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REPORT ON THE DETERMINATION OF SOUND ABSORPTION COEFFICIENTS OF BAILEY INTERIORS JUSTICE PANEL 1200MM X 1200MM PERFORATED PLASTER CEILING PANELS WITH A GLASSWOOL BACKING (50MM @ 32KG/M^3) TESTED WITH A 400MM AIR GAP IN A REVERBERATION ROOM.

Testing Procedure:	AS ISO 354 - 2006
Testing Laboratory:	Applied Acoustics Laboratory School of Electrical and Computer Engineering RMIT University Melbourne, Victoria 3000, Australia NATA Accreditation Number: 1421
Client:	Bailey Interiors Pty. Ltd. 83-85 Boundary Road Mortdale, New South Wales 2223 Australia
Date of Test:	18th of July 2013
Date of Report:	3rd of September 2013
Report Number:	13-091/PD
Testing Officer:	Peter Dale

Peter Dale
Approved NATA Signatory

Accredited for compliance with ISO/IEC 17025

REPORT ON THE DETERMINATION OF SOUND ABSORPTION COEFFICIENTS OF BAILEY INTERIORS JUSTICE PANEL 1200MM X 1200MM PERFORATED PLASTER CEILING PANELS WITH A GLASSWOOL BACKING (50MM @ 32KG/M^3) TESTED WITH A 400MM AIR GAP IN A REVERBERATION ROOM.

1. INTRODUCTION

The tests described in this report were carried out at the request of the Bailey Interiors Pty. Ltd. to determine the sound absorption coefficients of a sample of Bailey Interiors Justice Panel 1200mm x 1200mm Perforated Plaster Ceiling Panels with 50mm thick 32kg/m^3 Glasswool installed to rear of panels tested with a 400mm air gap.

The tests were carried out using the Reverberation Room of the School of Electrical and Computer Engineering, The Royal Melbourne Institute of Technology Limited.

Testing has been carried out in accordance with AS ISO 354–2006 "Acoustics: Measurement of sound absorption in a reverberation room".

At the request of the Client, the weighted sound absorption coefficient α_w has been determined in accordance with AS ISO 11654-2002 "Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption".

The equipment used to perform these tests has been calibrated at an accredited laboratory and is in current calibration.

2. TEST FACILITIES AND PROCEDURES

2.1 Facilities The Reverberation Room is of pentagonal plan with the ceiling inclined with respect to the floor. No two room dimensions are equal or in the ratio of small whole numbers. The volume of the room is 200.0 cubic metres. A sufficiently diffuse sound field is established by the inclusion of 17 stationary diffusing boards of panelboard, each of one-sided area approximately one square metre and suspended with random orientation. The total two-sided area of the diffusing elements is 0.16 of the total boundary surface area of the room. Previous tests carried out in the room have established that diffusivity of the room sound field is acceptable.

The total surface area of the room boundaries and diffusing elements is 235.6 square metres.

2.2 Generation of sound field The test signals is random noise, band limited to a frequency range of 40Hz to 6300Hz. Three individual loudspeaker positions are used to excite the sound field in the Reverberation Room. The signal is fed to each loudspeaker in turn.

2.3 Receipt of signals Four microphones each mounted in statistically independent locations in the Reverberation Room are used to measure the sound field decays in the room. Ten sound decays are obtained at each of the twelve loudspeaker/microphone combinations, thus representing 120 decays for each frequency band.

The microphone signal is relayed via a microphone amplifier, to a Bruel & Kjaer 3560 Pulse Multi Analyser System. The Pulse analyser is interfaced to a personal computer. A program running on the personal computer allows the determination of the reverberation time from the sound decays in accordance with the standard. The measuring equipment has been calibrated by an external laboratory, and is in current calibration.

3. SAMPLE FOR TESTING

As provided by Client:

Bailey Interiors Justice Panel 1/ 00mm x 1/ 00mm Perforated Plaster Ceiling Panels with 50mm thick 32kg/m^3 Glasswool installed to rear of panels tested with a 400mm air gap:

Manufacturer:	Bailey Interiors Pty. Ltd.
Product Designation:	Justice Panel
Colour:	White
Nominal Open Area of Panel:	10.4%
Nominal Individual Panel Size:	1200 mm x 1200 mm x 13mm
Test Air gap:	400mm
Dimensions of Sample:	3.00m x 3.61m
Area of Sample:	10.83m^2
Insulation:	Glass-wool insulation, 32kg/m^3 and 50mm thick installed against the rear face of the panels.
Panel Mounting:	Type E-400

The panels were tested by mounting the panels on a 420mm in height, 20mm thick MDF Frame with dimensions 2840mm wide by 3640mm long that was installed on the floor of the Reverberation Chamber. The sample under test was supported in the MDF Test Frame by a steel suspension frame to achieve a 400mm void between the underside of the sample under test and the floor of the Reverberation Chamber. The glasswool insulation was installed on top of the steel suspension frame and the ceiling panels were installed on the frame with the glasswool directly behind rear face (ie the non-sound incident face) of the ceiling panel. The mass of the Plaster Ceiling panels compressed the glasswool around the perimeter of the ceiling panel where the suspension frame is supporting the sample under test. Standard ceiling panel suspension grid was also installed in the joins between adjacent ceiling panels on the sound-incident side of the panels under test to replicate a standard field installation.

