RMIT University

Building 1 Level 1 Room 1
124 La Trobe Street
Melbourne VIC 3000
Australia

GPO Box 2476V
Melbourne VIC 3001
Australia

Tel. +61 3 9925 2000
Fax +61 3 9925 2000
• www.rmit.edu.au

REPORT ON THE DETERMINATION OF AIRBORNE SOUND TRANSMISSION LOSS IN ONE-THIRD OCTAVE BANDS AND WEIGHTED SOUND REDUCTION INDEX (R_W) OF A 226MM FOOTPRINT RENDERED 35MM BENEX PANEL WALL SYSTEM

Testing Procedure:	AS 1191-2002
Testing Laboratory:	Applied Acoustics Laboratory RMIT University School of Electrical and Computer Engineering Melbourne, Victoria 3000, Australia NATA Accreditation Number 1421
Client:	Benex Group Pty. Ltd. Cooyong Centre 1 Torrens Street Braddon, ACT 2612 Australia
Date of Test:	16th of September 2013
Date of Report:	23rd of September 2013
Report Number:	13-117A/PD
Report Drafted by:	John Watson
Testing Officer:	Peter Dale

P Dale

Peter Dale
Approved Signatory

WORLD RECOGNISED
ACCREDITATION

Accredited for compliance with ISO/IEC 17025

REPORT ON THE DETERMINATION OF AIRBORNE SOUND TRANSMISSION LOSS IN ONE-THIRD OCTAVE BANDS AND WEIGHTED SOUND REDUCTION INDEX (R_W) OF A 226MM FOOTPRINT RENDERED 35MM BENEX PANEL WALL SYSTEM

1. INTRODUCTION

The test described in this report was carried out at the request of Benex Group Pty. Ltd. to determine the airborne sound transmission loss and the Weighted Sound Transmission Index (R_w) of a 226mm Footprint Rendered 35mm Benex Panel Wall System.

The test has been carried out using the pair of sound transmission rooms of the School of Electrical and Computer Engineering, RMIT University. The sample under test is mounted in the vertical aperture between a reverberant source room and a reverberant receiving room.

The sound pressure level difference resulting between these two rooms when a sound source operates in the source room is used in conjunction with the surface area of the sample and the equivalent absorption area of the receiving room to determine the airborne sound transmission loss of the sample.

Testing has been carried out in accordance with Australian Standard 1191-2002, Acoustics: Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. The Weighted Sound Transmission Index (R_w) has been determined as specified in AS/NZS ISO 717.1-2004 Acoustics – Rating of sound insulation in buildings and of building elements, Part I: Airborne Sound Insulation.

The measuring facilities and method have been accredited by the National Association of Testing Authorities, Australia (NATA) Accreditation No. 1421, and testing has been conducted fully in accordance with those terms of accreditation.

2. TEST FACILITIES

The sound transmission suite consists of a reverberant source room volume of 115.82 cubic metres and a reverberant receiving room of volume 114.73 cubic metres. Both rooms have an irregular geometry featuring a pentagonal floor plan with no two walls parallel, and with non-parallel floors and ceilings. The rooms are constructed of 305mm reinforced concrete, supported on laminated-rubber isolators, and acoustically de-coupled from one another by a 50mm closed cell polyurethane gasket.

The irregular room shape has been chosen to assist in the production of diffuse sound fields. Such diffuseness is further enhanced:

(a) In the receiving room by the inclusion of nine fixed non-rectangular panels, suspended in the room with random orientation. Six panels each have an area of 1.44 square metres and three each have an area of 1.67 square metres. The total one-sided area of these panel diffusers is 13.65 square metres, being 55.7% of that of the largest single boundary surface (the ceiling).

(b) In the source room by inclusion of nine fixed non-rectangular polyvinyl chloride panels suspended in the room with random orientation. Four panels each have an area 1.86 square metres, the other five each have an area 1.24 square metres. The total one-sided area of these panel diffusers is 13.64 square metres, being 56.5% of that of the largest single boundary surfaces (the ceiling).

The average sound absorption coefficient of the diffusers and the internal surfaces of the rooms is below 0.06 in each test frequency band.

3. EQUIPMENT

The equipment used in performing this test is listed below.

