AIRO

Report of Pre-Completion Testing
at
Centrium Woking,
off Victoria Way, Station Approach,
Woking, Surrey

Report No: SRB/5326/A
Date of Issue: 26 October 2004
Property Type: Purpose built dwelling-houses
Date of test: 4 October 2004

ACOUSTICAL INVESTIGATION & RESEARCH ORGANISATION LTD
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AIRO is a UKAS accredited testing laboratory No. 0483 and measurements to British Standards BS EN ISO 140-4 & 7:1998 and BS EN ISO 717-1 & 2:1997 together with Approved Document E to The Building Regulations are included on our schedule of accreditation. UKAS is the United Kingdom Accreditation Service.

Test Engineer:

S R Baxter BEng MIOA
Assistant Engineer

Client: Ardmore Construction Limited
c/o Barratts Southern, Centrium Woking
off Victoria Way, Station Approach
Woking
Surrey
GU22 7AE

Comparison with Approved Document E (2003) to The Building Regulations 2000 (ref 1):

Test No.	Rooms	$D_{nT,w}+C_{tr}$ (dB)			$L'_{nT,w}$ (dB)		
		Measured	Required	Pass/Fail	Measured	Required	Pass/Fail
1	Living Room, Plot 244 to Bedroom, Plot 245	51	≥45	PASS	--	--	--
2	Bedroom 2, Plot 246 to Living Room, Plot 245	50	≥45	PASS	--	--	--
3 & 4	Living Room, Plot 250 to Living Room, Plot 245	56	≥45	PASS	58	≤58	PASS
5 & 6	Bedroom, Plot 250 to Bedroom, Plot 245	52	≥45	PASS	60	≤60	PASS

Equipment

Type	Serial No.	Type	Serial No.
Norsonic 121 Sound Level Analyzer	29791	B&K 3923 Rotating Microphone Boom	1113618
GRAS 40AE Condenser Microphone	34700	B&K 3923 Rotating Microphone Boom	1213966
GRAS 40AE Condenser Microphone	34699	Norsonic 1251 Sound Level Calibrator	29213
Norsonic 1201 Microphone Pre-Amplifier	29386	Norsonic 211A Tapping Machine	25175
Norsonic 1201 Microphone Pre-Amplifier	28083		

The test procedures in Annex B of Approved Document E (2003) have been followed.

Approved by:

A J Jones BSc PhD CPhys MInstP FIOA
Managing Director

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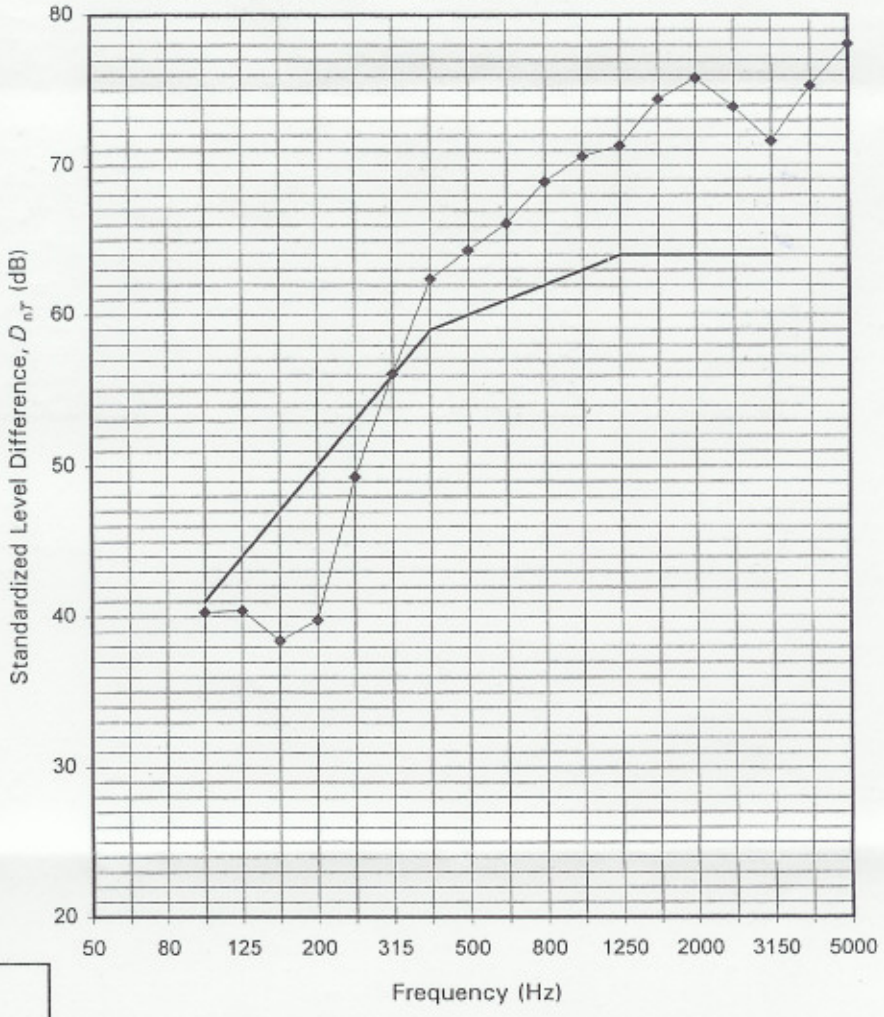
Test 1 - Airborne Sound Insulation across Separating Wall

