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THE SOUND INSULATION OF A SYSTEM BUILT HOUSING ESTATE - AGAINST AIRCRAFT NOISE, TRAFFIC NOISE AND NEIGHBOURS

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INTRODUCTION

As part of a housing agreement the GLC have provided 77 dwellings on a site in the London Borough of Hounslow. The estate consists of terraced 3-bedroom two storey houses and 1-bedroom two storey flats. The units were system built, i.e., much pre-construction was carried out in a factory, including casting of concrete panels and finishing. As the site (Figure 1) was exposed to aircraft noise from Heathrow (50-55 NNI) and road traffic noise (18-hour L10 73 dBA), additional acoustic insulation was required. The effect of this additional insulation was measured in the two storey houses.

PLANNING REQUIREMENTS

The London Borough of Hounslow's planning consent is based on drawings approval, guidance being given on the Council's development control policy in respect of the sound insulation for new residential buildings in the borough.

For aircraft noise the overall requirement is in line with the advice contained in DOE Circular 10/73 and the GLC Noise and Vibration Guidelines. For areas in excess of 50 NNI the minimum attenuation required is 35 dB (averaged over 100-3150 Hz).

For road traffic, facades exposed to L10 18 hour averages above 68 dBA should be insulated to provide internal L10 values of 45 dBA (0600-2400) and 35 dBA (0000-0600). This compares with Circular 10/73 guidance of a 50 dBA L10 minimum and 40 dBA L10 'good' standard. The GLC guideline recommends an internal level of 35 dBA L10 for bedrooms between 2200-2400 hours.

The party walls must comply with the conditions of the Building Regulations 1976 Part G. All insulated rooms are to be fitted with a mechanical ventilator as specified in the Noise Insulation Regulations and 8AA Grants Scheme.

DESCRIPTION OF HOUSES

Three variations of the standard 3-bedroom two storey house were used on the estate. At ground floor level the front and back wall are 102.5mm facing brick/25mm insulation & vapour barrier/100mm rc panel, at first floor level 150mm rc panel with the alternatives of tile or render for the external skin. In cases where brick cladding was used the internal panel was reduced to 100mm thickness (Figure 2).

A Skansen double window system consisting of 4mm/50mm/4mm was fitted to bedrooms and living rooms. These units were side hung double casement construction with compressible seals. Rooms with double windows were fitted additionally with a Silavent Freshflo combined mechanical ventilator and air relief.

The roof consisted of an asymetrical pitched construction with an outer skin of heavyweight concrete interlocking tiles (46 kgm/m^2), 80mm mineral wool insulation and ceilings of two layers of 12.7mm plasterboard.

The party walls (Figure 3) were constructed of two leaves of 80mm reinforced concrete with a 70mm cavity which had previously been shown to meet the requirements of the Building Regulations by the 'four wall test'.

MEASUREMENT & ANALYSIS

Aircraft - the aim was to measure the standardised level difference in ⅓ octave bands over as wide a spectrum range as possible.