Equipment Name	Description
Desktop Computer	Manuf. By Acer: Veriton 2800, 2.8GHz Intel Pentium D, 591MHz – 512MB RAM S/N: 62703956
Pulse LabShop Version 13 Software	Bruel & Kjaer
Pulse Hardware Interface	Bruel & Kjaer Type 3560B-030 S/N: 2463302
Measuring Amplifier	Bruel & Kjaer Type 2610 S/N 1646952
Microphone 1	Bruel & Kjaer Type 4192 S/N 2735396
Microphone 2	Bruel & Kjaer Type 4192 S/N 2114482
Microphone 3	Bruel & Kjaer Type 4192 S/N 2493521
Microphone 4	Bruel & Kjaer Type 4192 S/N 2552490
Microphone Preamplifier 1	GRAS Type 26AK S/N 21137
Microphone Preamplifier 2	GRAS Type 26AK S/N 44523
Microphone Preamplifier 3	GRAS Type 26AK S/N 19528
Microphone Preamplifier 4	GRAS Type 26AK S/N 68026
Microphone Power Supply 1	GRAS Type 12AR S/N: 171471
Microphone Power Supply 2	GRAS Type 12AR S/N: 171472
Amplifier	Playmaster Pro
Speakers	Lorantz Audio
Fortin Standard Barometer	Casella London 3054
Whirling Hygrometer	Dobbie Bros Australia, S/N: NA

4. PROCEDURES

Testing has been conducted in accordance with the methods of AS1191:2002 – Acoustics: Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

Random noise is fed to a single loudspeaker placed in a corner of the source room. In each one-third octave band of centre frequency 100Hz to 5000Hz, the mean sound pressure level in each room is found by the use of microphones connected to a Bruel & Kjaer Pulse Analyser. Eight independent locations of the microphone are used in each room, with the signals temporally averaged for the sampling time of 64 seconds.

The equivalent absorption area of the receiving room is determined by measurement of the reverberation time in each one-third octave band. A loudspeaker is placed in one corner of the receiving room and 10 decays are obtained at each of the eight microphone positions, between 100Hz and 5000Hz. The microphone signal is relayed via a microphone amplifier, to the Bruel & Kjaer Pulse Analyser. The 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 AS ISO 354:2006 - Acoustics: Measurements of Sound Absorption in a Reverberation Room.

The measuring equipment has been calibrated by an external accredited calibration laboratory, and is in current calibration.

5. SAMPLE DESCRIPTION

5.1 Details of Sample under Test: 226mm Footprint Rendered 35mm Benex Panel Wall System

Description: 226mm Footprint Rendered 35mm Benex Panel Wall System

Studs and Frame: 64mm Steel Studs and Frame on both sides – staggered alignment from the Send side to the Receive Side of the Wall System; 20mm air gap between frames

Transmit Side: 35mm Benex Panels @ 1000kg/m^3 (Approx. Surface Density of Panel: 35kg/m^2), acrylic render – nominally 3-4mm thick.

Receive Side: 35mm Benex Panels @ 1000kg/m^3 (Approx. Surface Density of Panel: 35kg/m^2), acrylic render – nominally 3-4mm thick.

Infill: Polymax Prime 50 Polyester – 50mm thick, Nominal Measured Density: 18.8kg/m^3

Perimeter Sealant: Bostik Polyurethanes – Fireban One (Limestone Part Polyurethane Sealant, Item Code: 224200, Batch No. 13HO158)

Panel Adhesive: Bostik Polyurethanes – Fireban One (Limestone Part Polyurethane Sealant, Item Code: 224200, Batch No. 13HO158)

Acrylic Render: Rockcote Fast Prep Keycote

Wall System Under Test Curing Time: Nominally 72 Hours

Mounting and Installation Notes:

1) 64mm Steel Studs and Frame both sides with studs @ 600mm centres – staggered alignment, 20mm air gap between frames.
2) Transmit Room: 35mm Benex Panels @ 1000kg/m^3 (Approx. Surface Density of Panel: 35kg/m^2) glued to Steel studs @ 600mm centres and glued using Bostik Fireban One to adjacent 35mm Benex Panels, Fixing to studwork w/ screws (30mm x 10 gauge Wood Tek class 4 coated) from wall cavity – screws do not penetrate external face of the 35mm Benex Panel – nominally 1 screw fixed per panel (except for the top row of 35mm Benex Panels – screws unable to be fixed), 4mm acrylic render applied to exposed 35mm Benex Panels.
3) Receive Room: 35mm Benex Panels @ 1000kg/m^3 (Approx. Surface Density of Panel: 35kg/m^2) glued to Steel studs @ 600mm centres and glued using Bostik Fireban One to adjacent Benex Panels, Fixing to studwork w/ screws (30mm x 10 gauge Wood Tek class 4 coated) from wall cavity – screws do not penetrate external face of the 35mm Benex Panel – nominally 1 screw fixed per panel (except for the top row of 35mm Benex Panels – screws unable to be fixed), 4mm acrylic render applied to exposed 35mm Benex Panels.
4) The Perimeter of the Benex Panels on both sides sealed with Bostik Fireban One.
5) Polymax Prime 50 Polyester installed in the Wall Void

