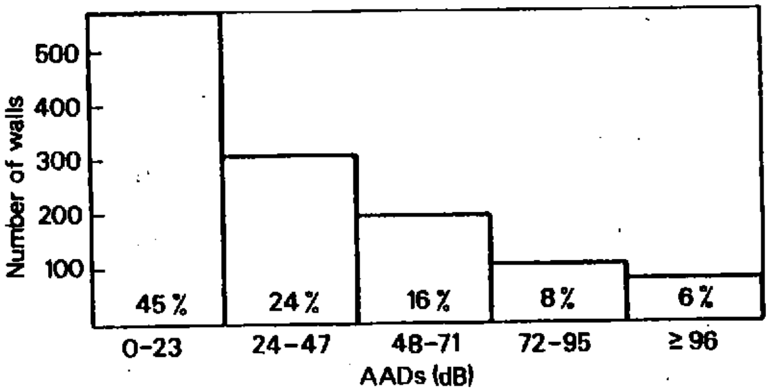

Figure 1 Distribution of AADs for unbiased sample of 1270 walls

PERFORMANCE OF INDIVIDUAL TYPES OF CONSTRUCTION

For individual types of construction, the aim has been to assess typical performance in the absence of special features like lightweight ceilings; results probably affected by such features have been excluded, as have measurements from dwellings between which there was a step or stagger, features usually favourable to sound insulation. Full conditions for inclusion are described in refs 4-6.

Results are summarised in Table 1. A few possible combinations of material, finish and solid or cavity construction in party walls are omitted for want of sufficient data; but, more importantly, with brick and dense blockwork party walls results are given only for dwellings where the associated external wall leaf had a mass of at least 120 kg/m^2 or consisted of lightweight panels, and so met or approximated to a deemed-to-satisfy requirement(1). Further measurements are being made to determine the conditions under which using blockwork inner leaves of mass less than 120 kg/m^2 significantly affects the insulation achieved with heavy party walls. (With the deemed-to-satisfy specification(1) for cavity lightweight concrete party walls, the flanking restrictions, though applicable, are seldom critical because with a lightweight blockwork party wall it is common practice to use similar blocks for the inner leaf.) 'Dense block' refers to walls of natural aggregate blockwork, nearly all of which would achieve the 415 kg/m^2 deemed-to-satisfy mass if plastered. 'Lightweight aggregate' refers to walls built of blocks, possibly slotted, with aggregates such as clinker, which would be expected to achieve a mass of 250 kg/m^2 (the deemed-to-satisfy value for cavity walls) if plastered.

A major feature of the results is variability: only for the first four types listed is the best estimate for the standard deviation of AADs less than 15 dB, and for several it exceeds 20 dB.

Obviously dissatisfaction is most likely to arise from dwellings at the lower end of the performance distribution for their type. Thus assessing likely acceptability solely from mean performance is liable to be misleading. The AAD level likely to be exceeded by only a small percentage appears a more appropriate criterion, although the best percentage to use is debatable. In Table 1, constructions have been arranged in order of the best estimates for their 95th percentile AADs (the values probably exceeded by only 5%).

Another consequence of variability, illustrated in Table 1 for mean AADs, is that confidence intervals are often wide. Confidence intervals are wider for 95th percentiles. Thus there is considerable uncertainty about the true ranking order.

For only two listed types did all tested examples achieve the performance standard (AAD ≤ 23 dB), and for only one type were all AADs worse than 23 dB. On best estimates, nearly 95% of plastered solid brick walls (subject to the flanking restriction) and well over 95% of examples of the first five types listed should provide insulation in the best two (0-23; 24-47 dB AAD) performance bands. Except for these and the last type listed, the estimated 90% performance range extends into three or even four of the broad bands.

Mass is seen to be the main factor in the relative rankings of masonry walls with a similar finish; differences between the performances of corresponding solid and cavity walls are generally small and not all in the same direction. No type of dry lined wall performed better than its plastered analogue. The difference varied: it was very small with cavity lightweight aggregate blockwork and particularly large with cavity dense blockwork.

REFERENCES

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5 E C SEWELL and R S ALPHEY 1977. BRE Current Paper 43/77. Field measurements of the sound insulation of heavy solid concrete party walls
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TABLE 1 SUMMARY OF SURVEY RESULTS FOR INDIVIDUAL TYPES OF PARTY WALLS

For mean AADs, figures in parenthesis are ends of 90% confidence intervals; other figures for mean and 95th percentile AADs are best estimates.

* Indicates that the sample was restricted to party walls associated with external flanking walls meeting or approximating to a deemed-to-satisfy requirement.

Abbreviations: Ltwt. agg. = Lightweight aggregate blockwork;
Aerated. = Aerated concrete blockwork;
conc. = concrete;
FF/PL. = fair-faced or plastered;
%ile. = percentile;

Material	Finish	Solid or cavity width (mm)	Sample size	Measured AADs ≤ 23dB (%)	Parameters of AAD distribution (dB)			
					Mean			95th %ile
*Dense block	plastered	≥ 50	22	100	(2)	5	(8)	12
Timber frame	dry lined	≥200	53	100	(4)	6	(8)	14
Dense conc.	FF/PL.	solid	41	98	(4)	7	(9)	19
*Dense block	plastered	solid	21	90	(6)	13	(20)	28
No-fines	plastered	solid	48	79	(7)	13	(18)	37
*BRICK	PLASTERED	SOLID	104	63	(16)	20	(25)	48
*Brick	plastered	≥ 50	30	47	(19)	29	(40)	61
Ltwt.agg.	plastered	solid	21	48	(14)	30	(47)	61
Brick	dry lined	solid	59	36	(23)	32	(40)	65
Dense block	dry lined	≥ 50	24	17	(31)	42	(53)	70
Ltwt.agg.	plastered	≥ 75	65	23	(34)	41	(49)	76
Ltwt.agg.	dry lined	solid	31	19	(30)	44	(58)	80
Ltwt.agg.	plastered	50-70	42	36	(26)	40	(53)	82
Ltwt.agg.	dry lined	≥ 50	45	29	(29)	42	(55)	85
Aerated	plastered	≥ 75	59	22	(34)	44	(55)	85
Brick	dry lined	≥ 38	25	28	(25)	44	(64)	88
Aerated	plastered	solid	21	24	(25)	49	(73)	97
Aerated	plastered	50-70	23	13	(45)	67	(89)	119
Aerated	dry lined	solid	18	0	(85)	99	(114)	126