	SOURCE ROOM			RECEIVE ROOM		
Test No.	Room	Plot/No	Vol. (m^3)	Room	Plot/No	Vol. (m^3)
1	Living Room	244	48	Bedroom	245	29

Standardized Level Difference according to BS EN ISO 140-4:1998

Frequency (Hz)	D_{nT} (dB)
50	
63	
80	
100	40.3
125	40.4
160	≥ 38.4
200	≥ 39.8
250	≥ 49.3
315	≥ 56.1
400	≥ 62.4
500	≥ 64.3
630	≥ 66.1
800	≥ 68.9
1000	≥ 70.6
1250	≥ 71.3
1600	≥ 74.4
2000	≥ 75.8
2500	≥ 73.9
3150	≥ 71.6
4000	≥ 75.3
5000	≥ 78.1
6300	
8000	
10000	



Rating according to BS EN ISO 717-1:1997	
$D_{nT,w}$ (C;C_{tr}):	60 (-3;-9) dB
$D_{nT,w} + C_{tr}$ =	51 dB

$C_{50\text{-}3150}$: -- $C_{50\text{-}5000}$: -- $C_{100\text{-}5000}$: -2 dB

$C_{tr,50\text{-}3150}$: -- $C_{tr,50\text{-}5000}$: -- $C_{tr,100\text{-}5000}$: -9 dB

Evaluation based on a result obtained by a field method.

