Proceedings of the Institute of Acoustics

LIGHTWEIGHT BLOCKWORK DOES IT MEET THE BILL - A REMEDIAL TALE.

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INTRODUCTION

Earlier this year as occupants moved into a block of flats, complaints were received that they could hear their neighbours.

South Bank University were instructed by the architect who designed the block to investigate the problem.

There are a number of contributory factors to this problem, including:

1) a low background noise level in the flats,
2) poor workmanship on the part of the builder,
3) room geometry,
4) the performance of lightweight blockwork.

LOW BACKGROUND NOISE LEVELS

The apparent performance of a partition decreases as the background noise level reduces.

Very low background noise levels can result in complaints being received about the performance of the partition even though when measured that partition has a performance well in excess of party wall grade requirement.

This problem seems to be increasing with the increase in the practice of blocking rat runs and the increased use of well fitting double glazing.

This indicates that the level of insulation required for a party wall/floor should vary depending on the background noise level.

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THE INVESTIGATION

On the first visit it was decided to undertake a partial sound insulation test on a number of party walls and floors to see the extent of the problem. The test was conducted between the second bedroom party walls, because it was adjudged that they would have the poorer performance compared to that between the main bedrooms (see plan 1). The test would use just one selected microphone position in each room to estimate the performance. However if there were a possibility that the partition would be adequate, then the more usual six positions would be used.

All the party walls had a poor performance, the partition between the second bedrooms having an estimated $D_{nT,w}$ of 43 to 44 dB. (Subsequently a number of complete tests were undertaken by another organisation on four second bedroom party walls had a mean $D_{nT,w}$ of 44.3 dB. Between the main bedrooms the party wall insulation was 47 dB.)

The floors performed well having an estimated performance of 56 dB.

There were essentially two variations of party wall:

- between the main bedrooms of adjacent flats,
- between the second bedrooms of adjacent flats.

The measured difference in performance between the two types of bedroom was 3 dB. This difference can be accounted for by room geometry (see below).

WORKMANSHIP

The junction between the wall and ceiling was exposed in one of the rooms. The party wall was plastered lightweight blockwork, the specification demanded a small gap (approx 10 mm) between the top of blockwork and soffit. This gap was meant to be filled with rockwool. However there was a much larger gap of some 15 to 30 mm and there was no soft fill or sealant at all.

It was obvious that this gap had to be closed not only to improve the sound insulation but also to meet fire regulations. The gap was filled by injecting a mortar mix. This gave a marginal improvement of around 2 dB.

It was decided that the actual construction of the party wall should be investigated. Consequently one square meter of the plaster adjacent to external wall was removed

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together with a similar area of the external wall plasterboard lining to expose external party wall junction with structural soffit. This exposed the following:

- that the actual blockwork was not as specified, it was a lower density. That is the builder had used a standard grade lightweight blockwork instead of the party wall grade. This probably resulted in a reduced performance of around 2 dB,
- the vertical joints between the blockwork was both wider than specified and they were not completely filled with mortar. This probably reduces the performance by some 1 to 2 dB,
- there was no soft joint fill between blockwork and structural soffit in party wall. This reduces the performance by about 2 dB,
- there was no soft joint fill between blockwork and structural soffit in external wall. This probably reduces the performance by some 1 to 2 dB,
- there was no cavity stop in external wall cavity.

The above deficiencies were considered to contribute significantly (around 7 dB) to the poor performance of the party wall but not to be the complete story.

ROOM GEOMETRY

Consider four identical rooms (each 5 by 2.6 by 2.4 m) all constructed of the same material and laid out as in plan 1. If the weighted sound reduction index R_w of the partition is 53 dB then the predicted $D_{nT,w}$'s range from 52.3 through 55 to 57.1 dB for partitions (a), (b) and (c) respectively.

These have been calculated from the formulae relating standardised level difference to the sound reduction index:

$$D_{nT,w} = R_w - 10 \lg (S/(0.32V)) \quad dB \qquad (1)$$

where V is volume and S the surface area of the contiguous area of party wall.

the area of the partition $S = xz$ (2)

the volume of receiving room $V = xyz$ (3)

(this assumes that the whole area of the partition is the transmission path.)

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thus

$$D_{nT,w} = R_w - 10 \lg 1/.32y \quad dB \quad (4)$$

It is to be noted that the weighted level difference will always be less than the sound reduction index for pairs of rooms that have both a complete common wall and the other side having a length less than 3.125 m.

Thus the measured insulation will vary with width of receiving room.

