MARSHALL DAY
Acoustics

Level 3 69 Cambridge Terrace
PO Box 4071
Christchurch 8140 New Zealand
T: +64 3 365 8455 F: +64 3 365 8477
www.marshallday.com

27 June 2018

Potius Building Systems Ltd
PO Box 1749
Nelson 7040

Attention: Gavin Robertson

Dear Gavin

IN-SITU SOUND INSULATION TESTING
SCOPE OF WORK AND FEE PROPOSAL

Marshall Day Acoustics has carried out acoustic testing within Block N of Nelson College. This building is of lightweight construction and utilises a Potius floor system. These tests were undertaken to assess the suitability of the Potius flooring system within Ministry of Education funded developments. The following tests were carried out:

- Airborne sound insulation of the classroom separating floor
- Impact sound insulation of the classroom separating floor
- Reverberation time within both the ground and first floor classrooms
- Airborne sound insulation of the building envelope (external to internal) of the ground floor classroom

The tests were undertaken on 21 June 2018.

MINSTRY OF EDUCATION REQUIREMENTS

Table 1 summarises the Ministry of Education Designing Quality Learning Spaces – Acoustics (DQLSA) requirements in relation to teaching spaces. It should be noted that where the DQLSA provides design targets for sound insulation, we expect a 5 point leeway is permitted on site. This approach is consistent with the New Zealand Building Code requirements for sound insulation between household units.

Table 1: Key Ministry of Education DQLS-A Acoustic Requirements

	Design Requirement[1]	On-site Performance
Airborne sound insulation between teaching spaces (no doors)	STC 50	> FSTC 45
Impact sound insulation between teaching spaces	IIC 55	> FIIC 50
Overall Internal Noise Levels	35 – 45 dB L_{Aeq}	< 45 dB L_{Aeq}
Reverberation Time	0.5 – 0.8 secs[2]	< 0.8 secs

1 Where noise criteria are presented as a range, the lower value in the range is the design objective and the higher value is the maximum allowable level on site.

2 Having a reverberation time lower than the design objective would not be detrimental to the acoustic environment and a reverberation time lower than 0.5 secs on-site would be acceptable

TESTING PROCEDURES & METHODOLOGY

Calibration checks were made prior to and after the tests and no significant drift was observed.

Airborne Sound Insulation

The airborne sound insulation performance test was carried out and verified using the procedures detailed in ASTM E 336, and the field sound transmission class verified using the method described in ASTM E 413.

The loudspeaker was placed in the source room in a position to generate an even distribution of sound throughout the room. The signal generator was used to generate a steady random noise signal (pink noise) which was reproduced via the loudspeaker. The sound pressure level was measured in the source room and receiving room over the one-third octave band frequency range 100 Hz to 4000 Hz. Two measurements were made using a moving microphone sweep in each room with a measurement period of ten seconds.

The loudspeaker was then moved to a new position in the source room and the foregoing tests were repeated.

The loudspeaker was moved to the receiving room and the sound analyser used to measure the reverberation time in each of the one-third octave bands between 100 Hz and 4000 Hz. The internal programme of the meter was used to generate and cut off the random noise signal, which was reproduced in the room by the active loudspeaker source, and to measure the decay rate of the sound in the room.

The background noise level was measured in the receiving room. Measurements were made at two positions using a measurement period of ten seconds.

Impact Sound Insulation

The impact sound insulation test was carried out and verified using the procedures detailed in ISO 140: Part VII, and the field impact insulation class verified using the method described in ASTM E 989.

The tapping machine was placed on the floor in the source room. The machine was set into operation which generates cyclic impacts on top of the floor. The sound pressure level was measured in the receiving room over the one-third octave band frequency range 100 Hz to 4000 Hz by averaging over two moving microphone sweeping measurement positions. Measurements were conducted for each of four tapping machine locations to give a total of eight measurements. Each measurement period was ten seconds. The measurement positions were selected to determine the average sound level over the whole of the room.

The loudspeaker and the sound analyser were used to measure the reverberation time in each of the one-third octave bands between 100 Hz and 4000 Hz. The internal programme of the meter was used to generate and cut off the random noise signal, which was reproduced in the room by the loudspeaker, and to measure the decay rate of the sound in the room.