The sound-incident side of the ceiling panel featured a perforated face and is pictured below in detail in Figure 1. Figure 2 depicts the sample installed in the Reverberation Chamber for testing.

Figure 1: Ceiling Panel Face Detail: Bailey Interiors Justice Panel 1200mm x 1200mm Perforated Plaster Ceiling Panels.

Figure 2: Bailey Interiors Justice Panel 1200mm x 1200mm Perforated Plaster Ceiling Panels with 50mm thick 32kg/m^3 Glasswool installed to rear of panels tested with a 400mm air gap installed into the Reverberation Chamber for testing.

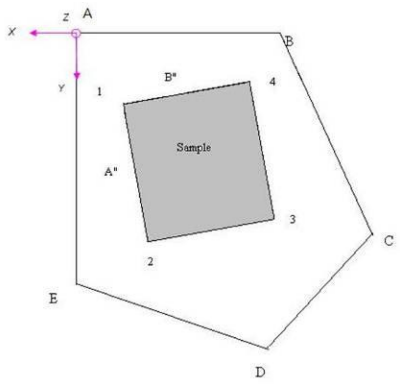
4. LOCATION OF SAMPLE IN THE REVERBERATION ROOM

Reverberation Chamber (Not to scale)

X and Y co-ordinates of the sample location in the Reverberation Room

Corner Ref. Number	X co-ordinate (metres)	Y co-ordinate (metres)
1	-1.00	2.02
2	-1.40	5.61
3	-4.38	5.28
4	-3.98	1.69

Descriptor	Diagram Reference	Length (m)
Sample Length 1 to 2	Diagram Ref. A"	3.61
Sample Length 1 to 4	Diagram Ref. B"	3.00



5. RESULTS

The mean reverberation times at each frequency for the empty room, $T60_e$,, the room with the sample installed, $T60_{e+s}$, the sound absorption coefficient and the 95% confidence interval are provided in Table 1. The results are rounded to 0.01. The 95% confidence interval for each frequency is determined from the standard deviation of the reverberation times of the empty room and the room with the sample. The k factor used to determine the 95% Confidence interval is 2.201.

The results for the sample are detailed in Table 1, Table 2 and Graph 1 of this report.

Test conditions:

Room Empty:	Air temperature	20.8^{O}C,
	Relative Humidity	51%
	Barometric Pressure	0.7670 metre of mercury.
Room with Sample:	Air temperature	20.7^{O}C,
	Relative Humidity	64%
	Barometric Pressure	0.7593 metre of mercury.

Table 1: Reverberation times and Sound Absorption Coefficients of Bailey Interiors Justice Panel 1200mm x 1200mm Perforated Plaster Ceiling Panels with 50mm thick 32kg/ m^3 Glasswool installed to rear of panels tested with a 400mm air gap.

Octave Centre Frequency Bands, Hz	Average RT's for Empty Room $T60_e$	Average RT's for Room with Sample $T60_{e+s}$	Sound Absorption Coefficient α_s	95% Confidence Interval for α_s
100	8.594	3.318	0.55	0.15
125	8.944	3.439	0.53	0.18
160	9.410	3.051	0.66	0.07
200	9.505	2.830	0.74	0.09
250	8.664	2.605	0.80	0.06
315	8.087	2.469	0.84	0.06
400	8.272	2.511	0.83	0.04
500	7.430	2.265	0.91	0.04
630	7.224	2.164	0.96	0.03
800	6.597	2.259	0.86	0.03
1000	6.105	2.272	0.82	0.03
1250	5.321	2.367	0.69	0.03
11100	4.617	2.389	0.60	0.02
2000	4.202	2.436	0.52	0.02
2500	3.515	2.377	0.43	0.03
3150	2.908	2.192	0.38	0.03
4000	2.337	1.853	0.41	0.03
5000	1.976	1.653	0.41	0.03

The weighted sound absorption coefficient α_w of the sample determined in accordance with AS ISO 11654-1997 "Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption" is:

$$\alpha_w = 0.55(LM)$$

The Practical Sound Absorption Coefficients are detailed below in Table 2. These values have been determined in accordance with AS ISO 11654-1997 "Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption".

Table 2: Practical Sound Absorption Coefficients for the Sample

Frequency (Hz)	**125**	**250**	**500**	**1000**	**2000**	**4000**
Practical Sound Absorption Coefficient, α_p	0.60	0.80	0.90	0.80	0.50	0.40

N.R.C. of the sample calculated in accordance with ASTM C423-90A is: .0.75

Graph 1: Sound Absorption Coefficients of Bailey Interiors Justice Panel 1200mm x 1200mm Perforated Plaster Ceiling Panels with 50mm thick 32kg/m^3 Glasswool installed to rear of panels tested with a 400mm air gap.