The perimeter of both sides of the steel studs and the sample under test was acoustically sealed with Bostik Fireban One. The joins between Benex Panels was sealed with Bostik Fireban One.

Diagram 1 below presents a schematic view of the cross-section of the wall footprint. Also presented below if Figure 1 is a surface detail image of the 35mm Benex Panel. Figure 2 and Figure 3 below depict the 226mm Footprint Rendered 35mm Benex Panel Wall System as seen from the Send and Receive Room respectively. Appendix 1 contains the schematic sketch of the 226mm Footprint Rendered 35mm Benex Panel Wall System as generated by the Client.

Nominal Surface Density of the Wall System Under Test: 71.9kg/m^2
Dimensions of Sample: 3.75m x 2.85m
Area of Sample: 10.69m^2

The sample was tested on the 16th of September 2013.

Diagram 1: 226mm Footprint Rendered 35mm Benex Panel Wall System

Side View:

Infill: 1 layer of Polymax Prime 50 Polyester installed into the wall cavity

- Not to scale

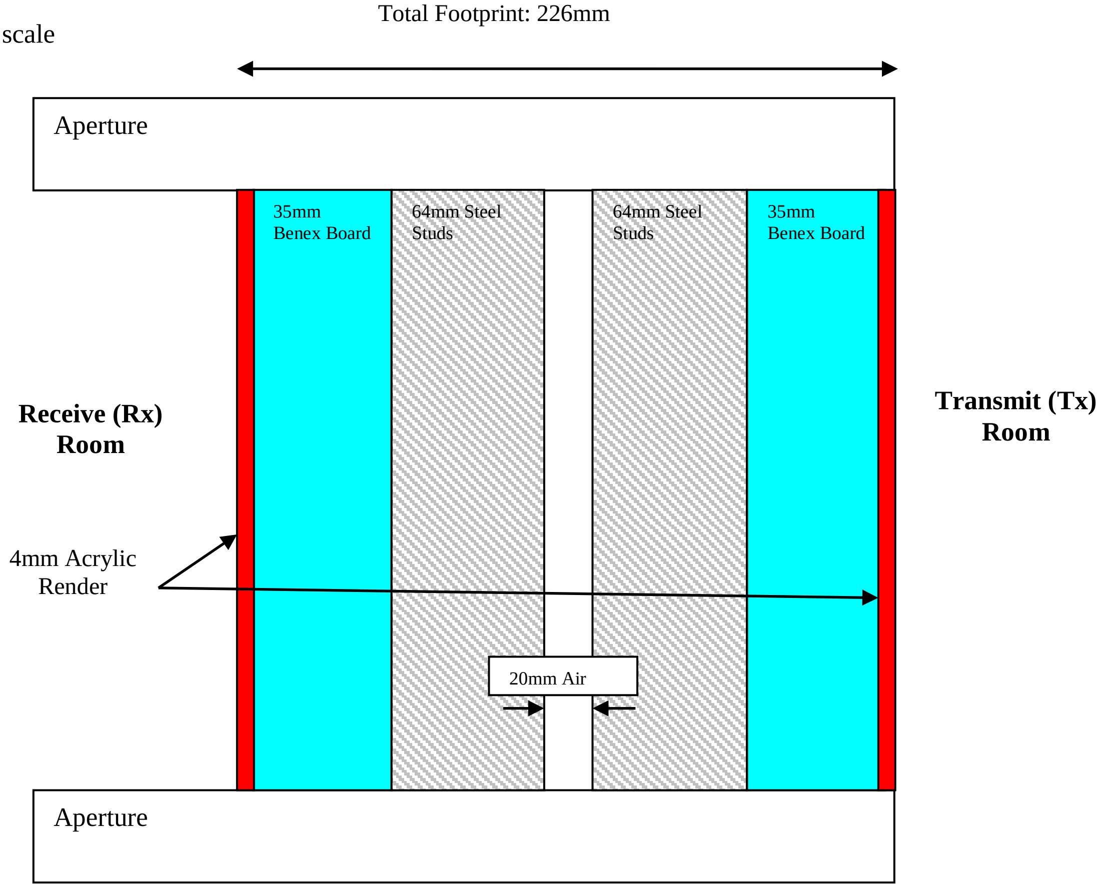


Figure 1: 35mm Benex Panel surface detail – Left: Core detail, Right: exposed surface detail.