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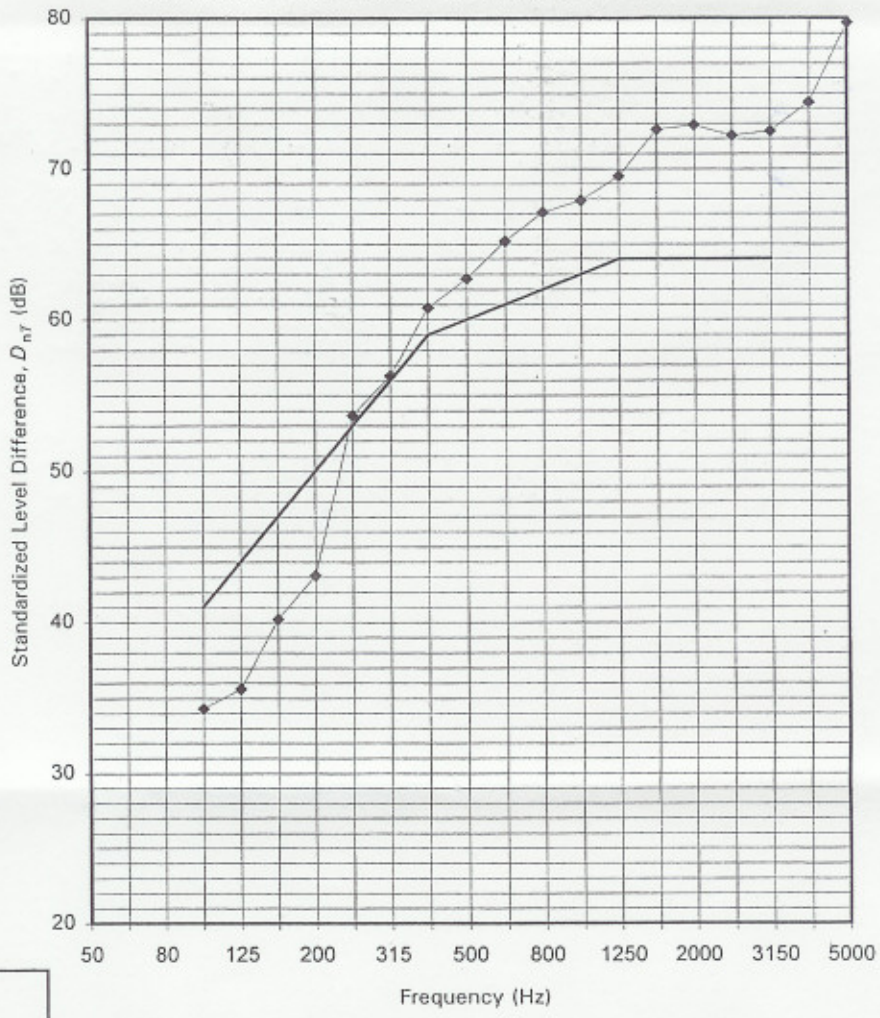
Test 2 - Airborne Sound Insulation across Separating Wall

	SOURCE ROOM			RECEIVE ROOM		
Test No.	Room	Plot/No	Vol. (m^3)	Room	Plot/No	Vol. (m^3)
2	Bedroom 2	246	24	Living Room	245	48

Standardized Level Difference according to BS EN ISO 140-4:1998

Frequency (Hz)	D_{nT} (dB)
50	
63	
80	
100	34.3
125	35.6
160	≥ 40.2
200	43.1
250	≥ 53.7
315	≥ 56.3
400	≥ 60.8
500	≥ 62.7
630	≥ 65.2
800	≥ 67.1
1000	≥ 67.9
1250	≥ 69.5
1600	≥ 72.6
2000	≥ 72.9
2500	≥ 72.2
3150	72.5
4000	74.4
5000	79.7
6300	
8000	
10000	



Rating according to BS EN ISO 717-1:1997	
$D_{nT,w}$ (C;C_{tr}):	60 (-4;-10) dB
$D_{nT,w} + C_{tr}$ =	50 dB

$C_{50\text{-}3150}$: -- $C_{50\text{-}5000}$: -- $C_{100\text{-}5000}$: -3 dB

$C_{tr,50\text{-}3150}$: -- $C_{tr,50\text{-}5000}$: -- $C_{tr,100\text{-}5000}$: -10 dB

Evaluation based on a result obtained by a field method.

