

**REPORT ON THE DETERMINATION OF SOUND ABSORPTION
COEFFICIENTS OF BAILEY INTERIORS NU TR2000 600MM x 600MM
PERFORATED PLASTER CEILING TILES WITH SORBERTEXTILE P44FR
ACOUSTIC FABRIC ADHERED TO THE UNDERSIDE OF THE TILE
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: 7th of July 2014

Date of Report: 24rd of April 2015

Report Number: 14-078/JW

Report drafted by: Peter Dale

Testing Officer: John Watson



John Watson
Testing Officer



Accredited for compliance with ISO/IEC 17025

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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 Nu TR2000 600mm x 600mm Perforated Plaster Ceiling Tiles with Sorbertextile P44FR acoustic fabric adhered to the underside of the tile 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 Nu TR2000 Perforated 600mm x 600mm Plaster Ceiling Tiles with
P44FR acoustic fabric adhered to the underside of the tile and tested with a 400mm air gap:
Sorbertextile

Manufacturer:	Bailey Interiors Pty. Ltd.
Product Designation:	Nu TR2000
Construction:	Perforated Plaster with Sorbertextile P44FR acoustic fabric adhered to the underside of the tile.
Colour:	White
Nominal Open Area of Panel:	14.3%
Slot Type:	Rectangular pattern at 45 degrees to tile edges
Nominal Slot Size:	11.0mm x 5.5mm
Number of slots per tile:	578
Nominal Individual Panel Size:	600mm x 600mm x 30mm
RMIT Measured Individual Panel Size:	585mm x 585mm x 33mm
Single Tile Weight (including backing):	4.5kg
Nominal Test Air gap:	400mm
Dimensions of Sample:	3.00m x 3.60m
Area of Sample:	10.80m ²
Acoustic Fabric Backing:	Sorbertextile P44FR manufactured by Pyrotek Noise Control (147-149 Magowar Road, Girraween, NSW 2145, Australia)
Acoustic Fabric Colour:	Black
Adhesive:	Heat activated

The sample was tested on the 7th of July 2014.

The tiles were tested by mounting the tiles on a 420mm in height, 25mm thick MDF Frame with dimensions 3050mm wide by 3650mm long that was installed on the floor of the Reverberation Chamber giving a total sample surface area of 10.80m².

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 tiles were installed with the Sorbertextile P44FR adhered to the underside of the tile with the perforated plaster face incident to the sound field. Standard ceiling tile suspension grid was also installed in the joins between adjacent ceiling tiles on the sound-incident side of the tiles under test to replicate a standard field installation.

The sound-incident side of the ceiling panel featured a perforated face with the rectangular pattern and is pictured below in detail in Figure 1. Figure 2 shows the rear face of the panel with the Sorbertextile P44FR acoustic fabric installed. Figure 3 depicts the sample installed in the Reverberation Chamber for testing.

Figure 1: Ceiling Panel front face Detail: Bailey Interiors Nu TR2000 600mm x 600mm Perforated Plaster Ceiling Tiles with Sorbertextile P44FR acoustic fabric adhered to the underside of the tile.

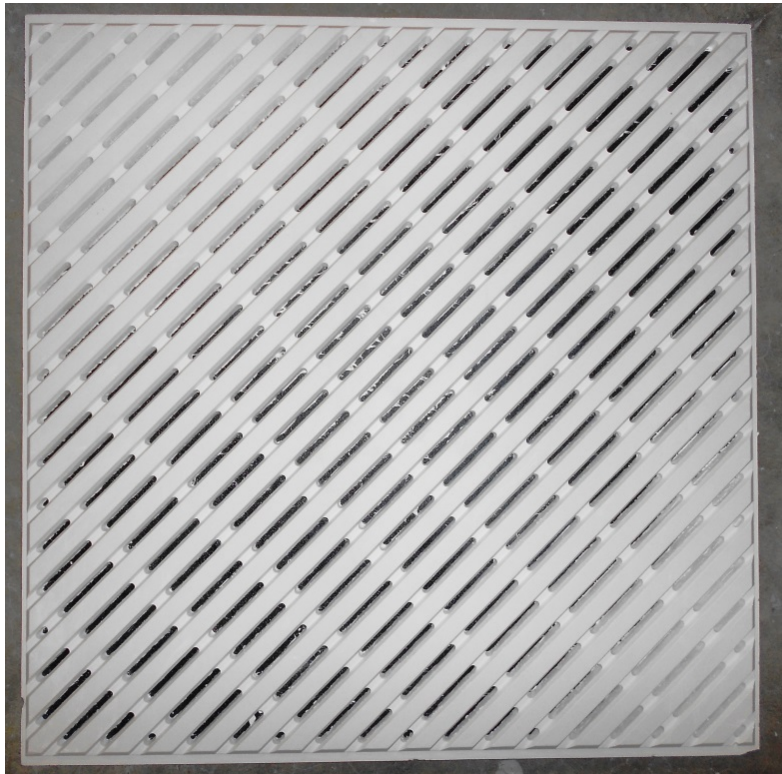


Figure 2: Rear Face of Ceiling Tile: Bailey Interiors Nu TR2000 Perforated Plaster Ceiling Tiles with Sorbertextile P44FR acoustic fabric installed to rear of the tile.