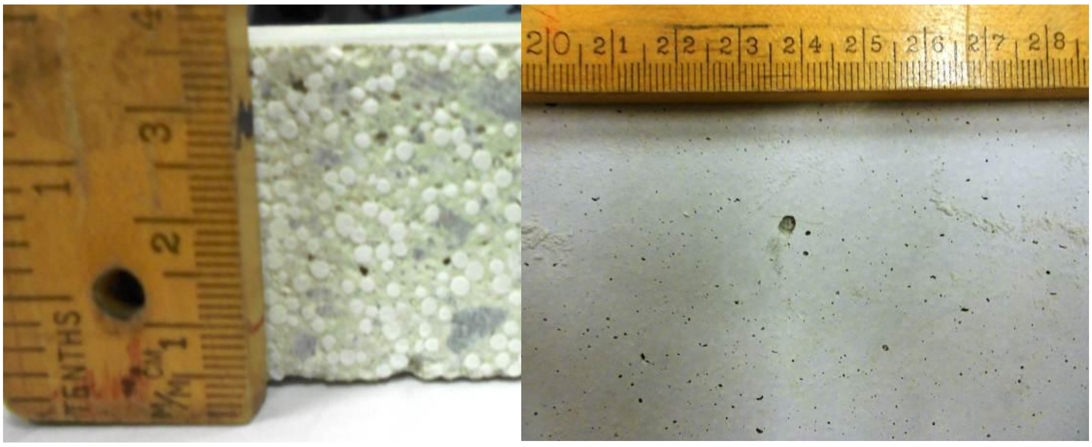


Figure 2: 226mm Footprint Rendered 35mm Benex Panel Wall System built into the Test Aperture for testing as seen from the Send Room.

Figure 3: 226mm Footprint Rendered 35mm Benex Panel Wall System built into the Test Aperture for testing as seen from the Receive Room.

3. RESULTS

The measured airborne sound transmission loss, R (dB), at each one-third octave bandwidth of centre frequencies between 100Hz – 5000Hz is given in tabular form to the nearest decibel. The Weighted Sound Reduction Index (R_w) reference curve, in each one-third octave bandwidth of centre frequencies between 100Hz and 3150Hz are expressed in tabular form and are also represented graphically for the sample tested. There are no significant errors in transmission loss values due to flanking transmission, filler wall or background noise. The Weighted Sound Reduction Index of the sample is determined in accordance with AS/NZS ISO 717.1-2004.

The precision in the results is expressed as the 95% confidence interval in the determined sound transmission loss. The K value used to determine the 95% confidence interval is 2.365. This interval is estimated from the 95% confidence interval in each of the average source room level, the average receiving room level and the receiving room absorption/surface area of sample. These values are included in the table of results.

6.1 Sample **-** Test Conditions

Temperature:	Receive Room	: 20.1 ^{0}C.
	Send Room	: 21.0 ^{0}C.
Humidity:	Receive Room	: 52%.
	Send Room	: 50%.
Sample Surface Area:	10.69 m^2	
Room Volumes:	Receive Room	: 120.34 m^3.
	Send Room	: 114.66 m^3.