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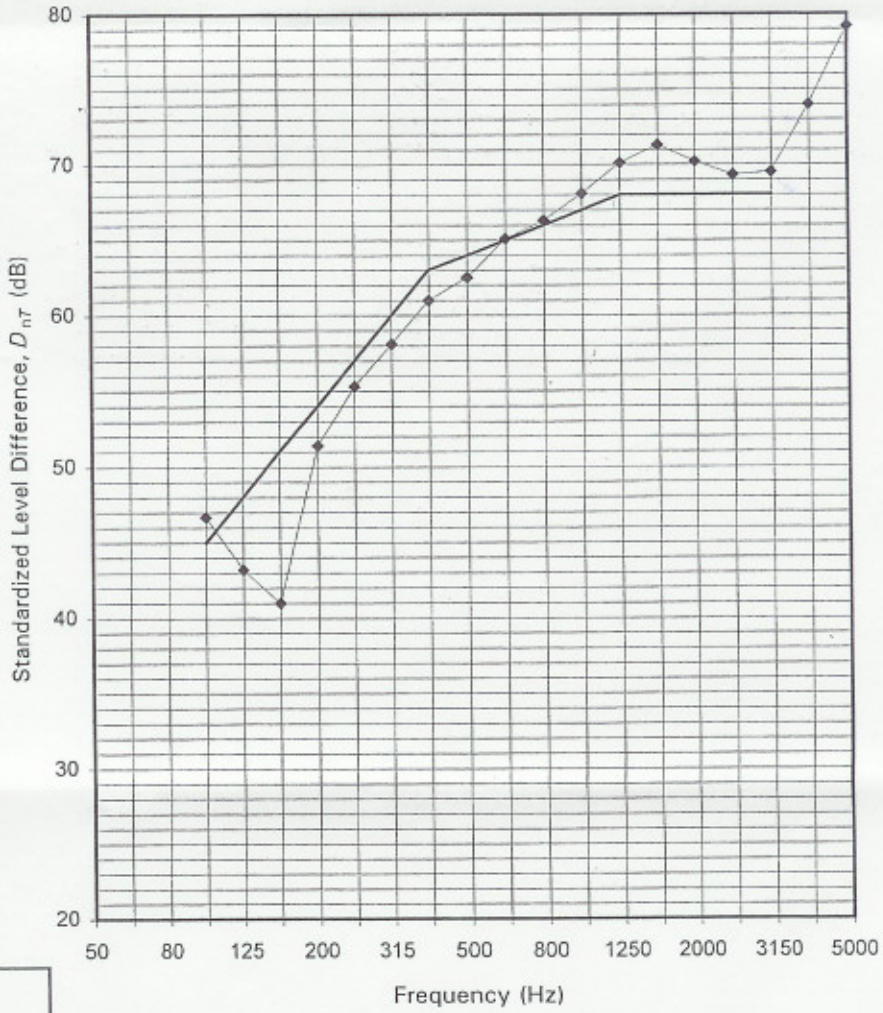
Test 3 - Airborne Sound Insulation across Separating Floor

Test No.	SOURCE ROOM			RECEIVE ROOM		
	Room	Plot/No	Vol. (m^3)	Room	Plot/No	Vol. (m^3)
3	Living Room	250	47	Living Room	245	48

Standardized Level Difference according to BS EN ISO 140-4:1998

Frequency (Hz)	D_{nT} (dB)
50	
63	
80	
100	≥ 46.7
125	43.2
160	≥ 41.0
200	≥ 51.4
250	≥ 55.3
315	≥ 58.1
400	≥ 61.0
500	≥ 62.5
630	≥ 65.1
800	≥ 66.3
1000	68.1
1250	70.1
1600	71.3
2000	70.2
2500	69.3
3150	69.5
4000	74.0
5000	≥ 79.2
6300	
8000	
10000	



Rating according to BS EN ISO 717-1:1997	
$D_{nT,w}$ (C;C_{tr}):	64 (-3;-8) dB
$D_{nT,w} + C_{tr}$ =	56 dB

$C_{50\text{-}3150}$: -- $C_{50\text{-}5000}$: -- $C_{100\text{-}5000}$: -2 dB

$C_{tr,50\text{-}3150}$: -- $C_{tr,50\text{-}5000}$: -- $C_{tr,100\text{-}5000}$: -8 dB

Evaluation based on a result obtained by a field method.

