

**REPORT ON THE DETERMINATION OF SOUND
ABSORPTION COEFFICIENTS OF THE ANDREWS GROUP BOLON BOTANIC
COLLECTION WOVEN VINYL FLOORING (500MM X 500MM TILES, 3.8KG/M²,
2.9MM THICK) 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: The Andrews Group
62 River Street
South Yarra, Victoria 3141
Australia

Date of Test: 3rd of August 2015

Date of Report: 3rd of August 2015

Report Number: 15-140/JW

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 EC Group to determine the sound absorption coefficients of a sample of The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick) 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 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 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 Channel 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:

The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick):

Product Name:	Bolon Botanic Collection Woven Vinyl Flooring
Construction Detail:	Woven vinyl
Use Classification:	32 General Commercial (as per ISO 10874)
Surface Density:	3.8kg/m ² (ISO 8543)
Tile Thickness:	2.9mm (ISO 1765)
Flooring Tile Backing:	Plasticised PVC with fibreglass interlayer for dimensional stability

The full technical information for the Bolon Botanic Collection Woven Vinyl Flooring is presented in full in Appendix 1.

RMIT Measured Nominal Tile Thickness:	3.32mm
RMIT Measured Nominal Tile Mass:	0.90kg/tile
RMIT Measured Nominal Surface Density:	3.59kg/m ²
Nominal Individual Module/Tile Size:	500mm x 500mm
Nominal Box Quantity:	4.0m ² (16 tiles per box)
Dimensions of Sample:	2.50m x 4.51m
Area of Sample:	11.28m ²

The sample provided by the Client for testing comprised of 1 colour/pattern of The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick). Depicted in Figure 1 below is the detail of the sound incident face of the flooring tile. Figure 2 below depicts the woven vinyl details of the sound incident face of the flooring tile under test. Figure 3 depicts the details of the PVC backing.

The Flooring Tiles were tested by mounting the tiles directly on the floor of the Reverberation Chamber with the woven face exposed to the sound-field as depicted below in Figure 4. There was no underlay installed under the Flooring tiles. The tiles were arranged in a rectangular array of 9 x 5 flooring tiles with the sides of the test sample enclosed by metallic slats in accordance with the recommendations in AS ISO 354–2006 “Acoustics: Measurement of sound absorption in a reverberation room”. The sample dimensions were 2500mm x 4510mm giving a total sample area of 11.28m².

The sample was tested on the 3rd of August 2015.

Figure 1: Flooring Tile Colour Pattern Detail – The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick)



Figure 2: Flooring Tile Pile Detail – The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick)

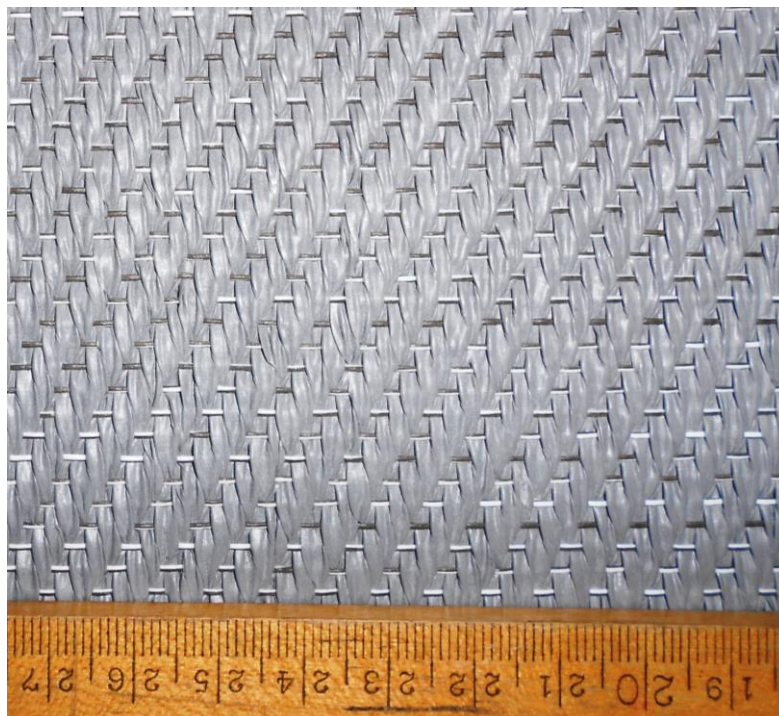


Figure 3: Flooring Tile Backing Detail – PVC



Figure 4: The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick) installed into the Reverberation Chamber for testing.