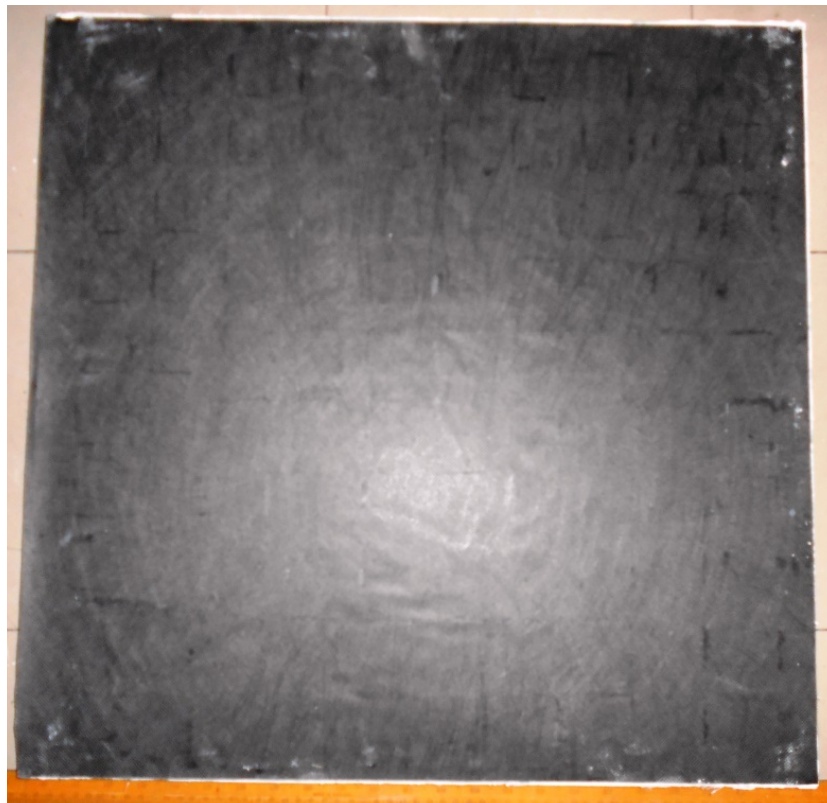


Figure 3: Bailey Interiors Nu TR2000 600mm x 600mm Perforated Plaster Ceiling Tiles with Sorbertextile P44FR acoustic fabric adhered to the underside of the tile tested with a 400mm air gap installed in Reverberation Room for testing.



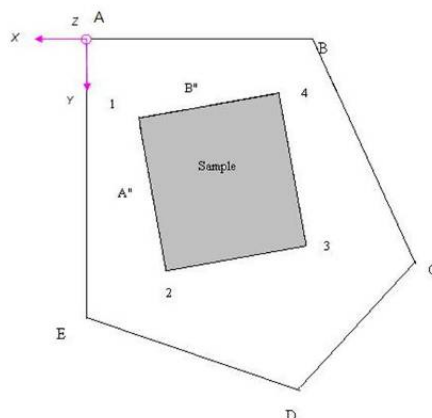
4. LOCATION OF SAMPLE IN THE REVERBERATION ROOM

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	2.00
2	-1.31	5.59
3	-4.30	5.33
4	-3.99	1.74

Descriptor	Diagram Reference	Length (m)
Sample Length 1 to 2	Diagram Ref. A''	3.60
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 21.3°C
Relative Humidity 40%
Barometric Pressure 0.7710 metre of mercury.

Room with Sample: Air temperature 21.0°C
Relative Humidity 40%
Barometric Pressure 0.7674 metre of mercury.

Table 1: Reverberation times and Sound Absorption Coefficients of Bailey Interiors Nu TR2000 Perforated 600mm x 600mm Plaster Ceiling Tiles with Sorbertextile P44FR acoustic fabric adhered to the underside of the tile and tested with a 400mm air gap.

1/3 rd Octave Centre Frequency Bands (Hz)	Average RT's for Empty Room $T60_e$ (s)	Average RT's for Room with Sample $T60_{e+s}$ (s)	Sound Absorption Coefficient α_s	95% Confidence Interval for α_s
100	8.358	3.633	0.46	0.10
125	9.235	3.254	0.59	0.12
160	9.454	3.442	0.55	0.07
200	9.352	3.284	0.59	0.04
250	8.542	3.045	0.63	0.06
315	8.250	3.012	0.63	0.04
400	8.299	3.049	0.62	0.05
500	7.405	3.094	0.56	0.04
630	7.059	2.852	0.62	0.04
800	6.191	2.817	0.58	0.02
1000	6.062	2.660	0.63	0.03
1250	5.279	2.525	0.62	0.02
1600	4.588	2.349	0.62	0.02
2000	4.048	2.214	0.61	0.01
2500	3.390	1.974	0.63	0.02
3150	2.774	1.761	0.61	0.03
4000	2.168	1.505	0.60	0.03
5000	1.746	1.255	0.66	0.04

N.R.C. of the sample calculated in accordance with ASTM C423-90A is: 0.65

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:

$$\alpha_w = 0.60$$

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	0.55	0.60	0.60	0.60	0.60	0.60

Graph 1: Sound Absorption Coefficients of Bailey Interiors Nu TR2000 Perforated 600mm x 600mm Plaster Ceiling Tiles with Sorbertextile P44FR acoustic fabric adhered to the underside of the tile and tested with a 400mm air gap.

