

**NEW SCIENCE BLOCK – XAVERIAN COLLEGE, RUSHOLME
POST CONSTRUCTION ASSESSMENT**

On behalf of:

Seddon Construction Ltd

NEW SCIENCE BLOCK – XAVERIAN COLLEGE, RUSHOLME POST CONSTRUCTION ASSESSMENT

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1. INTRODUCTION

- 1.1 Hepworth Acoustics Ltd was commissioned by Seddon Construction to carry out an acoustic assessment in connection with the new science block at Xaverian College in Rusholme, Manchester.
- 1.2 This post-construction stage assessment has been commissioned to determine compliance with acoustic criteria detailed in Building Bulletin 93 '*Acoustic Design of Schools - Performance Standards 2015*'. Referred to hereafter as BB93:2015.
- 1.3 This report includes the testing methodology, results, and assessment for the following items:
- Measurement of the airborne and impact sound insulation in a sample number of spaces;
 - Measurement of internal ambient noise levels in a sample number of spaces;
 - Measurement of the reverberation time in a sample of teaching and study spaces.
- 1.4 The various noise units and indices referred to in this report are described in Appendix A. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2. COMPLIANCE CRITERIA

2.1 Compliance is demonstrated through a programme of pre-completion acoustic testing carried out by a compliant test body, in accordance with the BB93:2015 requirements of the ANC handbook '*Good Practice Guide, Acoustic testing of Schools*' 2015.

2.2 The criteria to demonstrate compliance are as follows:

- Achieve the performance standards set out in Section 1 of Building Bulletin 93: *Acoustic Design of School's Performance Standards*, February 2015 relating to airborne sound insulation between spaces and impact sound insulation of floors.
- Achieve the indoor ambient noise level standards set out within Section 1 of BB93:2015 for all room types.
- Achieve the requirements relating to reverberation time for teaching and study spaces set out within table 6 in Section 1 of BB93:2015.

Scheme of Compliance Testing

2.3 Therefore, this post construction assessment has involved:

- Measurement of the airborne and impact sound insulation in a sample number of spaces;
- Measurement of internal ambient noise levels in a sample number of spaces;
- Measurement of the reverberation time in a sample of teaching and study spaces.

Consultant Competency

2.4 The assessment must be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body.

2.5 All work carried out in relation to this assessment has been carried out under the control of James Shaw, Senior Acoustic Consultant at Hepworth Acoustics, who has worked as an Acoustic Consultant for 10 years, is a Member of the Institute of Acoustics (MIOA), and is an Association of Noise Consultants registered tester, and is therefore deemed competent to carry out acoustic design and compliance testing.

3. TESTING & ASSESSMENT

Methodology

- 3.1 The compliance testing was carried out on Thursday 12th June 2025.
- 3.2 The noise survey was carried out using a Brüel and Kjær 2250 'Class 1' sound level meter (s/n: 3011706). Field acoustic calibration checks were carried out both before and after the measurement periods. No variance in the calibrated noise levels noted.
- 3.3 Measurements of airborne sound insulation have been carried out in accordance with the testing methodology of BS EN ISO 16283-1:2014 (the successor to of BS EN ISO 140), the relevant principles of BS EN ISO 354:2003, and the guidance provided in BS EN ISO 140-7:1998.
- 3.4 Reverberation times were measured following the relevant principles of BS EN ISO 354:2003 and guidance provided in BS EN ISO 140-7: 1998.

Assessment of Airborne & Impact Sound Insulation

- 3.5 The adopted criteria in respect of sound insulation between acoustically sensitive spaces and other occupied spaces are based upon relevant sound insulation criteria defined in BB93:2015 which takes into consideration the likely level of activity noise, the degree of privacy required and the sensitivity of the adjacent space.
- 3.6 The results of the airborne sound insulation tests are detailed in Tables 1 and 2.

Table 1: Measured Airborne Sound Insulation of Walls (dB)

Room 1 (Source)	Room 2 (Receiver)	$D_{nT,w}$		Pass/Fail
		Criterion	Measured	
Demo Lab (CU01-03)	Demo Lab (CU01-04)	≥45	52	Pass
Demo Lab (CU02-03)	Demo Lab (CU02-04)	≥45	50	Pass
Demo Lab (CU00-03)	Demo Lab (CU00-04)	≥45	51	Pass

Table 2: Measured Airborne Sound Insulation of Floors (dB)

Room 1 (Source)	Room 2 (Receiver)	$D_{nT,w}$		Pass/Fail
		Criterion	Measured	
Demo Lab (CU02-03)	Demo Lab (CU01-03)	≥45	58	Pass
Demo Lab (CU01-03)	Demo Lab (CU00-03)	≥45	53	Pass

- 3.7 The results of the impact sound insulation testing on floors are set out in Table 3.

Table 3: Measured Impact Sound Insulation of Floors (dB)

Room 1 (Source)	Room 2 (Receiver)	$L'_{nT,w}$		Pass/Fail
		Criterion	Measured	
Demo Lab (CU02-03)	Demo Lab (CU01-03)	≤ 60	49	Pass
Demo Lab (CU01-03)	Demo Lab (CU00-03)	≤ 60	46	Pass

Note – For impact sound insulation, lower values of $L'_{nT,w}$ indicate better sound insulation

- 3.8 The airborne and impact sound insulation tests on walls and floors have therefore demonstrated compliance with the relevant criteria for the development.

