CSIRO ACOUSTIC MEASUREMENT REPORT

Commonwealth Scientific and Industrial Research Organisation, Infrastructure Technologies
Acoustics Testing Laboratory, Gate 5, 2 Normanby Road, Clayton, Vic 3168 Australia

Report No:
AC287-18-1

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), Test configuration: Type E-200]

Description: • Bailey "EcoCheck Acoustic Coffer" ceiling panels, • direct-fix type,
• with pre-fitted glass fibre batts behind the perforated areas (stapled to rear of panel)

Panel Details[3]

- Moulded plaster ceiling panels, approx 1200 x 600 mm, designed to be nail/screw-fixed to overhead ceiling battens.
- Factory-fitted with two glass fibre batts (500 x 500 mm, Bradford Supertel, ≈42 kg/m³, 20 mm thick, faced with black Regina tissue fabric), stapled to the rear of the panel behind the perforated areas.
- Perforated with a regular pattern of holes, approx 5.5 mm dia (3364 count per panel; 1682 count per half-panel), all penetrating through the plaster panel and exposing the tissue face of the glass fibre batt behind; the decorative effect of the perforations was supplemented by a raised coffer profile, framing each perforated area.
- Open area percentage[4] (estimated): 11.1%

Installation

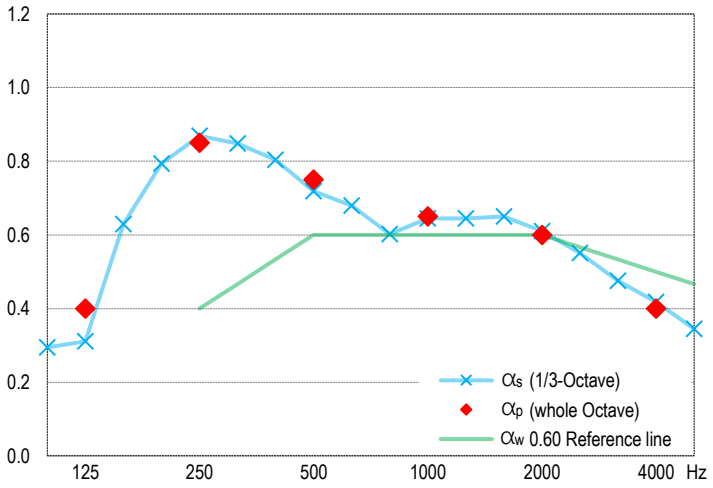
- The test specimen was installed as an upside-down ceiling on the floor of the chamber.
- A 200 mm deep enclosure (32 mm MDF timber, approx 23 kg/m², built to surround an area of 3600 x 3000 mm) was placed on the floor of the chamber at an 11° angle to the chamber walls (not parallel, as per AS ISO 354 cl 6.2.1.2). Two modules (each 100 mm deep) were stacked to create the E-200 enclosure.
- A system of plastic support feet sitting on aluminium extrusions (upside-down Tees) was set up inside the enclosure to support the panels with their exposed face nominally flush with the enclosure. The cavity behind was a single undivided cavity without internal partitions.
- Panels were arranged in a 3 x 5 array on the support system.
- All relevant joins in the installation were taped to close off any gaps – ie the junctions of the enclosure modules to each other, to the floor, and to the panel array, and where adjacent panels butted against each other in the installed array.
- Specimen installation was carried out by laboratory staff.

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

Panel details – Left: whole panel, Right: close-up view

Measurement Details & Results

Freq	Absorption coefficients			Reverberation times, T_{60} (sec)	
Hz	α_s	α_p	95% Conf (δ)	Empty room	with Specimen
100	0.29		0.06	5.25	3.48
125	0.31	0.40	0.06	6.26	3.81
160	0.63		0.08	6.70	2.80
200	0.79		0.13	5.92	2.32
250	0.87	0.85	0.08	4.83	2.03
315	0.85		0.07	6.21	2.27
400	0.80		0.05	6.06	2.33
500	0.72	0.75	0.06	5.75	2.44
630	0.68		0.04	5.52	2.47
800	0.60		0.04	5.22	2.57
1000	0.64	0.65	0.05	5.06	2.44
1250	0.65		0.04	4.58	2.32
1600	0.65		0.03	4.13	2.19
2000	0.61	0.60	0.03	3.72	2.13
2500	0.55		0.03	3.28	2.07
3150	0.48		0.03	2.87	1.99
4000	0.42	0.40	0.04	2.35	1.79
5000	0.34		0.04	1.89	1.57



Performance Indices[1,2]
α_w = 0.60 (L)
SAA = 0.70
NRC = 0.70

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:	9 Aug 2021	9 Aug 2021
Temperature & humidity:	17 °C, 56 % R.H.	16 °C, 60 % R.H.
Atmospheric pressure:	1011 mBar	1011 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 1200 x 600 mm of ceiling area being 'treated' by each panel.

Issuing Authority

Signed: .....
David Truett
Date: 11 August 2021

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3050-A-060
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 Norsonic NOR276 dodecahedron loudspeakers, driven in turn by a Norsonic NOR280 power amplifier.
Calibration: • Analyser: December 2019 (NATA cal)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by a plaster-board 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