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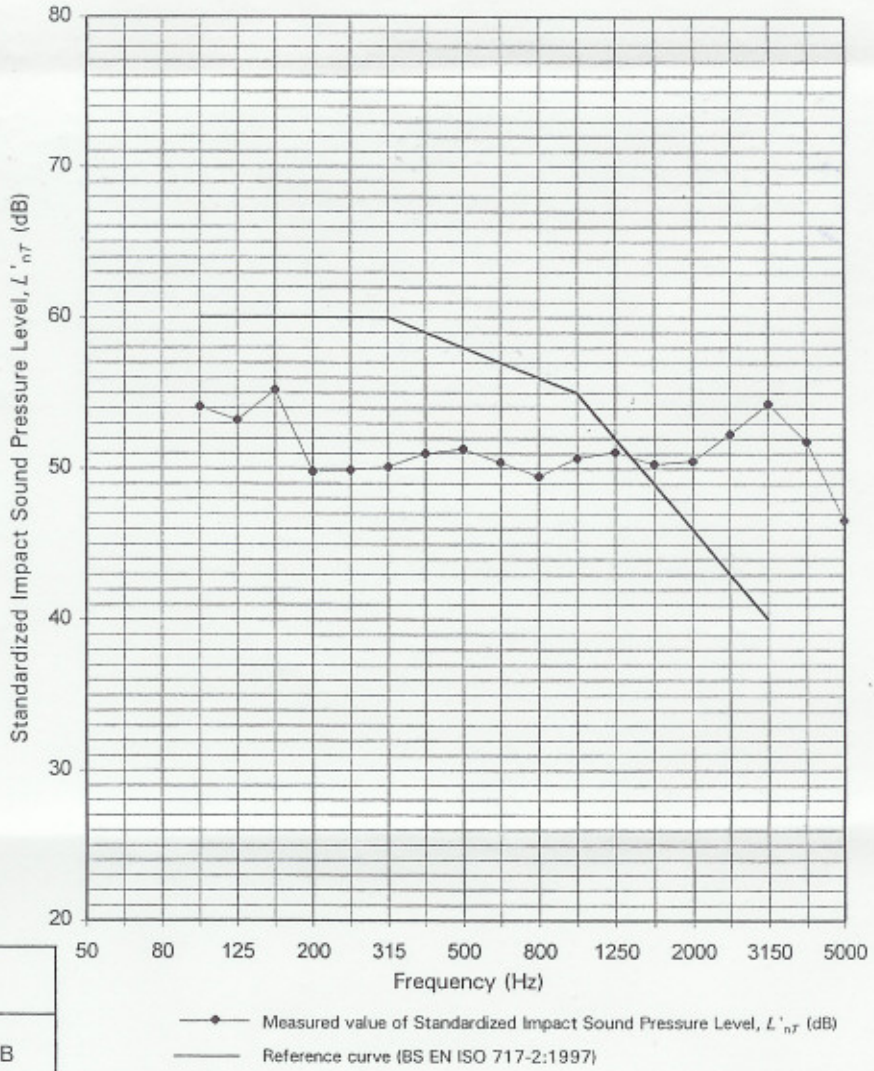
Test 4 - Impact Sound Transmission through Separating Floor

Test No.	SOURCE ROOM			RECEIVE ROOM		
	Room	Plot/No	Vol. (m^3)	Room	Plot/No	Vol. (m^3)
4	Living Room	250	47	Living Room	245	48

Standardized Impact Sound Pressure Level according to BS EN ISO 140-7:1998

Frequency (Hz)	L'_{nT} (dB)
50	
63	
80	
100	54.1
125	53.2
160	55.2
200	49.8
250	49.9
315	50.1
400	51.0
500	51.3
630	50.4
800	49.5
1000	50.7
1250	51.1
1600	50.3
2000	50.5
2500	52.3
3150	54.3
4000	51.8
5000	46.6
6300	
8000	
10000	



Rating according to BS EN ISO 717-2:1997	
$L'_{nT,w}$ (C_I):	58 (-10) dB
$L'_{nT,w}$ =	58 dB

