

Report ALA 15-086-3

**Laboratory Measurement of
Airborne Sound Attenuation between
Rooms Sharing a Common Ceiling Plenum**

**Random - Nail-up tile – Plaster Acoustic Tile
Straight Edges to all Ends**

Tested to ASTM E1414/E1414M – 11A

**BAILEY INTERIORS
83 to 85 Boundary Road
Mortdale NSW 2223**

20 April 2015

1. TEST OBJECTIVE

Bailey Interiors commissioned Acoustic Laboratories Australia to measure the room-to-room airborne sound insulation of the ‘Random’ nail-up plaster acoustic ceiling tile with straight edges to all ends with a plenum above it. The test was carried out on April 02, 2015.

The tests were carried out at the Heafod Laboratory facility in Bayswater, Western Australia. The ceiling sample under test was installed in an exposed Tee Bar ceiling suspension system with a plenum above a dividing wall that separates the two rooms of the test facility. The laboratory space is arranged so that it simulates a pair of horizontally adjacent rooms sharing a common suspended ceiling system, plenum and dividing wall. The dividing wall extends to the underside of the ceiling system which is continuous over the two rooms.

The test was carried out in accordance with Australian Standard AS2499:2000, *Acoustics – Measurement of sound insulation in buildings and of building elements – Laboratory measurement of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it.*

2. DESCRIPTION

2.1 Test Sample

The plaster acoustic tile sample under test as described by the manufacturer consists of:

- Bailey Interiors ‘Random’ 600 x 600 mm plaster acoustic ceiling tile with straight edges on all ends, screw fixed to furring channels
- Tile is butt jointed on all edges
- 6mm Diameter round holes (31 x 36 active holes per tile)
- Nominal 8.7% open area
- 25mm glasswool insulation at 32 kg/m³ backing within each tile compressed to 20mm thickness
- Thin plaster skim coat over insulation to seal the tile
- Overall thickness of tile is 28mm
- Nominal Surface density 14.4 kg/m²

2.2 Installation of the Sample:

The tile was a screw fixed into a furring channel at 600mm centres. The tile has butt joints located over the furring channel and T & G joint between furring channels.

The Furring channels were suspended on hangers connected to a secondary support system of 5 tee bars suspended 220 mm from the soffit of the slab. Ceiling grid was suspended off this secondary grid. The overall ceiling plenum depth is 740mm.

The ceiling was continuous over the 75mm by 50mm partition capping. Two strips of Raven RP 48 soft EPDM “D” seal were adhered to the

partition capping to provide a seal to the plaster acoustic tile continuous over the capping.

3. TEST FACILITIES

Size of test Rooms: The test facility consists of a parallelepiped room 9.0m long, 4.9m wide and 3.6m high. A barrier from floor to underside of ceiling divides the space unequally into two areas 4m and 4.5 metres long. The rooms are constructed of reinforced concrete with a vibration break in the walls, floor and roof in the line of the barrier. The volumes of the two rooms below the ceiling are 68m³ and 55m³

Dividing Wall: The dividing barrier is constructed as a dual stud, insulated plasterboard partition wall with 2 layers 13mm fire rated plasterboard each side of the partition. The wall is 4.9 metres wide and tapered at its upper extremity. The cap on top of the wall is 75mm x 50mm.

Plenum Depth: The plenum height is 740mm

Plenum Width: The plenum width at the separating wall was set at 4.3 metres . The restriction in the plenum width was achieved by installing 16mm fire-rated plasterboard barriers on either side of the plenum. Plenum barriers extended from the top of ceiling tile to underside of slab over.

Plenum Lining: All sides of the plenum are lined with 75mm 32Kg/m³ density fibreglass insulation with sound absorption coefficients meeting requirements of ASTM 1414 clause 7.1.5.1

Acoustic Diffusion: Sound diffusion is achieved in each room by 6 off 1.2m square 19mm structural ply panels randomly oriented and suspended on two poles within the room. 8.64m² of one sided acoustic diffusion is provided in each room. This meets requirements of Appendix ZZ Clause 5.1.6).