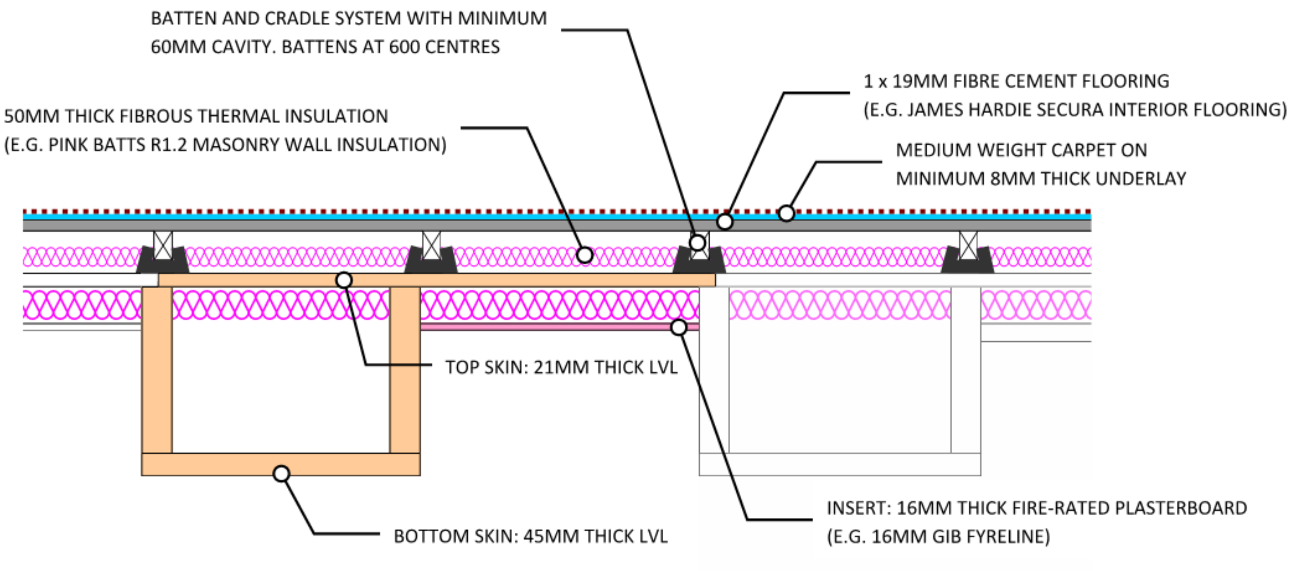
The background noise level was measured in the receiving room. Measurements were made at two positions using a measurement period of ten seconds.

CONSTRUCTIONS

Floor

We understand that the base floor construction is as shown in Figure 1.

