ACOUSTIC LABORATORIES AUSTRALIA PTY LTD

AIRBORNE SOUND ATTENUATION BETWEEN ROOMS SHARING A COMMON CEILING PLENUM

SHADEX – Plaster Acoustic Tile – Tegular Edge Polyester Insulation

Report No. ALA 16-095-2

Tested to ASTM E1414/E1414M – 11A

15th August 2016

For

AUSTRALIAN PLASTER ACOUSTICS

83 – 85 Boundary Road
MORTDALE NSW 2223

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Rev No.	Rev Date	Revision Description	Prep by	Check by
initial	15-August. 2016	Initial report	N Gabriels	K Hearne

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1. TEST OBJECTIVE

Australian Plaster Acoustics commissioned Acoustic Laboratories Australia to measure the room-to-room airborne sound insulation of the 'Shadex' plaster acoustic ceiling tile with tegular edge with a plenum above ceiling. The test was carried out on August 9, 2016.

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 general accordance with ASTM E1414/E1414M-11a - Standard Test Method for *Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.*

2. DESCRIPTION

2.1 Test Sample

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

- Australian Plaster Acoustics 'Shadex' 600 x 600 mm plaster acoustic ceiling tile with Tegular edges on all sides
- Nominal 10.5% open area
- 25mm Polyester insulation at 32 kg/m3 backing within each tile compressed to 20mm thickness
- Thin (2mm) plaster skim coat over insulation to seal the tile
- Overall thickness of tile is 28mm
- Nominal weight 4.5 kg / tile

2.2 Installation of the Sample:

The tile was installed within a 600 x 600mm Rondo Duo exposed grid ceiling system.

The tee bar was suspended on 20 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.

A Tee bar was located on the partition capping. A 6mm timber spacer was located under the Tee bar to permit the testing of Tegular edge tiles.

3. TEST FACILITIES

3.1 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 68m^3 and 55m^3.

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3.2 **Separating Wall**

The dividing barrier is constructed as a dual stud, insulated plasterboard partition wall with 3 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.

3.3 **Plenum**

3.3.1 *Plenum Height*: The plenum height is 740mm.

3.3.2 *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.

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

3.4 **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.

3.5 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**
15 ^{o}C	64 %	16 ^{o}C	62%

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.

4.1 **Sound Source**

Two wide band random noise generators were connected via a 2 channel 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 was adjusted so that the sound levels in the receiving room were at least 10 dB above the Background noise level in all relevant frequency bands.

4.2 **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.

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4.3 Reverberation Time Measurements

The Reverberation Time in the receiving room was measured using two source positions and 5 microphone positions, providing 10 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 10 measurement positions in each room were then arithmetically averaged, equating to a total of 60 decays in each room

4.4 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: 4/4/16)
- B&K Microphone Type 4189 Serial No 2643586 (Cal: 4/04/16)
- 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

5.1.1 Ceiling Attenuation Class

The airborne sound attenuation between rooms 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 32**

The Ceiling Attenuation Class CAC was determined in accordance with ASTM E413 *Classification for Rating of Sound Insulation*

5.1.2 Normalised Ceiling Attenuation $D_{n,c}$

The normalised ceiling attenuation between rooms as determined in octave bands is set out below

Normalised Ceiling Attenuation in Octave Bands						
Frequency (Hz)	125	250	500	1k	2k	4k
Sound Reduction (R) in dB	14	24	30	38	34	36

5.2 Equivalent Sound Absorption Area

The equivalent absorption area in each of the rooms was determined from the measured Reverberation Time.

The Equivalent Absorption Area and the Normalised Ceiling Attenuation $D_{n,c}$ of the specimen at each one third octave band with centre frequencies between 100 and 4,000 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 $D_{n,c}$ dB
100	15.1	14.3	13.5
125	14.5	13.7	13.3
160	12.8	7.3	17.1
200	11.1	6.6	22.7
250	10.7	7.8	24.9
315	11.3	7.0	24.2
400	12.6	8.9	27.4
500	13.3	10.5	31.6
630	14.1	11.1	33.3
800	14.0	11.2	36.5
1k	13.8	11.4	39.0
1.25k	14.6	11.5	37.5
1.6k	13.0	10.6	35.3
2k	11.0	9.1	35.1
2 5k	10.2	8.3	33.3
3.15k	9.8	8.3	33.5
4k	9.6	8.2	35.0

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

5.3 Significance

The data in this report was obtained in a laboratory environment specified in ASTM E1414. According to ASTM E1414-11A Section 5, this environment does not include many elements typical in the real world environments which may substantially alter the performance of a system by providing alternate paths for the sound to be transmitted between rooms. However, this type of test method has been successfully used for a number of years to compare ceiling systems.