C_I: -10 dB $C_{I,50\text{-}2500}$: --

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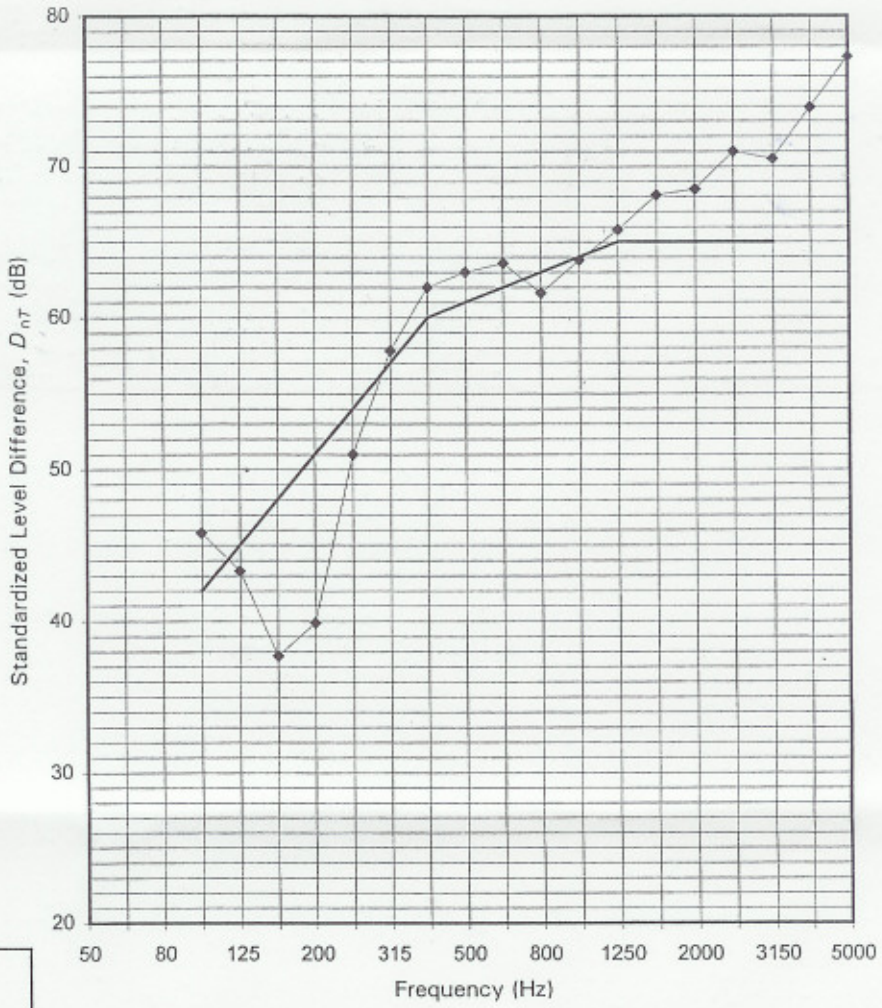
Test 5 - Airborne Sound Insulation across Separating Floor

Test No.	SOURCE ROOM			RECEIVE ROOM		
	Room	Plot/No	Vol. (m^3)	Room	Plot/No	Vol. (m^3)
5	Bedroom	250	25	Bedroom	245	29

Standardized Level Difference according to BS EN ISO 140-4:1998

Frequency (Hz)	D_{nT} (dB)
50	
63	
80	
100	≥ 45.8
125	≥ 43.3
160	37.7
200	≥ 39.9
250	≥ 51.0
315	≥ 57.8
400	≥ 62.0
500	≥ 63.0
630	≥ 63.6
800	61.6
1000	63.8
1250	65.8
1600	68.1
2000	68.5
2500	71.0
3150	70.5
4000	73.9
5000	77.3
6300	
8000	
10000	



Rating according to BS EN ISO 717-1:1997	
$D_{nT,w}$ (C;C_{tr}):	61 (-4;-9) dB
$D_{nT,w} + C_{tr}$ =	52 dB

$C_{50\text{-}3150}$: -- $C_{50\text{-}5000}$: -- $C_{100\text{-}5000}$: -3 dB

$C_{tr,50\text{-}3150}$: -- $C_{tr,50\text{-}5000}$: -- $C_{tr,100\text{-}5000}$: -9 dB

Evaluation based on a result obtained by a field method.