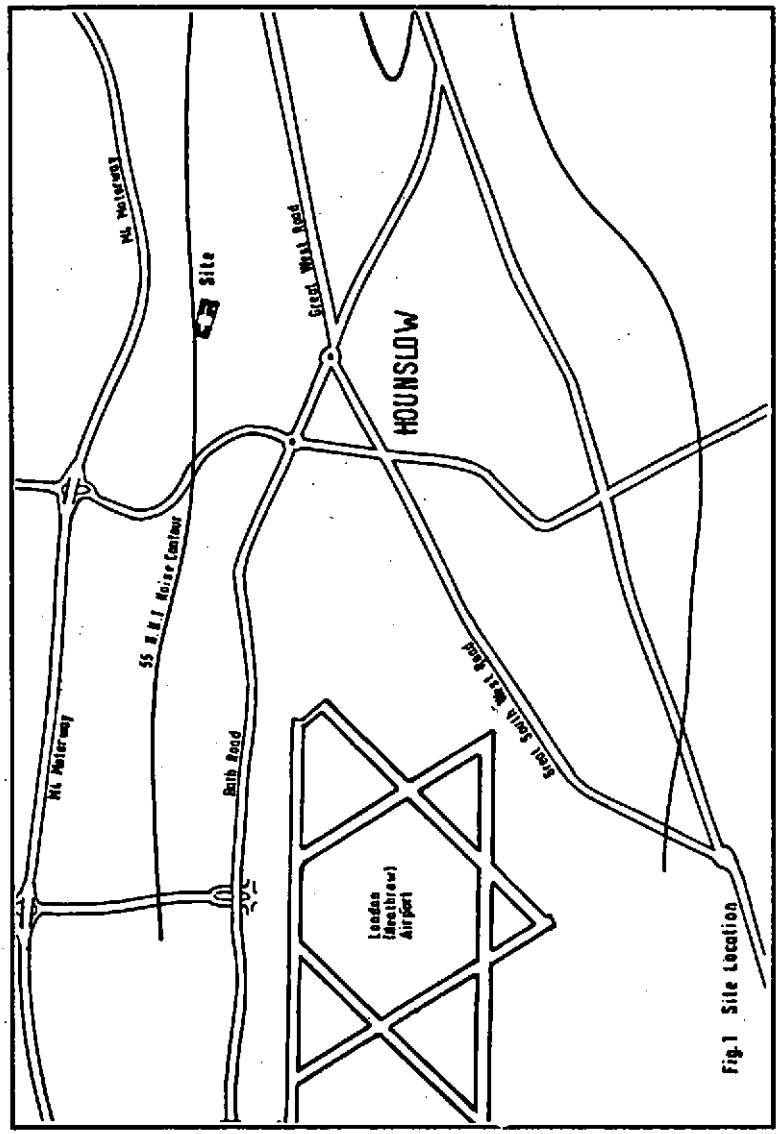

Fig.1 Site Location

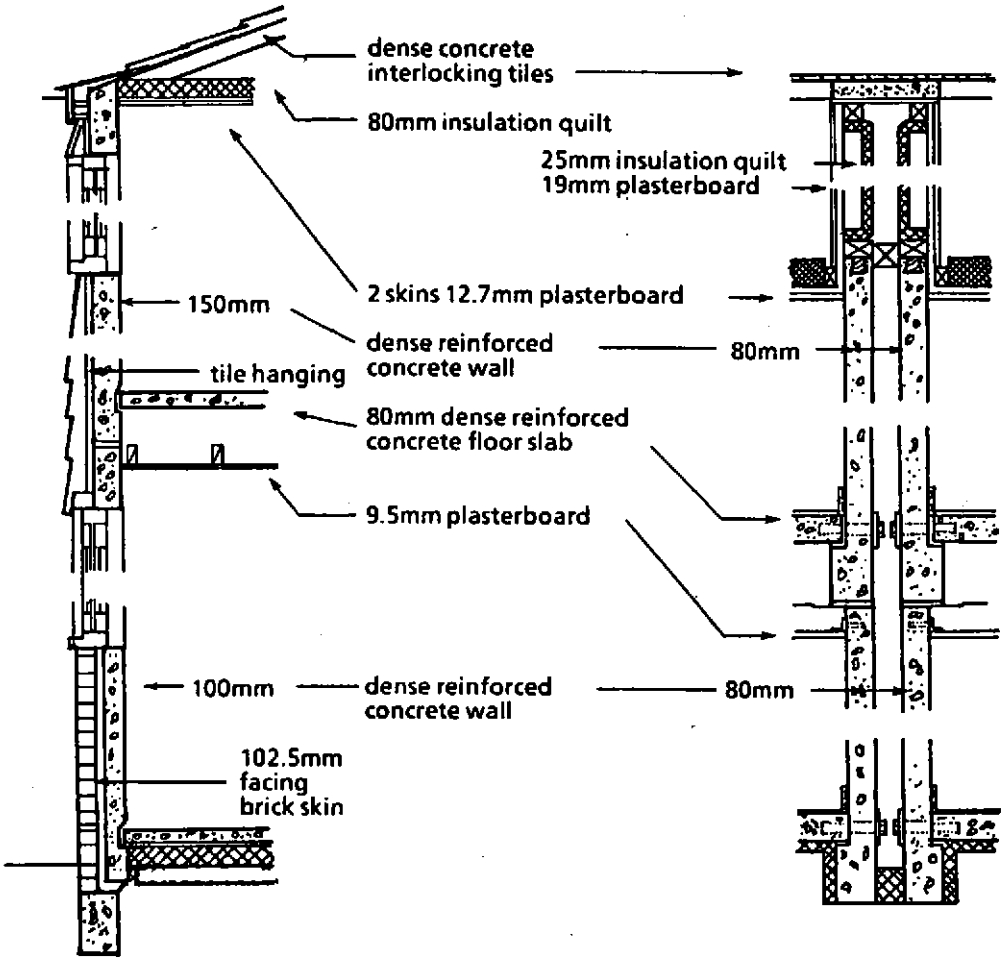

Fig 2 Section through external wall. NTS

Fig 3 Section through separating wall. NTS

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By using Bruel & Kjaer Type 4165 microphones and Type 2619 pre-amplifiers fed directly into two Nagra IV-SJ AM tape recorders, four track simultaneous recording was possible of overflying aircraft. Additionally the FM cue tracks of the recorders were used for announcements. The microphones were positioned as follows:

1. External free-field 9m above ground level approximately 1m above ridge height.
2. In the roofspace. 3. In the first floor bedroom. 4. In the ground floor living room.

The internal microphones were moved at regular intervals to improve averaging. The system had previously been shown to have a flat spectrum response over the range 20Hz - 20KHz, a high pass roll-off filter was used below 20Hz to maximise the available dynamic range. Recordings of gun shots were taken for each room to determine reverberation times .

Subsequent analysis was performed on a General Radio ⅓ octave real time analyser using the control and data storage facilities of a DEC PDP8 computer. The analysed sections of the flyover were approximately between the '10 dB down from peak' points. A further constraint was that any analysed levels should be 10 dB above the background for the particular ⅓ octave band. These conditions gave analysis periods of 16 or 32 seconds, coincidence of analysis being achieved across the four channels using audio markers on the cue tracks. The gun shots were analysed on a Nortronic 823 system, the results being manually added to the computer data files. Computer programs were available for assembly of the data files and calculation of Leq differences with and without RT corrections.

Road traffic - external measurements were made over a 24 hour period of hourly statistical parameters and Leq values using a Bruel & Kjaer Type 4426 community noise analyser and associated printer. The microphone was mounted 1m from the relevant facade. Using the source traffic noise, facade insulation recordings were made on a Nagra IV-SJ using a similarly mounted external microphone and averaged internal microphone positions. Analysis was carried out as for the aircraft recordings, gun shots again being used for reverberation time estimation. Using the appropriate computer programs internal levels were calculated for the relevant time periods.

Party walls - Four walls were measured according to BS 2750: Part 4 1980 using a multiplexed Nortronic 811 system.

RESULTS

Aircraft -

Figure 3 shows the standardised level differences for the front bedroom of a rendered finish house.

Figure 4 shows the standardised level differences for the living room of the same dwelling.

Figure 5 shows the simple level differences for 'OUT - ROOFSPACE' and 'ROOFSPACE - BEDROOM'.

Road Traffic -

Table 1 A summary of the road traffic results with the predicted bedroom levels .

Facade Type	SLD dB (100 - 3150 Hz)	Facade Reduction dBA	Internal bedroom level Worst hour L10 dBA		
			(0600-2400)	(0000-0600)	(2200-2400)
TILE	32	31	44 (45)	36 (35)	39 (35)
RENDER	32	31	44 (45)	36 (35)	39 (35)
BRICK	33	33	42 (45)	34 (35)	37 (35)

Figure 6 gives standardised level differences for the three types of house.

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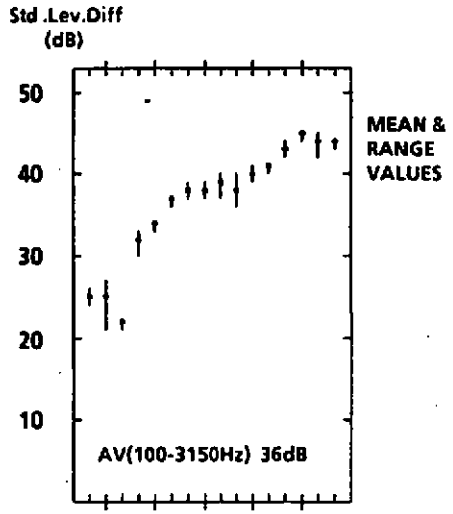