Temperature / Humidity: The temperature and relative humidity conditions at commencement of test were:

Acoustic Chamber 2		Acoustic Chamber 3	
Temperature.	Rel. Humidity	Temperature.	Rel. Humidity
19 °C	40 %	20 °C	40%

4. TEST PROCEDURE

The test procedure involves a sound source fed to loudspeakers in the source room being measured in both the Source and Receiver rooms, and the measurement of Reverberation Times in the Receiver room. The measurement is carried out in both directions with loudspeakers installed in each room during the entire test. The suspended ceiling normalised level difference is measured separately for each direction of test; the value reported is the arithmetic average of the two results.

Sound Source: Two wide band random noise generators were connected via an amplifier to two loudspeakers. The loud speakers were positioned in the trihedral corners of the room opposite the barrier wall.

The noise level of the source in the receiving room was adjusted so that the received sound levels were at least 10 dB above the Background noise level in all relevant frequency bands.

Microphone Positions: A single microphone was used for the measurement in both the source and receiver rooms. A total of 8 microphone positions were used in both the source and receiving room. Microphone positions were selected to comply with requirements of AS 2499 'Annex'.

Reverberation Time Measurements: The Reverberation Time in the two receiving rooms was measured using two source positions and 4 microphone positions, providing 8 independent source / microphone positions in each room. The Reverberation time was evaluated over a 30 dB range.

The 6 decays at each measurement position were first ensemble averaged, and then the results at each of the 8 measurement positions in each room were then arithmetically averaged. A total of 48 decays in each room

Test Equipment:

- Neutrik Minirator MR1 – Professional sound source.
- Yamaha P3200 Stereo Amplifier Type 3600 – 400 watt / channel
- Behringer Eurorack MX602A Serial D002205486
- B&K Analyser Type 2270 Serial No 2644641 – (Cal: 10/4/14)
- B&K Microphone Type 4189 Serial No 2643586 (Cal: 11/04/14)
- Rion NC73 Sound Level Calibrator Serial No 1030728 – (Cal: 17/09/14)
- Lorantz Speakers
- Vaisla HM34C Humidity & Temperature Meter Serial No: V2910014

5. RESULTS

- 5.1 *Results:* The room-to-room airborne sound insulation of the Test Sample was tested at each one third octave band with centre frequencies between 100 and 5000 Hertz. The results of the measurements in 1/3 octave

bands are given in the attached Data Sheet. The Ceiling Attenuation Class was determined at **CAC 37**

- 5.2 The Ceiling Attenuation Class CAC was determined in accordance with ASTM E413 *Classification for Rating of Sound Insulation*
- 5.3 *Equivalent Sound Absorption Area:* The equivalent absorption area in each of the rooms was determined from the measured reverberation time in accordance with AS/ISO 354.

The Equivalent Absorption Area and the Normalised Level Difference D_{nc} of the specimen at each one third octave band with centre frequencies between 100 and 3,150 Hertz is given in the Table 1.

Centre Frequency Hz	Room AC2 Equivalent Absorption Area A in m2	Room AC3 Equivalent Absorption Area A in m2	Normalised Ceiling Attenuation Dnc dB
100	13.9	13.8	18.7
125	14.7	10.2	18.5
160	12.6	7.2	21.6
200	9.9	6.3	25.4
250	10.4	7.5	26.3
315	12.7	10.1	26.1
400	12.4	10.6	33.5
500	12.0	10.4	37.4
630	11.7	10.3	41.4
800	9.7	9.5	44.9
1k	9.1	7.9	46.4
1.25k	8.0	7.0	47.0
1.6k	7.8	6.3	45.2
2k	7.5	5.8	43.6
2.5k	7.4	5.5	41.8
3.15k	8.0	5.9	39.3
4k			

TABLE 1. Equivalent Absorption Area in each of the test chambers, and Normalised Ceiling Attenuation of Sample