6.2 Sound Transmission Loss Results and Weighted Sound Reduction Index R_w:

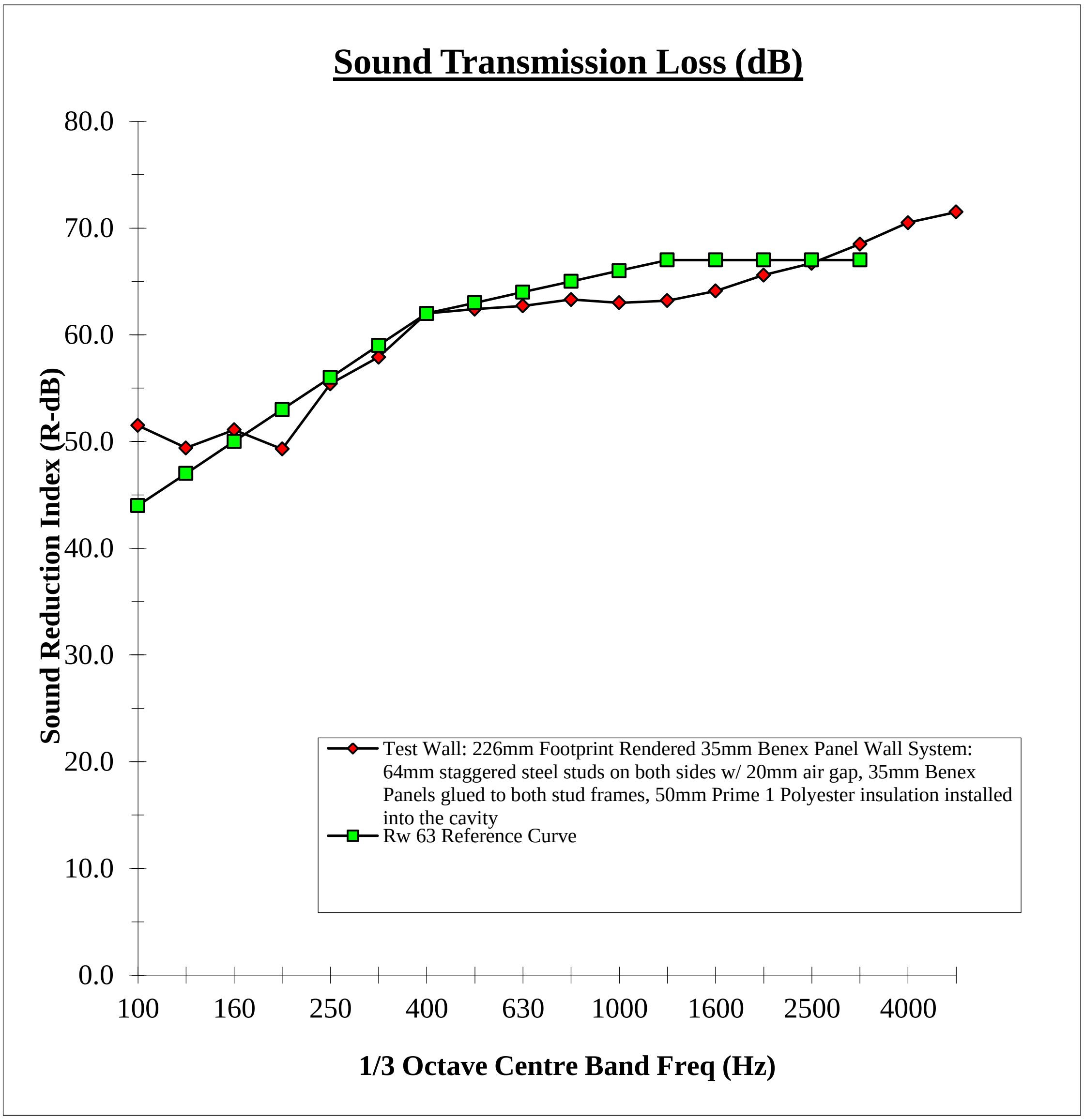
The Weighted Sound Reduction Index of the test sample is: $R_w(C; C_{tr})$ = 63(-1; -4) dB.

Based on laboratory measurements. Rating determined in accordance with AS/NZS ISO 717.1-2004

Table I: Table of results for 226mm Footprint Rendered 35mm Benex Panel Wall System.

1/3 Octave Centre Frequency Hz	Sound Transmission Loss : R dB	R_w 63 Reference Curve	95% Confidence levels, dB.
100	51.5	44	2.7
125	49.4	47	2.8
160	51.1	50	2.2
200	49.3	53	1.5
250	55.4	56	1.4
315	57.9	59	1.1
400	62.0	62	1.1
500	62.4	63	0.6
630	62.7	64	0.7
800	63.3	65	0.6
1000	63.0	66	0.5
1250	63.2	67	0.7
1600	64.1	67	0.4
2000	65.6	67	0.6
2500	66.7	67	0.5
3150	68.5	67	0.4
4000	70.5	-	0.6
5000	71.5	-	0.7

Chart 1: Graph of results for 226mm Footprint Rendered 35mm Benex Panel Wall System.



<u>Appendix 1:</u> 226mm Footprint Rendered 35mm Benex Panel Wall System – Client Schematic Diagram