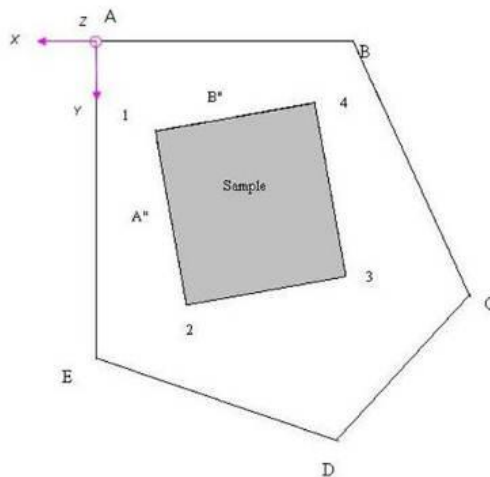
4. LOCATION OF SAMPLE IN THE REVERBERATION ROOM

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	-1.13	1.38
2	-1.57	5.87
3	-4.06	5.62
4	-3.62	1.14

Descriptor	Diagram Reference	Length (m)
Sample Length 1 to 2	Diagram Ref. A''	4.51
Sample Length 1 to 4	Diagram Ref. B''	2.50



5. RESULTS

The mean reverberation times at each frequency for the empty room, $T60_{e,r}$, 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 20.3°C,
Relative Humidity 32%
Barometric Pressure 0.7660 metre of mercury.

Room with Sample: Air temperature 20.5°C,
Relative Humidity 32%
Barometric Pressure 0.7660 metre of mercury.

Table 1: Reverberation times and Sound Absorption Coefficients of The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick) tested with a 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 α_s	95% Confidence Interval for α_s
100	9.420	9.483	0.00	0.04
125	8.857	8.776	0.00	0.04
160	9.433	9.159	0.01	0.03
200	9.516	9.772	0.00	0.03
250	8.850	8.644	0.01	0.02
315	8.290	8.053	0.01	0.03
400	8.557	8.341	0.01	0.02
500	7.619	7.192	0.02	0.02
630	7.023	6.710	0.02	0.02
800	6.380	6.290	0.01	0.02
1000	5.993	5.842	0.01	0.01
1250	5.111	4.889	0.03	0.01
1600	4.377	4.058	0.05	0.02
2000	3.812	3.384	0.10	0.01
2500	3.095	2.769	0.12	0.02
3150	2.477	2.320	0.09	0.02
4000	1.843	1.780	0.07	0.03
5000	1.495	1.483	0.04	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:

