

Client: Bailey Interiors Pty Ltd
83-85 Boundary Road, Mortdale, NSW 2223

Measurement Type: Sound Absorption

AS ISO 354-2006 [R2016]: *Acoustics-Measurement of sound absorption in a reverberation room*
AS ISO 11654-2002 [R2016] (ISO 11654:1997): *Acoustics-Rating of sound absorption-Materials and systems*

Test Specimen [Specimen area: 3.6 x 3.0 m (10.8 m²)]

Description: • Bailey "Shadex" (original design) drop-in ceiling tiles, • in 600 mm grid,
• with integral glass fibre batts, exposed at rear to the cavity airspace (Type E-200)

Tile Details³

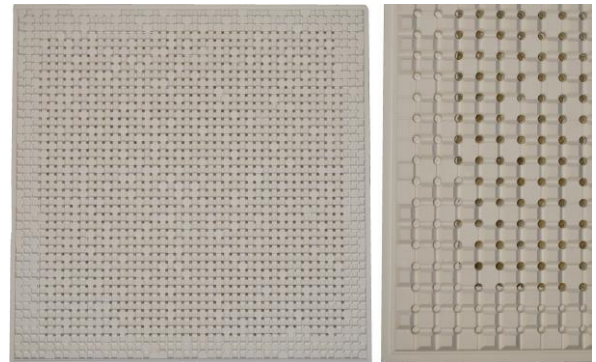
- Moulded plaster ceiling tiles designed to drop into a standard 600 mm suspended ceiling grid.
- Perforated with a regular pattern of 1849 circular holes (43 x 43 array), of which 2 lines around the perimeter were not open at the rear, and the remainder (39 x 39) opened into the glass fibre batt behind. Hole size was approx 5 mm at the face, tapering to 4.5 mm at the rear, positioned at approx 13 mm spacing.
- Decorative effect of perforations was supplemented by additional moulding details (grooves in the tile face between the perforations, and varying height of facets in between as per photo).
- Open area percentage⁴ (estimated): 10.1 % (based on mouth area of all 1849 holes); 6.7 % (based on throat area at rear of holes, of only those holes opening into the fibre batt behind).
- Each tile was fitted with a semi rigid high-density CSR Bradford glass fibre batt, 500 x 500 x 20 mm (approx 42 kg/m³); installed during production of the tile, fixed in place by way of plaster skim-coat around the perimeter of the batt; the majority of the batt remaining open and exposed to the cavity.

Installation

- The test specimen was installed as an upside-down ceiling on the floor of the chamber.
- A 200 mm deep enclosure (32 mm MDF timber, approx 23 kg/m², built to surround an area of 3600 x 3000 mm) was placed on the floor of the chamber at an 11° angle to the chamber walls (not parallel, as per AS ISO 354 cl6.2.1.2). The enclosure consisted of two 100 mm deep modules stacked to create the E-200 enclosure. The junctions of the enclosure modules to each other, to the floor, and to the tile array were all taped.
- A system of plastic support feet sitting on aluminium extrusions (upside-down Tees) was set up inside the enclosure to support the tiles with their exposed face nominally flush with the enclosure. The cavity behind was a single undivided cavity without internal partitions.
- Tiles were arranged in a 6 x 5 array on the support system, then a full grid of main and cross tees was placed on top to cover the gaps between the tiles, matching a normal ceiling installation.
- Specimen installation was carried out by laboratory staff.



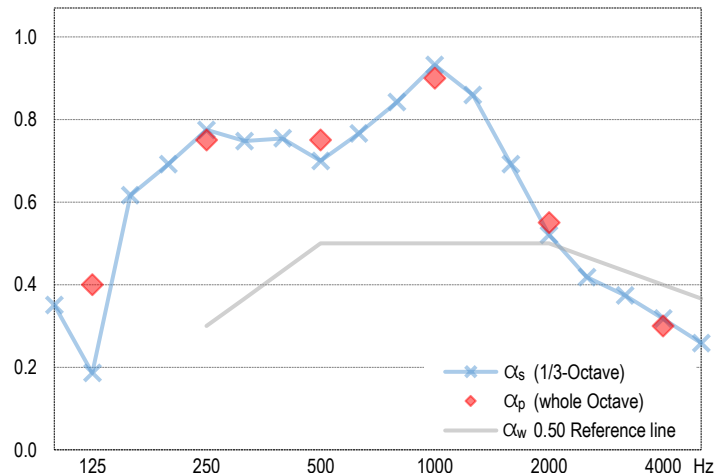
Test specimen installed for testing (image inverted to depict ceiling installation)



Tile details – Left: whole tile, Right: close-up view

Measurement Details & Results

Freq Hz	Absorption coefficients			Reverberation times, T ₆₀ (sec)	
	α _s	α _p	95% Conf (δ)	Empty room	with Specimen
100	0.35		0.08	5.47	3.34
125	0.19	0.40	0.05	5.90	4.32
160	0.62		0.10	6.12	2.71
200	0.69		0.07	5.61	2.45
250	0.77	0.75	0.06	4.82	2.15
315	0.75		0.04	5.68	2.35
400	0.75		0.04	5.68	2.34
500	0.70	0.75	0.04	5.27	2.37
630	0.77		0.04	5.10	2.22
800	0.84		0.04	4.86	2.06
1000	0.93	0.90	0.05	4.71	1.91
1250	0.86		0.04	4.32	1.93
1600	0.69		0.04	3.85	2.04
2000	0.52	0.55	0.03	3.49	2.18
2500	0.42		0.02	3.12	2.18
3150	0.37		0.03	2.89	2.13
4000	0.32	0.30	0.02	2.44	1.95
5000	0.26		0.04	2.01	1.73



Performance Indices^{1,2}

α_w = 0.50 (LM)
SAA = 0.72
NRC = 0.75

The required 12 spatially independent decay curves came from ensemble averaging 10 successive decays with each of 3 different source loudspeaker positions, all sampled by 4 fixed microphones, using linear averaging.

Measurement Conditions

	Empty room	with Test Specimen
Date of measurement:	12 Mar 2021	12 Mar 2021
Temperature & humidity:	23 °C, 58 % R.H.	23 °C, 60 % R.H.
Atmospheric pressure:	1000 mBar	1001 mBar

Notes, Deviations etc

1. Shape indicators (L, M, and H), if any, following the α_w index, indicate α_p values above the reference contour by ≥ 0.25 in the Low, Medium or High frequency ranges respectively; it is strongly recommended to use this single number rating in combination with the complete sound absorption coefficient curve.
2. SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.

3. Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
4. Open area estimates are based on 600 x 600 mm of ceiling area being 'treated' by each tile.

Issuing Authority

Signed:

David Truett

Date:

17 March 2021

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 4 microphones (1 x B&K 4134, 1 x B&K 4166, and 2 x GRAS 40AR) on B&K and GRAS preamps, in fixed positions as per AS ISO 354
Noise source: • Room populated with three dodecahedron loudspeakers; (2 x Norsonic NOR276 & 1 x B&K 4296), driven in turn by a Norsonic NOR280 power amplifier.
Calibration: • Analyser: July 2018 (NATA cal)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by an MDF wall) • parallelepiped with dimensional proportions 1:1.3:1.6 for distribution of room modes • approx 202 m³ total room volume • approx 215 m² surface area excluding diffusers
Diffusers: • 20 stationary diffusers, approx 40 m² total surface area
Absorption area: • in accordance with AS ISO 354, unless noted otherwise