



noise.co.uk Ltd
Report No U20

Measurement of Airborne & Impact Sound Insulation

University of Durham, Pavilion H, Howlands Farm, Durham.



For: The Concrete Centre

1.0 Summary Information

Required ISO Test Report Information

(cross referenced where required)

		Tests Carried Out to:	Analysed to:
a)	Standards	EN ISO 140-4: 1998 EN ISO 140-7: 1998	BS EN ISO 717-1: 1997 BS EN ISO 717-2: 1997
b)	Organisation performed the measurements	noise.co.uk Ltd	
c)	Name & Address of Client	Carl Sutcliffe, The Concrete Centre, Riverside House, 4 Meadows Business Park, Station Approach, Blackwater, Camberley.	
d)	Date of test	5 th August 2005	
e)	Description & identification of building construction and test arrangement	Building Type: New Build RFRP Tests: Airborne & Impact Performance of Floors/Walls General Construction: Tunnel Form Cast In Situ Concrete	
f)	Volumes of both test rooms	See Certification Detailed in Appendix	
g)	Standardized Level Difference (D_{nT}) Standardized Impact Sound Pressure Level (L'_{nT})	See Certification Detailed in Appendix	
h)	Area S used for evaluation of R'	N/a	
i)	Brief Description of details of Procedure & equipment	See Test Report Section 6.0 & 7.0	
j)	Limits of measurement	See Certification Detailed in Appendix	
k)	Flanking Transmission	N/a	

2.0 Object

The object of this report is to present the findings of an airborne & impact sound insulation survey at Pavilion H, Howlands Farm, Durham on floors & walls to identify their sound insulation performance.

The survey was carried out on 5th August 2005.

3.0 Scope

This report covers the presentation of the survey findings with analysis and discussion.

4.0 Site

Preamble:

The property is a purpose built block Rooms for Residential Purposes. As a new build RFRP property the sound insulation performance is to be assessed under the definitions in Table 1b on p8 of Approved Document E of the Building Regulations (2003).

The floor and wall construction detail is described as Tunnel Form wall thickness is 180mm with a concrete density of approximately **2300kg/m³** and a C40 concrete mix. Wall finish is **faced concrete**.

Tunnel Form slab finish is 225mm with a concrete density of approximately 2300kg/m³ and a C40 concrete mix. Slab has a trowelled finish and has a fully bonded 5mm carpet. Underdrawn ceiling comprises 15mm thick polystyrene on aluminum exposed grids. There are no timber edge battens.

NB – Impact tests were carried out on bonded carpet at the clients' request.

5.0 Measurements

The test regime consisted of wall and floor tests as identified below:

Test Summary Table

UKAS Test No	Scenario	Test
U020/1	Block H 1 st Floor Bed1 – Block H 1 st Floor Bed 2	Wall Airborne
U020/2	Block H 1 st Floor Bed 1 – Block H Ground Floor Bed 1	Floor Airborne
U020/3	Block H 1 st Floor Bed 1 – Block H Ground Floor Bed 1	Floor Impact
U020/4	Block H 1 st Floor Bed 2 – Block H Ground Floor Bed 2	Floor Airborne
U020/5	Block H 1 st Floor Bed 2 – Block H Ground Floor Bed 2	Floor Impact
U020/6	Block H Ground Floor Bed 1 – Block H Ground Floor Bed 2	Wall Airborne

Airborne Sound Transmission (Floors)

Measurements of the Standardised Level Difference (D_{nT}) were carried out in accordance with British Standards BS EN ISO 140-4: 1998. A single figure rating of airborne sound insulation performance (D_nT_w ; the Weighted Standardized Level Difference) was calculated from the measurements using the procedures detailed in BS EN ISO 717-1: 1997.

In each test, measurements of SPL were made in a minimum of five randomly chosen positions in both the source and receiver rooms for each speaker position. Measurements in the source room were not made close to the loud speaker.

The sound level meter was always positioned at least 0.5m away from any room boundary or diffuser and at least 1m from the source. Each measurement position was at least 0.7m away from other positions where practicable and on a different axis.

Sound pressure levels were made in one third octave bands from 100Hz - 3150Hz.

Each one third octave measurement took approximately 6 seconds.

Due to the layout of the property flanking transmission was minimised i.e. doors to rooms and to the corridors were kept closed at all times this reduced the obvious flanking paths when testing was in session.

The reverberation times of the receiving rooms were measured by recording wide band continuous pink noise. Measurements were taken using one speaker position, with a minimum of two readings at six selected positions.

The room layouts are detailed in the Appendix.

All SPL measurements are in dB re 20 micro pascals.

Airborne Sound Transmission (Walls)

Measurements of the Standardised Level Difference (D_{nT}) were carried out in accordance with British Standards BS EN ISO 140-4: 1998. A single figure rating of airborne sound insulation performance (D_nT_w ; the Weighted Standardized Level Difference) was calculated from the measurements using the procedures detailed in BS EN ISO 717-1: 1997.