Figure 1: Floor construction

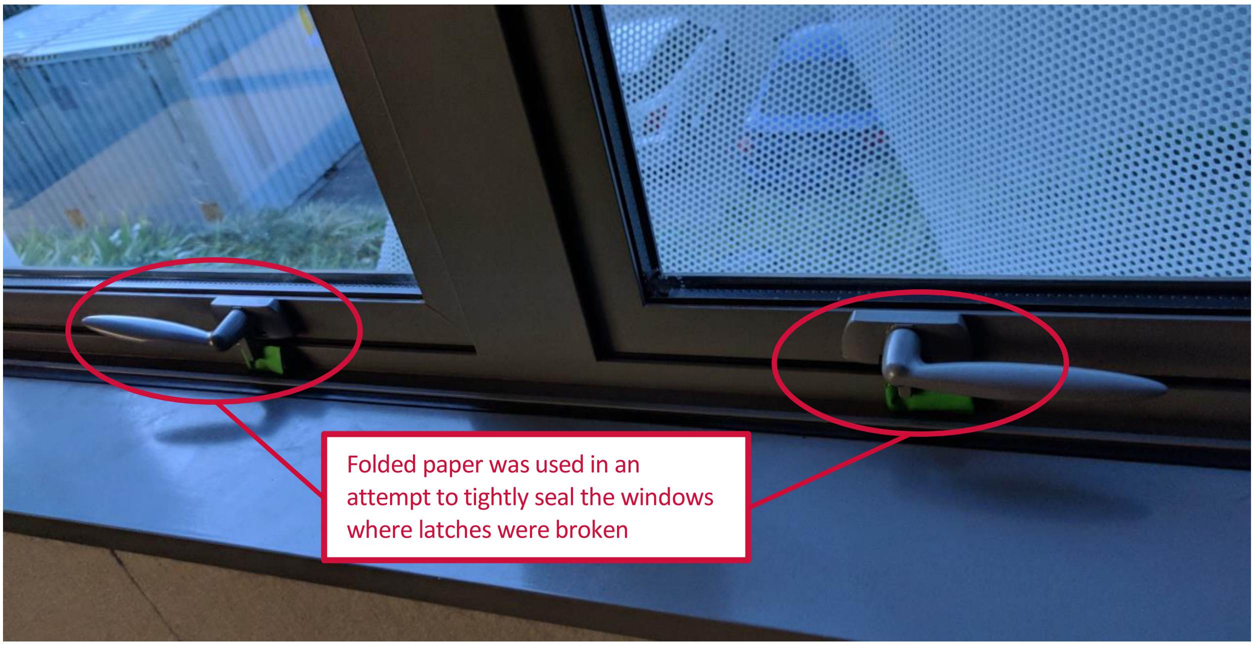


External Wall

We are unfamiliar with the construction of the external wall. However, we anticipate that it consists of a external cladding over a 6 mm RAB on a single 90 mm timber stud with a 13 mm standard plasterboard internal lining and an spray foam insulation in the cavity.

Double glazed windows have been installed. However, for the majority of the windows, the latching mechanism are broken such that the windows do not seal tightly. Effort was made to ensure that the windows were sealed as tightly as possible during testing but some sound leakage around the perimeter of the frame was still evident.