$$\alpha_w = 0.05$$

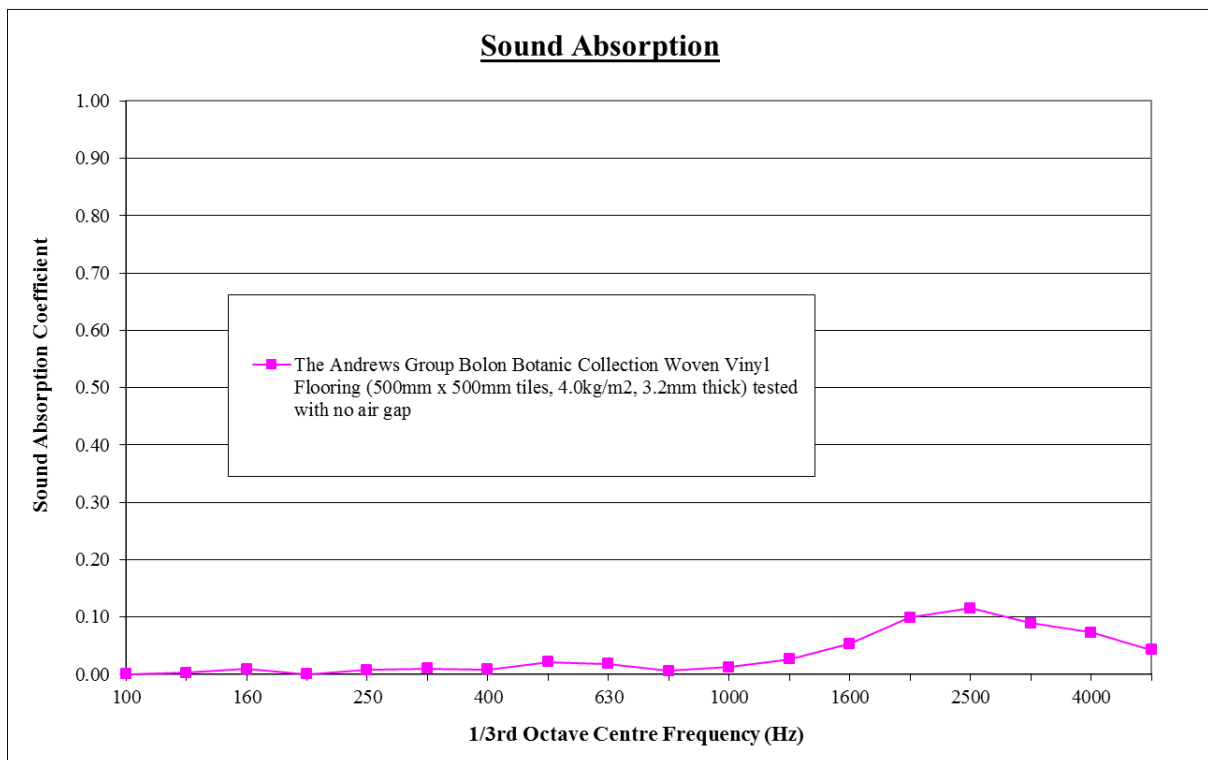
The Practical Sound Absorption Coefficients are detailed below in Table 2. These values have been determined in accordance with AS ISO 11654-2002 “Acoustics: Rating of sound absorption – Materials and systems”.

Table 2: Practical Sound Absorption Coefficients for the Sample

Frequency (Hz)	125	250	500	1000	2000	4000
Practical Sound Absorption Coefficient, α_p	0.00	0.00	0.00	0.00	0.10	0.05

N.R.C. of the sample calculated in accordance with ASTM C423-90A is: 0.05.

Graph 1: Sound Absorption Coefficients of The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring (500mm x 500mm tiles, 3.8kg/m², 2.9mm thick) tested with no air gap.



Appendix 1: The Andrews Group Bolon Botanic Collection Woven Vinyl Flooring Technical Information

Technical information Botanic

Construction: Woven vinyl flooring, product standard EN 15114

www.bolon.com for updated information

Included in EN 15114		Use classification	EN 685	32 General commercial	
		Weight	Rolls	ISO 8543	2,8 kg/m ²
			Tiles		3,8 kg/m ²
		Thickness	Rolls	ISO 1765	2,4 mm
			Tiles		2,9 mm
		Roll dimension	Width	EN 426	2000 mm
			Length		25 m
		Tile dimension	EN 994	500 x 500 mm. 20 St/Box, 5 m ²	
		Castor Chair	EN 985	Continuous use	
		Body Voltage	EN 1815**	Fulfilled	
		Thermal resistance	ISO 8302	Suitable for underfloor heating	
		Impact sound insulation*	EN ISO 10140	12 dB	
		Airborne sound absorption*	EN ISO 354	0,05	
		Colour fastness to light*	EN ISO 105-B02	8	
	Dimension stability	Rolls	ISO 2551	Fulfilled	
		Tiles	EN 986	Fulfilled	
Additional tests		Anti slip property	DIN 51130	R9	
		Friction	EN 13893	> 0,3	
		Pendulum	EN 13036-4	97-101	
		Reaction to fire	EN 13501-1	B _{s1}	
		Critical radiant flux	ASTM E 648	Class 1	
		Smoke density	ASTM E 662	< 450	
		Emission	EN ISO 16000-10	<20µg/m ³ h	
Certifications		CE certificate	EN 14041	No 0402-CPD-419004	
		Floor Score certificate	Rolls	SCSEC-10.2-2007	
			Tiles	SCS-FS-02007 SCS-FS-02240	
	Classification	Rolls Tiles	CSTB	U3 P2 E1/2 C1 No 12/12-1631 U3 P2 E1/2 C1 No 12/12-1631	

* Typical value

** EN 1815 replaces ISO 6356

Some of the collections are design protected.