20 April 2015



N Gabriels B Arch, FAAS
 Test and Report by

Date

K Hearne B.Arch, MAAS
 Checked by

If copied, this report must be reproduced in full



Airborne Sound Attenuation between Rooms

Sharing Common Ceiling Plenum

Unit 3/2 Hardy Street
 South Perth 6151
 Tel: 9474 4477
 Fax: 9474 5977

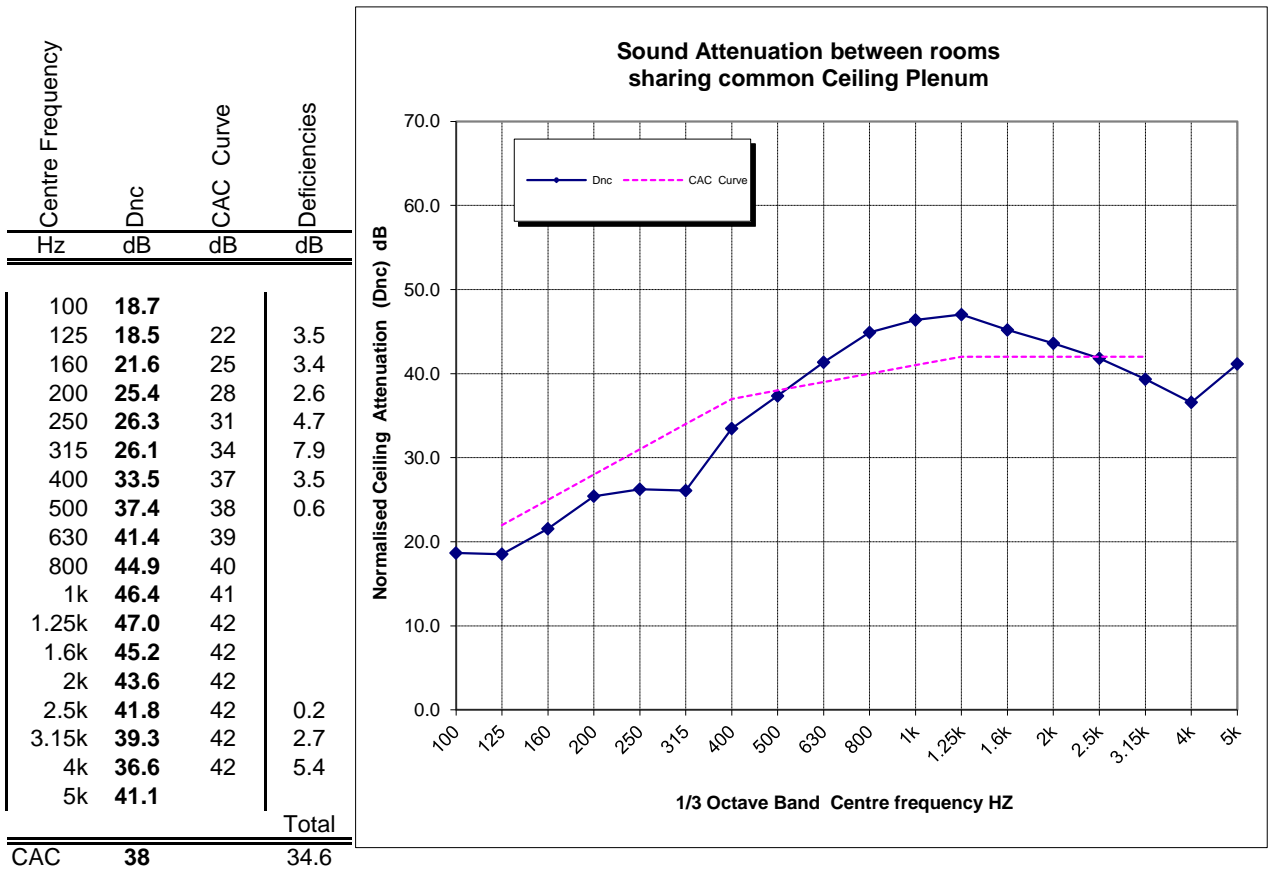
ALA Test No.: 15-086-3
Project: Bailey Interiors
Specimen: Nail-up Random CAC Meas.
Detail: 600 x 600 Plaster Acoustic Tile

Description of Specimen:

Nail-up Random 'straight edge' 600 x 600 X 28mm thick Plaster Acoustic **Meas. Date:** 16-Apr-15
 25mm glasswool insulation @ 32 kg/m3; compressed to 20mm
 Thin plaster skim coat over insulation to seal tile
 Sides of tile screw fixed to furring channels
 Plaster Acoustic Tile has Butt joints to ends between furring channels
 Nominal open area 8.7%
 Nominal surface density 14.4 kg/m2

Tested in accordance with
 ASTM E1414 / E1414M - 11a

CEILING ATTENUATION CLASS **CAC** **37**



N Gabriels
 Signatory:
 Tester: N Gabriels B.Arch, FAAS

Kingsley Hearne
 Date: 18-Apr-15
 Checked: K Hearne B.Arch, MAAS