The room layouts are detailed in the Appendix.

In each test, measurements of SPL were made in a minimum of five randomly chosen positions in both the source and receiver rooms for each speaker position. Measurements in the source room were not made close to the loud speaker.

The sound level meter was always positioned at least 0.5m away from any room boundary or diffuser and at least 1m from the source. Each measurement position was at least 0.7m away from other positions where practicable and on a different axis.

Sound pressure levels were made in one third octave bands from 100Hz - 3150Hz.

Each one third octave measurement took approximately 6 seconds.

Due to the layout of the property flanking transmission was minimised i.e. doors to rooms and to the corridors were kept closed at all times this reduced the obvious flanking paths when testing was in session.

The reverberation times of the receiving rooms were measured by recording wide band continuous pink noise. Measurements were taken using one speaker position, with a minimum of two readings at six selected positions.

The room layouts are detailed in the Appendix.

All SPL measurements are in dB re 20 micro pascals.

Impact Sound Transmission (Floors)

Measurements of the Standardized Impact Sound Pressure Level (L'_{nT}) were carried out in accordance with British Standards BS EN ISO 140-7: 1998. A single figure rating of impact sound insulation performance ($L'_{nT,W}$ the Weighted Standardized Impact Sound Pressure Level) was calculated from the measurements using the procedures detailed in BS EN ISO 717-2: 1997.

The room layouts are detailed in the Appendix.

4 tapping positions were selected. For each position measurements of SPL were made in 5 randomly chosen positions in the Flats below.

The tapping machine and sound level meter were always at least 0.5m away from the room boundary.

Sound pressure levels were made in one third octave bands from 100Hz - 3150Hz.

Each one third octave measurement took approximately 6 seconds.

The reverberation times of the receiving rooms were measured by recording wide band continuous pink noise. Measurements were taken using one speaker position, with a minimum of two readings at six selected positions.

Measurements were made in accordance with BS EN ISO 140-7

All SPL measurements are in dB re 20 micro pascals.

6.0 Measuring Equipment

Measurements were made using the following equipment:

- 1) NOR 118 Sound Level Analyser. UKAS calibration certificate no 30508 instrument Serial no 30508
- 2) NOR 1251 Calibrator. UKAS certificate no 01455 instrument Serial no 30747
- 3) Norsonic Dodecahedral Loudspeaker serial no: 30706

- 4) Norsonic Amplifier serial no: 30687
- 5) Norsonic Tapping Machine 211A serial no:29675: AIRO Calibration Certification available for inspection if required.

The sound level meter was calibrated immediately prior to and immediately after the measurements was carried out.

The calibration was as follows:

Before	114.1 dB
After	114.1 dB

The equipment has traceable calibration.

7.0 Results

Airborne Sound Insulation (Floors & Walls): (BS EN ISO 140-4: 1998)

The airborne sound insulation measurements were taken using a prescribed procedure in BS EN ISO 140-4: 1998. The measurements were taken with a steady source generating sound pressure levels in the frequency range (16 third-octave bands 100Hz – 3150Hz). Measurements were made in the source and receive rooms over one-third octave bands. The fixed position microphone method was used to obtain a good spatial average in the source and receive room.

A correction for the receive room affect is made by measuring the reverberation time in each third octave band across the frequency range following the procedures in BS EN ISO 354: 2003.

The correction, which is applied to allow for these reverberation times, is given in the following formula, as given in BS EN 140-4: 1998:

$$\text{Correction} = 10 \lg T / T_0 \text{ dB}$$

Where : T_0 = reference reverberation time 0.5 seconds

T = average reverberation time in the receive room.

The standardised level difference D_{nT} is given in decibels using the equation

$$D_{nT} = D + 10 \lg (T / T_0) \text{ dB}$$

Where D = the level difference ; $L_1 - L_2$

L_1 = average sound pressure level in the Source Room

L_2 = average sound pressure level in the Receive Room

The single figure descriptor of sound insulation D_{nTw} (Weighted Standardized Level Difference) and the Spectrum Adaptation Term C_{tr} measured in decibels (dB) are calculated in the procedure given in BS EN ISO 717-1: 1997 using the relevant reference curves. Unfavourable deviations (D_{nT}) from the reference curve are mentioned if they exceed 8.0dB.

FLOORS -The result achieved in this manner is compared to the guidelines given in Table 1a on p8 of Approved Document E (2003) of the Building Regulations which for separating floors in purpose built RFRP, no result is to be lower than **45dB $D_{nTw} + C_{tr}$** .

WALLS -The result achieved in this manner is compared to the guidelines given in Table 1a on p8 of Approved Document E (2003) of the Building Regulations which for separating walls in purpose built RFRP, no result is to be lower than **43dB $D_{nTw} + C_{tr}$** .

The Graphs in Appendix show the results in the room, plotted against the equivalent standard curve.