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AIRBORNE SOUND ATTENUATION BETWEEN ROOMS SHARING COMMON CEILING PLENUM

ALA Test No.: **16-095-2**
Client: **Australian Plaster Acoustics**
Specimen: Shadex tegular edge
Detail: 600 x 600 Plaster Acoustic Tile

Description of Specimen:

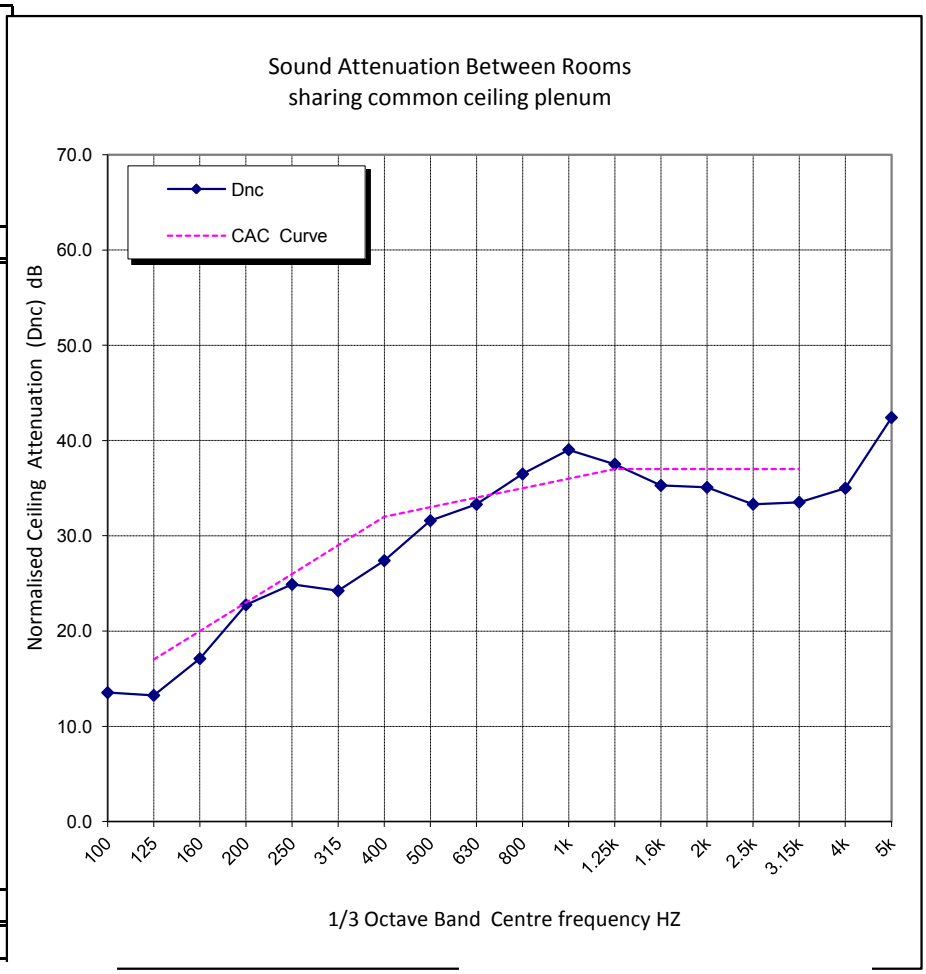
Shadex Tile, Tegular Edge 600 x 600 28mm thick Plaster Acoustic Tile
Nominal open area 15%
25mm Polyester insulation @ 32 kg/m3; compressed to 20mm
Thin 2mm plaster skim coat over insulation to seal tile
Weight per tile4.5 Kg
Lay in Tee Bar grid

Meas. Date: 09-Aug-16

Tested in accordance with
ASTM E1414 / E1414M - 11a

CEILING ATTENUATION CLASS **CAC** **32**

Centre Frequency	Dnc	CAC Curve	Deficiencies
Hz	dB	dB	dB
100	**13.5**		
125	**13.3**	17	3.7
160	**17.1**	20	2.9
200	**22.7**	23	0.3
250	**24.9**	26	1.1
315	**24.2**	29	4.8
400	**27.4**	32	4.6
500	**31.6**	33	1.4
630	**33.3**	34	0.7
800	**36.5**	35	
1k	**39.0**	36	
1.25k	**37.5**	37	
1.6k	**35.3**	37	1.7
2k	**35.1**	37	1.9
2.5k	**33.3**	37	3.7
3.15k	**33.5**	37	3.5
4k	**35.0**	37	2.0
5k	**42.4**		
			Total
CAC	**33**		32.3



Signatory:
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Date: 11-Aug-16

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