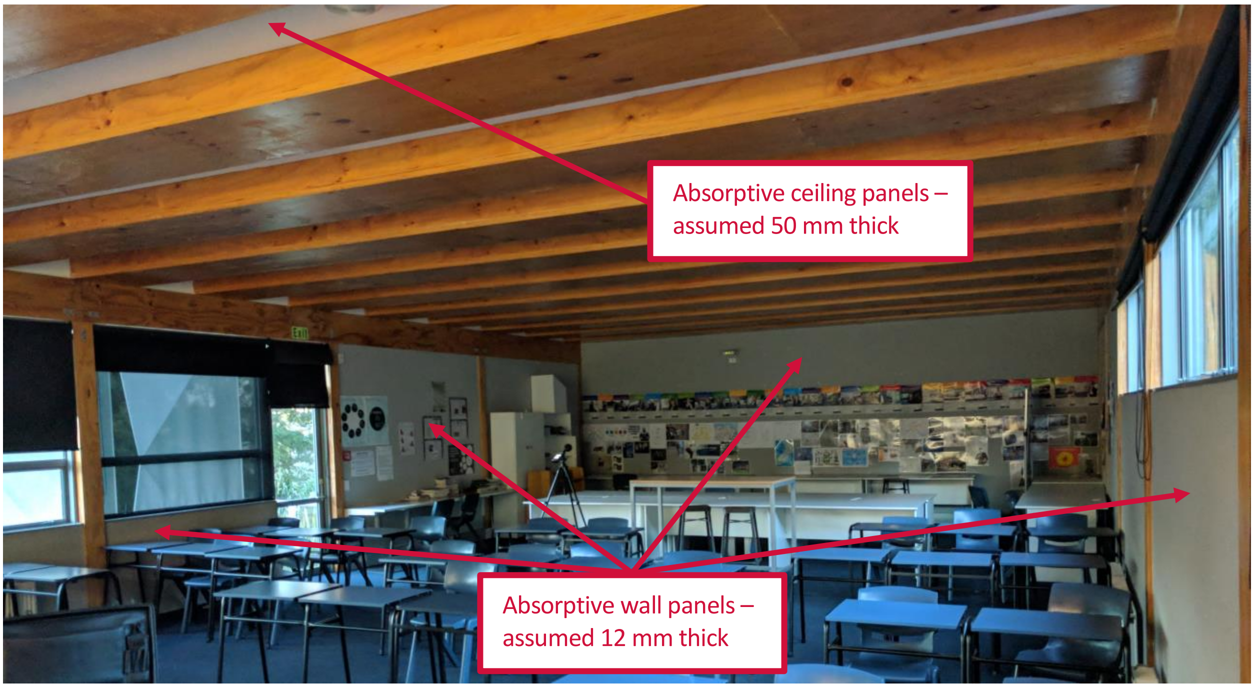
Figure 2: Broken Window Latches



Internal Room Finishes

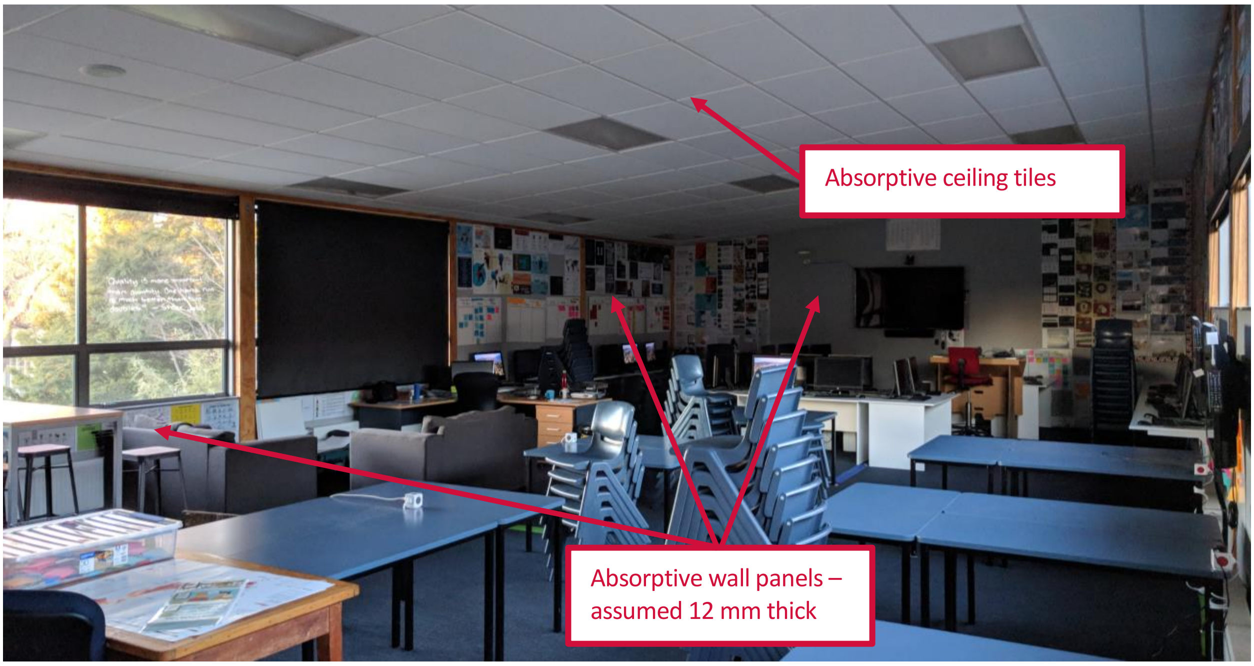
Within the ground floor classroom, absorptive panels (thickness unknown – appeared to be 50 mm thick) have been installed between the box beams as well as absorptive panels (thickness unknown – appeared to be 12 mm thick) to the majority of the available wall area.

Figure 3: Ground Floor Classroom



Within first floor classroom, a full suspended absorptive tile ceiling has been installed as well as absorptive panels (thickness unknown – assumed 12 mm thick) to the majority of the available wall area.

Figure 4: First Floor Classroom



RESULTS

The following tables summarise the results of each measurement and compares compliance against the DQLSA requirements.

Table 2: Internal Airborne Sound Insulation

Source Room	Receiver Room	Floor/Wall	Common Area	Receiver Room Volume	Measured Performance (FSTC)	Minimum DQLSA Requirement (FSTC)	Result
Ground Floor Classroom	First Floor Classroom	Floor	128 m^2	396.8 m^3	53	45	Pass

Table 3: Impact Sound Insulation

Source Room	Receiver Room	Receiver Room Volume	Measured Performance (FIIC)	Minimum DQLSA Requirement (FIIC)	Result
First Floor Classroom	Ground Floor Classroom	371.2 m^3	56	50	Pass

Table 4: Reverberation Time

Room	Room Volume	Measured Performance (secs)	Maximum DQLSA Requirement (secs)	Result
Ground Floor Classroom	371.2 m^3	0.35	0.8	Pass
First Floor Classroom	396.8 m^3	0.32	0.8	Pass

Table 5: External Airborne Sound Insulation

Source	Receiver Room	Wall Area	Receiver Room Volume	Measured Façade Reduction (dB)	Maximum DQLSA Internal Noise Level Requirement (dB L_{Aeq})	Maximum Permissible External Noise Level (dB L_{Aeq})[1]
External	Ground Floor Classroom	46.4 m^2	371.2 m^3	39	45	84

1 With windows open for ventilation a maximum reduction of 10 – 15 decibels can be expected. Therefore, maximum permissible external noise level to achieve the internal noise level requirement would be 55 - 60 dB L_{Aeq}

Yours faithfully

MARSHALL DAY ACOUSTICS LIMITED

Michael Morrow
Acoustician