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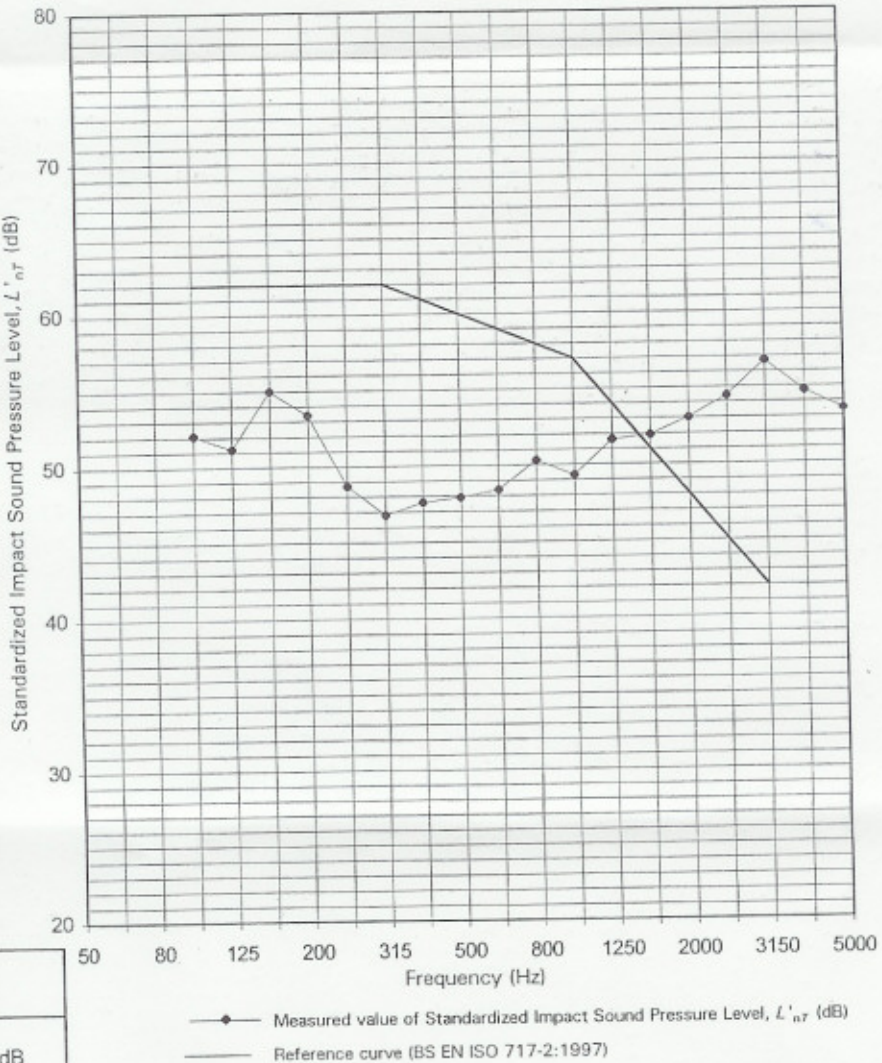
Test 6 - Impact Sound Transmission through Separating Floor

Test No.	SOURCE ROOM			RECEIVE ROOM		
	Room	Plot/No	Vol. (m^3)	Room	Plot/No	Vol. (m^3)
6	Bedroom	250	25	Bedroom	245	29

Standardized Impact Sound Pressure Level according to BS EN ISO 140-7:1998

Frequency (Hz)	L'_{nT} (dB)
50	
63	
80	
100	52.1
125	51.2
160	55.0
200	53.4
250	48.7
315	46.8
400	47.6
500	47.9
630	48.4
800	50.3
1000	49.3
1250	51.6
1600	51.9
2000	53.0
2500	54.4
3150	56.7
4000	54.7
5000	53.5
6300	
8000	
10000	



Rating according to BS EN ISO 717-2:1997	
$L'_{nT,w}$ (C_I):	60 (-12) dB
$L'_{nT,w}$ =	60 dB

C_I: -12 dB $C_{I,50\text{-}2500}$: --

Evaluation based on a result obtained by a field method.

Construction Details

Separating Wall:

The separating wall comprised two, 70 mm Knauf Soundshield C-stud partitions separated by a 60 mm cavity partially filled with 50 mm of Rocksil RS33 insulation. Both sides of the wall were closed with 2 x 12.5 mm layers of Knauf Soundshield board. An extra "sacrificial" layer of 12.5 mm Soundshield board was used on both sides of the wall to house sockets and services.

The estimated mass of the finished separating wall is 72 kg/m².

Separating Floor:

The separating floor comprised a 175 mm deep cast-in-situ concrete slab. The ceiling comprised a 12.5 mm layer of Knauf Soundshield board supported by 125 mm deep Knauf C-form ceiling channels that were fixed to the underside of the concrete slab.

The estimated mass of the finished separating floor is 376.5 kg/m².

External Wall:

The outer leaf of the external wall comprised 120 mm thick insulation faced on the outer side with 5 mm render. The inner leaf comprised 140 mm thick high density blockwork finished internally with 12.5 mm Knauf Soundshield board on Knauf sections.

