

**REPORT ON THE DETERMINATION OF SOUND ABSORPTION  
COEFFICIENTS OF WOVEN IMAGE “3D TILE-WAVE” WALL TILES  
TESTED WITH NO AIR GAP MEASURED IN A REVERBERATION ROOM.**

Testing Procedure: AS ISO 354 - 2006

Testing Laboratory: Applied Acoustics Laboratory  
RMIT University, School of Electrical and Computer Engineering  
Melbourne, Victoria 3000, Australia  
NATA Accreditation Number 1421

Client: Woven Image Pty. Limited  
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Date of Test: 7<sup>th</sup> October 2011

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Testing Officer: Peter Dale



Peter Dale  
Approved NATA Signatory



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# **REPORT ON THE DETERMINATION OF SOUND ABSORPTION COEFFICIENTS OF WOVEN IMAGE “3D TILE-WAVE” WALL TILES TESTED WITH NO AIR GAP MEASURED IN A REVERBERATION ROOM.**

## **1. INTRODUCTION**

The tests described in this report were carried out at the request of Woven Image Pty. Limited to determine the sound absorption coefficients of a sample of “3D Tile-Wave” wall tiles tested with no 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  $\alpha_w$  has been determined in accordance with AS ISO 11654-1997 “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 chamber. 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

#### 3.1 Description: Woven Image 3D Tile-Wave

Woven Image 3D Tile-Wave: The sample comprised of 3D Tile-Wave tiles mounted directly on to the reverberation room floor.

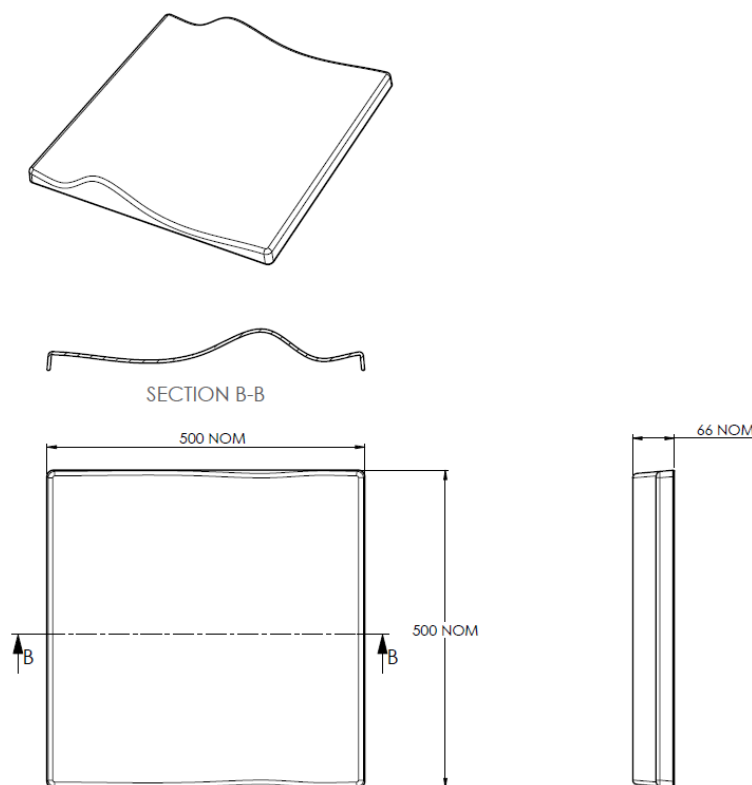
Description: 3D Tile-Wave Material: 100% PET, 15 % recycled  
Tile Thickness: 3.5mm  
Wave Ridge Height: 66mm  
Surface Density: 1430.4gsm (includes folded edges of tiles)  
Tile Size: 500mm x 500mm  
Primary Use: Wall Covering

Figure 1 design drawing for the 500mm x 500mm “3D Tile-Wave” tiles. Figure 2 depicts the wave pattern on the tiles.