Assessment of Internal Ambient Noise Levels

- 3.9 Internal ambient noise levels (IANL) were measured for a sample number of teaching and study spaces.
- 3.10 A mechanical ventilation system is provided in all indoor spaces, and as such, IANLs have been measured with the ventilation operating and windows closed.
- 3.11 All spaces were partially furnished with tables and wall units fitted but there were no chairs or other soft furnishings in place during the measurements. As ventilation noise was steady and there were periods of site noise, brief noise measurements (of <2 minute) were necessary to establish the ambient noise levels in the spaces.
- 3.12 Measurements of the IANLs were carried out at five locations within each room. Noise from the ventilation plant was the main source of noise during the measurements. Site noise was excluded from the measurements as far as possible.
- 3.13 The results of the measurements in each room have been logarithmically averaged to obtain the measured IANL.
- 3.14 The adopted internal ambient noise level design limit is shown in Table 1 of BB93:2015 and reproduced below in Table 4 as well as the rooms used in the testing and the measured IANLs.

Table 4: Measured Internal Ambient Noise Levels, dB $L_{Aeq,T}$

Room	IANL Design Range Limit	Measured IANL	Pass/Fail
Demo Lab (CU01-04)	40 dB $L_{Aeq,T}$	33 dB L_{Aeq}	Pass
Demo Lab (CU02-04)	40 dB $L_{Aeq,T}$	31 dB L_{Aeq}	Pass
Demo Lab (CU00-04)	40 dB $L_{Aeq,T}$	36 dB L_{Aeq}	Pass
Demo Lab (CU01-03)	40 dB $L_{Aeq,T}$	31 dB L_{Aeq}	Pass
Demo Lab (CU00-03)	40 dB $L_{Aeq,T}$	37 dB L_{Aeq}	Pass

- 3.15 The results of the IANL measurements show that the IANL design range limits adopted from BB93:2015 have been met in all tested spaces and therefore demonstrate compliance with the relevant criteria for the development.

Assessment of the Control of Reverberation

- 3.16 The 'interrupted method' of measuring reverberation time was used, and all rooms were partially furnished.
- 3.17 Reverberation time measurements were carried out using two source locations and three receiver locations (i.e. a total of 6 reverberation time measurements).
- 3.18 Results of the reverberation time measurements in the 500 Hz, 1 kHz and 2 kHz octave bands have been arithmetically averaged to obtain the mid frequency measured reverberation time, $T_{mf(s)}$, to one decimal place and the results are shown in Table 5.
- 3.19 The reverberation time limit adopted at the design stage is shown and compared to the measured reverberation time to determine compliance with the reverberation time criterion of BB93:2015.

Table 5: Measured Mid-Frequency Reverberation Times

Room	Criterion in T_{mf} (s)	Measured values in T_{mf} (s)	Pass/Fail
Demo Lab (CU01-04)	$\leq 0.8s$	0.8	Pass
Demo Lab (CU02-04)	$\leq 0.8s$	0.7	Pass
Demo Lab (CU00-04)	$\leq 0.8s$	0.7	Pass
Demo Lab (CU01-03)	$\leq 0.8s$	0.8	Pass
Demo Lab (CU00-03)	$\leq 0.8s$	0.7	Pass

- 3.20 The results of the reverberation time measurements show that the reverberation time design range limits adopted from BB93:2015 have been met in all tested spaces and therefore demonstrate compliance with the relevant criteria for the development.

4. SUMMARY

- 4.1 Hepworth Acoustics Ltd has carried out a post-construction acoustic assessment for a new science block at Xaverian College in Rusholme, Manchester.
- 4.2 This assessment included assessment of airborne sound insulation of separating walls and floors, impact sound insulation of separating floors, internal ambient noise levels, and reverberation times in a number of sample spaces.
- 4.3 The results of the acoustic testing indicate compliance with the relevant standards across all criteria.
- 4.4 Based on these findings, no additional modifications or remedial actions are considered necessary.

APPENDIX A: ACOUSTICS UNITS & INDICES

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise

climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. There are also a number of ways to describe sound insulation performance.

The indices used in this report are described below:

L_{Amax}	Maximum A-weighted Sound Level with Fast Time-weighting: The maximum A-weighted sound pressure level during the measurement period, using the Fast time-weighting of 125ms. L_{Amax} used in this report refers throughout to L_{AFmax} with the Fast time weighting, denoted L_{AFmax} or $L_{Amax,f}$ in other documents but L_{Amax} in BS 8233:2014 standard notation.
$L_{A90,T}$	A-weighted 90 Percentile Level: The A-weighted sound level exceeded for 90% of a measurement time period (T). $L_{A90,T}$ is generally used as a measure of Background Sound Level.
D	Level Difference: A field measurement of the airborne sound level difference between adjacent spaces, including in-situ sound transfer via flanking transmission paths in addition to the direct sound transmission through the separating partition (e.g. a wall/floor). The Level Difference metric (D) is given for a stated frequency band.
D_w	Weighted Level Difference: A frequency weighted single figure metric of the Level Difference (D) values across the frequency spectrum evaluated between 100Hz and 3.15kHz.
D_{nT}	Standardised Level Difference: A field measurement of the airborne sound level difference between adjacent spaces similar to the measured normalised level difference (D_n) but corrected to a standardised reverberation time of 0.5s. The standardised level difference includes flanking sound transmission on-site.
$D_{nT,w}$	Weighted Standardised Level Difference: A frequency weighted single figure.
L'_{nT}	Standardised Impact Sound Pressure Level: A 'field' metric in a stated frequency band of the impact sound insulation performance of a floor, as measured in-situ.
$L'_{nT,w}$	Weighted Standardised Impact Sound Pressure Level: A single figure frequency weighted in-situ impact sound insulation performance metric of a floor.