The estimated mass of the finished inner leaf of the external wall is 263.5 kg/m².

Internal Partitions:

The internal partitions comprised 50 mm Knauf Soundshield C-studs faced on both sides with 12.5 mm Knauf Soundshield board.

Procedure

Airborne Sound Insulation to BS EN ISO 140-4:1998

Airborne sound insulation measurements were performed according to a prescribed procedure that specifies the sound generated in the source room shall be steady and have a continuous spectrum in the frequency bands of interest. Measurements of the sound levels were made in both source and receive rooms at the one-third octave intervals from 100 Hz to 5000 Hz as recommended in the Standard (ref 2). The measurements were made such as to obtain a spatial average of the sound pressure level in each room. Reverberation time measurements were made in the receive room following the procedures of British Standard BS EN 20354:1993 (ref 3).

The Standardized Level Difference (D_{nT}) in decibels (dB) is calculated in each frequency band using the equation:

$$D_{nT} = L_1 - L_2 + 10 \lg \frac{T}{T_0} \qquad \text{dB}$$

where
- D_{nT} is the Standardized Level Difference (dB)
- L_1 is the average sound pressure level in the source room (dB)
- L_2 is the average sound pressure level in the receive room (dB)
- T is the average reverberation time of the receive room (seconds)
- T_0 is the reference reverberation time of 0.5 seconds

The Weighted Standardized Level Difference ($D_{nT,w}$) in decibels (dB) and the Spectrum Adaptation Terms (C and C_{tr}), also in decibels (dB), are calculated in accordance with BS EN ISO 717-1:1997 (ref 4) by comparison of the sixteen values of Standardized Level Difference from 100 Hz to 3150 Hz with the relevant reference curves.

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Procedure

Impact Sound Transmission to BS EN ISO 140-7:1998

A standard tapping machine fitted with steel hammers was used as the impact source. Measurements of the transmitted sound levels were made in the receive room at the one-third octave intervals from 100 Hz to 5000 Hz as recommended in the Standard (ref 2). The measurements were made such as to obtain a spatial average of the sound pressure level in the room. Reverberation time measurements were measured in the receive room following the procedures of British Standard BS EN 20354:1993 (ref 3).

The Standardized Impact Sound Pressure Level (L'_{nT}) in decibels (dB) is calculated in each frequency band using the equation:

$$L'_{nT} = L_i - 10 \lg \frac{T}{T_0} \quad \text{dB}$$

where
L'_{nT} is the Standardized Impact Sound Pressure Level (dB)
L_i is the average impact sound pressure level in the receive room (dB)
T is the average reverberation time of the receive room (seconds)
T_0 is the reference reverberation time of 0.5 seconds

The Weighted Standardized Impact Sound Pressure Level ($L'_{nT,w}$) in decibels (dB) and the Spectrum Adaptation Term (C_I), also in decibels, are calculated in accordance with BS EN ISO 717-2:1997 (ref 4) by comparison of the sixteen values of Standardized Impact Sound Pressure Level from 100 Hz to 3150 Hz with the relevant reference curves.

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References

1. The Building Regulations 2000

   Approved Document E: Resistance to the passage of sound (2003 Edition)
   - E1 Protection against sound from other parts of the building and adjoining buildings
   - E2 Protection against sound within a dwelling-house etc
   - E3 Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes
   - E4 Acoustic conditions in schools

   The Building Regulations 2000
   Amendments 2004 E: Resistance to the passage of sound

2. British Standard BS EN ISO 140
   Acoustics - Measurements of sound insulation in buildings and of building elements

   BS EN ISO 140-4:1998
   Field measurements of airborne sound insulation between rooms

   BS EN ISO 140-7:1998
   Field measurements of impact sound insulation of floors

3. British Standard BS EN 20354:1993
   Acoustics - Measurement of sound absorption in a reverberation room

4. British Standard BS EN ISO 717
   Acoustics - rating of sound insulation in buildings and of building elements

   BS EN ISO 717-1:1997
   Airborne sound insulation

   BS EN ISO 717-2:1997
   Impact sound insulation