Fig 3: FRONT BED

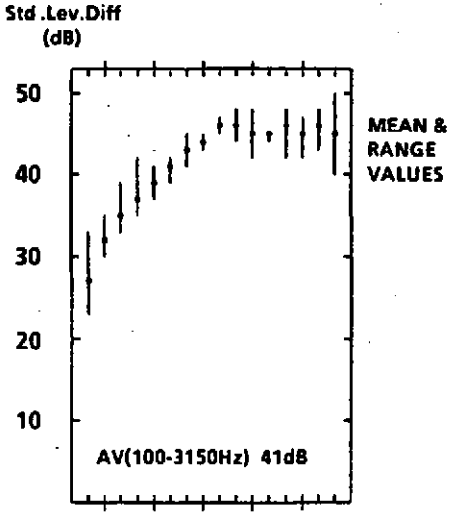

Fig 4: LIVING ROOM

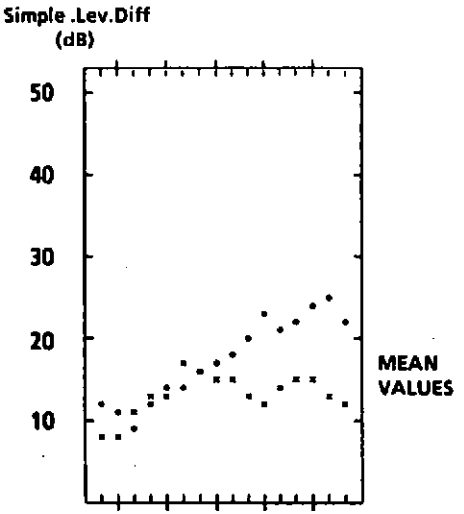

Fig 5: OUT - LOFT •
LOFT - BED ▪

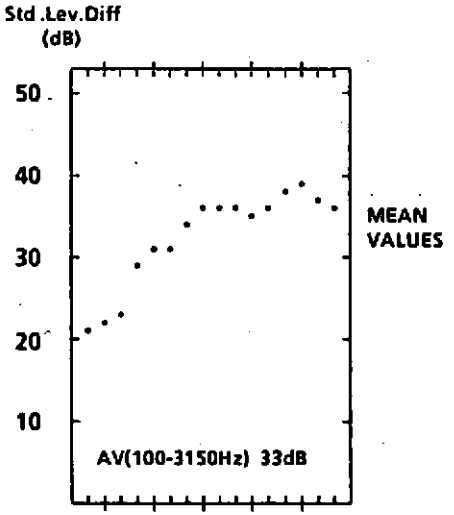

Fig 6 : FRONT BEDS

Party Walls

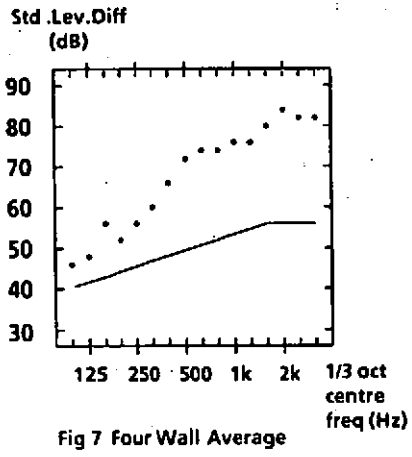

Fig 7 Four Wall Average

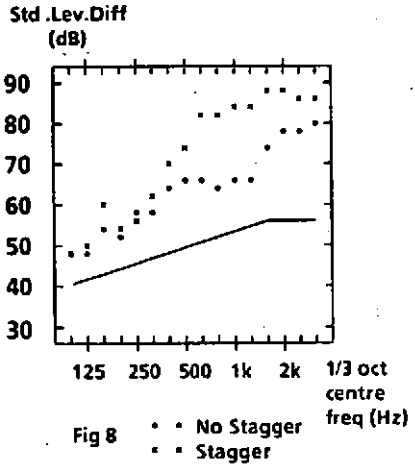

Fig 8

Figure 7 gives the four wall average compared with the Building Regulations Grade Curve.
Figure 8 gives the standardised level differences for the party walls with and without stagger.

.Ventilator Noise
The normalised 'A' weighted level in a bedroom with the Silavent Freshflo ventilator on at maximum rate was 40 dBA, at half full rate the level was 31 dBA.

CONCLUSIONS

1 The overall aircraft noise planning requirement that the dwellings should achieve a minimum attenuation of 35 dB (100 - 3150 Hz) was met.

2 The levels of road traffic noise inside the bedrooms complied with the DOE Circular 10/73, met the requirements of the London Borough of Hounslow but just exceeded the GLC guideline.

3 The self generated noise of the acoustic ventilator met the requirements of the type specified in the Noise Insulation Regulations and the BAA Noise Insulation Grant Scheme.

4 The party walls comfortably met the performance standards of the Building Regulations 1976.

5 Significant differences were measured in SLD between the sources of aircraft and road traffic noise.

ACKNOWLEDGEMENT

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