If $y > 3.125$ m then the $D_{nT,w}$ will be larger than R_w

if $y < 3.125$ m then $D_{nT,w}$ will be smaller than R_w

In this block of flats the second bedroom had a width of around 2.6 m which would result in a reduction of around 1 dB compared to the average sound reduction index and probably around 2 dB compared to the measured $D_{nT,w}$ of 55 dB.

Thus the second bedroom party walls were only just going to be satisfactory even if there were no constructional defects.

LIGHTWEIGHT BLOCKWORK

The lightweight blockwork that was specified to be used (party wall grade) has a measured weighted standardised level difference of 55 dB (8 tests).

The quoted superficial density m is 205 kg/m^2 and with dense plaster 253 kg/m^2.

The standard grade with dense plaster which was actually used has a superficial density of 206 kg/m^2.

The data sheet give the following formula for the average sound reduction index R_{ave}

$$R_{ave} = 21.6 \lg(m) - 1.2 \quad dB$$

Thus there will a predicted 2 dB difference in performance between the standard and party wall grade block.

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SUMMARY

For the party walls between second bedrooms.

Measured Party wall grade $D_{nT,w}$	= 55 dB
Predicted insulation of blocks used	= 55 - 2 = 53 dB
Measured insulation of blocks used	= 44 dB
Estimated reduction due to constructional defects	= 6 dB
Estimated reduction in performance of second bedrooms due to room geometry	= 2 dB
Thus there is a small difference between the measured insulation of 44 dB and estimated of	= 55 - 2 - 6 - 2 = 45 dB

THE TREATMENT

It was decided to tackle the problem from one side of the party wall by tackling the problem of the missing soft joint fill by filling the gaps with mortar; to apply Tri-line 50mm to the complete party wall (bedroom, hall and hall cupboard or in the other configuration bedroom and bathroom).

When tested this gave a $D_{nT,w}$ of 53 dB for a party wall between second bedrooms thus it was expected that there should be a slightly better performance between the main bedrooms.

CONCLUSION

Lightweight blockwork was unlikely to provide satisfactory insulation for many of the party walls even if the walls had been constructed correctly.

The Tri-line performed well giving a dramatic improvement in the insulation.

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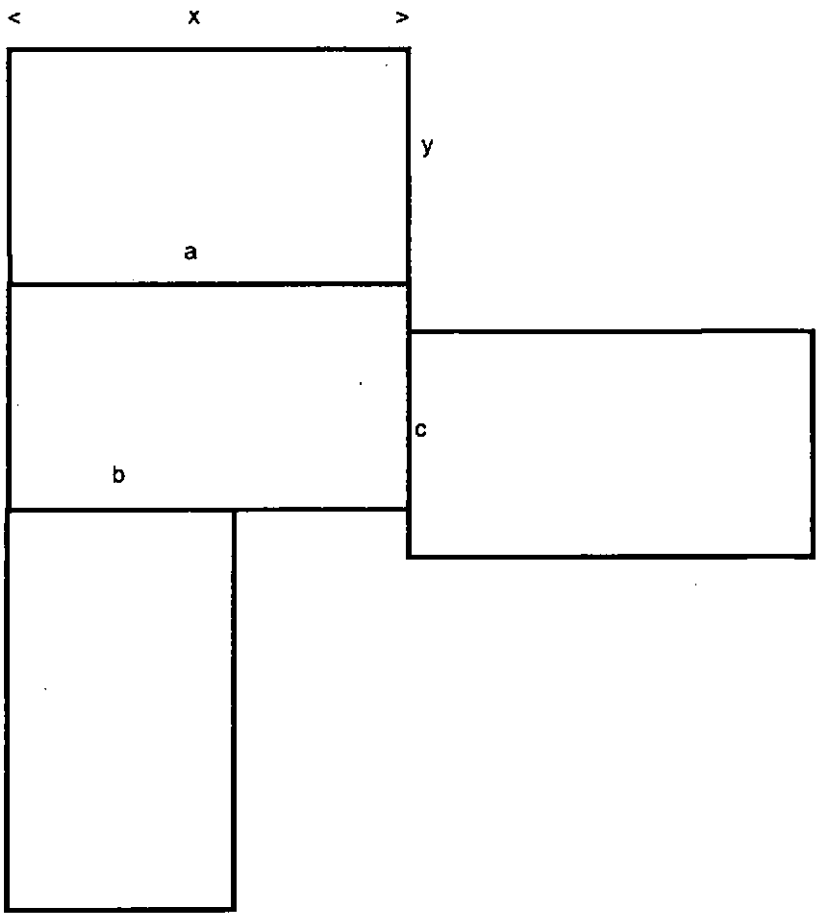

plan 1

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