The $D_{nTw} + C_{tr}$ results for each surface tested are shown below:

Summary of Floor Airborne Sound Insulation Test Results

Test No	Description	D_{nTw} dB	C_{tr} dB	$D_{nTw} + C_{tr}$ dB	Unfavourable Deviations	Achieved ADE2003 Value?
U020/2	Block H 1 st Floor Bed 1 – Block H Ground Floor Bed 1	66	-7	59	None	Yes
U020/4	Block H 1 st Floor Bed 2 – Block H Ground Floor Bed 2	66	-7	59	None	Yes

Summary of Wall Airborne Sound Insulation Test Results

Test No	Description	D_{nTw} dB	C_{tr} dB	$D_{nTw} + C_{tr}$ dB	Unfavourable Deviations	Achieved ADE2003 Value?
U020/1	Block H 1 st Floor Bed1 – Block H 1 st Floor Bed 2	52	-4	48	9.1dB @ 2000Hz	Yes
U020/6	Block H Ground Floor Bed 1 – Block H Ground Floor Bed 2	52	-3	49	None	Yes

Impact Sound Insulation (Floors): (BS EN ISO 140-7: 1998)

The impact sound insulation measurements were taken using a calibrated tapping source and the prescribed procedure in BS EN ISO 140-7: 1998. The measurements of the transmitted sound from the impact source were taken in the receive room across the 16 one-third octave bands 100Hz – 3150Hz. The fixed position microphone method was used to obtain a good spatial average in the source and receive room.

A correction for the receive room affect is made by measuring the reverberation time in each third octave band across the frequency range following the procedures in BS EN ISO 354: 2003.

The correction, which is applied to allow for these reverberation times, is given in the following formula, as given in BS EN 140-7: 1998:

$$\text{Correction} = 10\lg T/T_0 \text{ dB}$$

Where : T_0 = reference reverberation time 0.5 seconds

T = average reverberation time in the receive room.

The standardised level difference L'_{nT} is given in decibels using the equation

$$L'_{nT} = L_i - 10 \lg (T / T_0) \text{ dB}$$

Where L_i = average impact sound pressure level in the Receive Room

The single figure descriptor of impact sound insulation L'_{nTw} (Weighted Standardized Impact Sound Pressure Level) measured in decibels (dB) is calculated in the procedure given in BS EN ISO 717-2: 1997 using the relevant reference curves. Unfavourable deviations (L'_{nT}) from the reference curve are mentioned if they exceed 8.0dB.

The result achieved in this manner is compared to the guidelines given in Table 1a on p8 of Approved Document E (2003) of the Building Regulations which for separating floors in purpose built RFRP, no result is to be higher than **62dB L'_{nTw}** .

The Graphs in Appendix show the results in the room, plotted against the equivalent standard curve.

The L'_{nTw} results for each surface tested are shown below:

Summary of Floor Impact Sound Insulation Test Results

Test No	Description	L' _{nTw} dB	Unfavourable Deviations	Achieved ADE 2003 Value
U020/3	Block H 1 st Floor Bed 1 – Block H Ground Floor Bed 1	41	10.2dB @ 100Hz 8.2dB @ 125Hz	Yes
U020/5	Block H 1 st Floor Bed 2 – Block H Ground Floor Bed 2	42	13.1dB @ 100Hz	Yes

8.0 Discussion

Airborne Tests (Floors)

The two floors tested achieved the minimum criteria for “New Build Rooms for Residential Purposes” as stated in Table 1a on P8 of Approved Document E (2003).

Airborne Tests (Walls)

The two walls tested achieved the minimum criteria for “New Build Rooms for Residential Purposes” as stated in Table 1a on P8 of Approved Document E (2003). Subjectively, flanking was apparent through the doors.

Impact Tests (Floors)

The two floors tested were below the maximum criteria for “New Build Rooms for Residential Purposes” as stated in Table 1a on P8 of Approved Document E (2003).

9.0 Conclusions

Airborne: (Floors)

The two floor surfaces tested showed compliance with the minimum criterion for new build Rooms for Residential Purposes as identified in ADE 2003.

Airborne: (Walls)

The two wall surfaces tested achieved the minimum criterion for new build Rooms for Residential Purposes as identified in ADE 2003

Impact:

The two floors tested achieved the requirements for new build Rooms for Residential Purposes as identified in ADE 2003

10.0 Recommendations

The opinions & interpretations expressed herein are outside the scope of the UKAS Accreditation.

No further treatment is required.

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Noise & Vibration Consultant

Bibliography & References	
Ref	Title
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 between rooms.
BS EN ISO 717-1: 1997	Airborne sound insulation
BS EN ISO 717-2: 1997	Impact sound insulation
BS EN ISO 354: 2003	Acoustics – Measurement of sound absorption in a reverberation room.
Approved Document E (2003)	Resistance to the passage of sound

Appendix