The sample tested comprised of a 5 x 8 array of the tiles arranged to form a 2500mm x 4000mm rectangle. The tiles were placed in a single layer and with a uniform orientation directly on the test chamber floor. Figure 1 depicts the design drawings of the sample under test. Figure 2 depicts the top view of an individual Woven Image 3D Tile-Wave. The sample installed for testing is depicted in Figure 3. The sample was tested with the perimeter edges enclosed by metal edges in accordance with the recommendations contained in AS ISO 354.

The sample was tested with the sample mounted with no air gap between the sample and the floor of the reverberation chamber. The total surface area of the sample was 10.00m<sup>2</sup>.

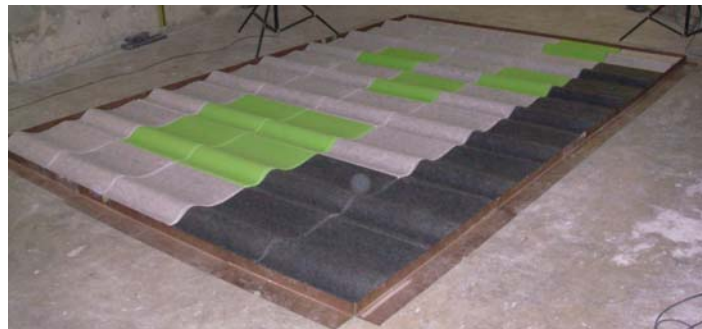
**Figure 1:** Design drawings of the 500mm x 500mm “3D Tile-Wave” tile.



**Figure 2:** Detail of the 500mm x 500mm “3D Tile-Wave” tile.



**Figure 2:** “3D Tile-Wave” tile tested with no air gap installed in Reverberation Chamber



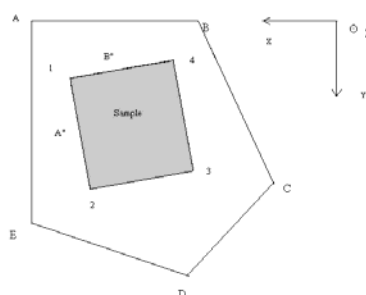
### 3.2 Location Of Sample In The Reverberation Room

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	-1.47	2.04
2	-2.03	6.00
3	-4.51	5.65
4	-3.95	1.69

Descriptor	Diagram Reference	Length (m)
Sample Length 1 to 2	Diagram Ref. A''	4.00
Sample Length 1 to 4	Diagram Ref. B''	2.50



## 4. 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:

<b>Room Empty</b>	Air temperature	19.0°C
	Relative Humidity	51%
	Barometric Pressure	0.7596 metre of mercury
<b>Room with Sample</b>	Air temperature	19.1°C
	Relative Humidity	48%
	Barometric Pressure	0.7588 metre of mercury

**Table 1:** Reverberation times and Sound Absorption Coefficients for “3D Tile-Wave” tile tested with no 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 $\alpha_s$	95% Confidence Interval for $\alpha_s$
100	9.513	8.403	0.04	0.05
125	8.502	7.631	0.04	0.08
160	10.243	7.531	0.11	0.05
200	10.164	7.355	0.12	0.05
250	9.885	6.574	0.16	0.05
315	9.050	5.161	0.27	0.03
400	7.956	4.402	0.33	0.02
500	7.630	3.648	0.46	0.04
630	7.027	3.148	0.57	0.03
800	6.717	2.946	0.62	0.03
1000	6.131	2.696	0.67	0.03
1250	5.566	2.445	0.74	0.03
1600	4.742	2.172	0.80	0.03
2000	4.116	1.978	0.84	0.04
2500	3.564	1.787	0.89	0.02
3150	2.910	1.666	0.81	0.05
4000	2.341	1.425	0.86	0.06
5000	1.925	1.245	0.87	0.05

The weighted sound absorption coefficient  $\alpha_w$  of the sample determined in accordance with AS ISO 11654-1997 “Acoustics: Sound Absorbers for Use in Buildings - Rating of sound absorption” is:

$$\alpha_w = 0.45(\text{MH})$$

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, $\alpha_p$	0.05	0.20	0.45	0.70	0.85	0.85

NRC of the sample calculated in accordance with ASTM C423-90A is: 0.55

**Graph 1:** Sound Absorption Coefficients of “3D Tile-Wave” tile tested with no air gap.

