



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:
AC235-03-1

Client: Woven Image Pty. Ltd.
37-39 Chard Road, Brookvale, NSW 2766 Australia

Measurement Type: Sound Absorption

AS ISO 354-2006 "Acoustics—Measurement of sound absorption in a reverberation room"

AS ISO 11654-2002 (ISO 11654:1997) "Acoustics—Rating of sound absorption—Materials and systems"

Test Specimen [Specimen area: 3.322 x 3.361 m = 11.165 m²]

Name:

Woven Image 'Mura' Board – Tested with a 50 mm air gap.

Test Specimen Details:

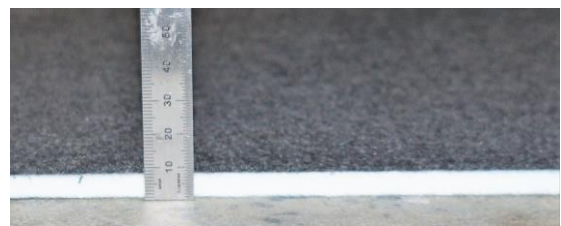
- Specimen composition:
 - 2 Layers of 100 % Polyethylene terephthalate (PET)
 - Sound incident face: 'Mura' 60 % recycled PET, 40 % PET
 - Base: 70 % recycled PET, 30 % PET
- Supplied for testing as four boards of dimension nom. 2800 x 1120 x 9 mm
- Measured density: 1820 gsm

Installation:

- The reverberation chamber was swept and vacuumed to remove dust.
- The test specimen was installed 'Mura' face exposed to the soundfield on randomly arranged 50 mm spacers to achieve a 50 mm air gap on the underside of the specimen under test.
- The specimen for testing consisted of 3 complete boards and an additional board cut along the 1120 dimension to 3 pieces of nom. 1120 x 522 mm.
- Boards were arranged in a rectangle 3.322 x 3.361 m, not parallel with the walls of the chamber (as per AS ISO 354).
- The perimeter edges of the test specimen were covered with a skirt of 1 mm thick folded steel angle, 60 mm high. Skirting members were pushed against the edges of the boards; pushing the boards against each other and minimising gaps at the skirt.
- Specimen installation was carried out by laboratory staff.



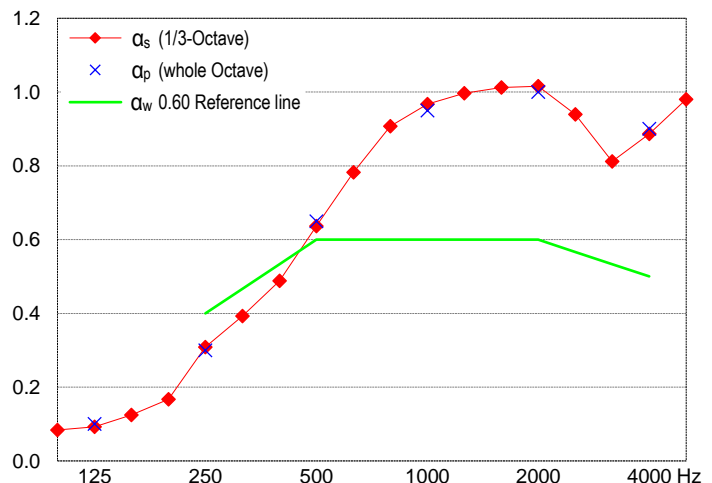
Test specimen installed in laboratory



Side view of board showing the 'Mura' layer and the Base material

Measurement Details & Results

Freq (Hz)	Absorption coefficient		Reverberation times, T ₆₀ (s)	
	α _s	α _p	Empty room	with Specimen
100	0.08		5.97	5.10
125	0.09	0.10	7.20	5.86
160	0.12		6.86	5.31
200	0.17		6.33	4.65
250	0.31	0.30	5.42	3.44
315	0.39		6.48	3.45
400	0.49		6.42	3.09
500	0.64	0.65	5.75	2.54
630	0.78		5.64	2.24
800	0.91		5.13	1.97
1000	0.97	0.95	4.98	1.87
1250	1.00		4.57	1.78
1600	1.01		4.16	1.70
2000	1.02	1.00	3.77	1.63
2500	0.94		3.36	1.61
3150	0.81		3.09	1.66
4000	0.89	0.90	2.68	1.48
5000	0.98		2.23	1.27



Performance Indices^{2,3}

α_w = 0.60 (MH)

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:	5 Feb 2018	5 Feb 2018
Temperature & humidity:	23 °C, 60 % R.H.	23 °C, 62 % R.H.
Atmospheric pressure:	1007 mBar	1008 mBar

Notes, Deviations etc

- Physical characteristics of materials may be as per client or supplier's advice; not necessarily verified by CSIRO.
- 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.
- SAA and NRC are defined in ASTM C423; laboratory requirements for which differ from AS ISO 354.
- Empty room absorption area in the 250 Hz band differed from the mean of the two adjacent bands by more than 15 %; a deviation from AS ISO 354.
- The test specimen was laid flat for approximately 48 hours prior to testing to allow relaxation of the specimen from any deformation associated with packaging, transport or manufacturing.

Issuing Authority

Signed:

John Watson

Date:

9 February 2018

Instrumentation

Real time analyser: • Brüel & Kjær PULSE LAN-XI type 3160-A-4/2
Microphones/preamps: • 2 x GRAS type 40AP and 2 x Brüel & Kjær type 4134 microphones, on B&K type 2669 preamps, in 4 fixed positions as per AS ISO 354
Noise source: • Norsonic NOR276 Dodecahedron loudspeaker driven by a Norsonic NOR280 power amplifier
Calibration: • Analyser: Feb 2016 (NATA cal)

Laboratory Construction

Reverb room: • 300 mm thick concrete (closed off from the adjoining room by a composite wall with plasterboard face)
• 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 otherwise⁴