RMIT UNIVERSITY

REPORT ON THE DETERMINATION OF AIRBORNE SOUND TRANSMISSION LOSS IN ONE-THIRD OCTAVE BANDS AND WEIGHTED SOUND REDUCTION INDEX (R_w) OF AN 80mm ULTRAPANEL EXTRUDED PANEL CONCRETE WALL

Testing Procedure:	AS 1191-1985
Testing Laboratory:	Acoustic Laboratory RMIT University, Department of Applied Physics Melbourne, Victoria 3000, Australia NATA Accreditation Number 1421
Client:	Ultrapanel Pty. Ltd. Creswick Rd. Ballarat, Victoria Australia, 3350
Date of Test:	18th October 2000
Date of Report:	16th November 2000
Report Number:	121I/00-046/JW
Testing Officer:	John Watson

NATA

Peter Dale
Approved NATA Signatory

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1. INTRODUCTION

The test described in this report was carried out at the request of Ultrapanel Pty. Ltd. on the 18th of October 2000 to determine the airborne sound transmission loss and the weighted sound transmission index (R_w) of an Ultrapanel extruded panel concrete wall as specified in AS 1276.1:1999 Acoustics – Rating of sound insulation in buildings and of building elements, Part I: Airborne Sound Insulation.

The test has been carried out using the pair of sound transmission rooms of the Department of Applied Physics, The Royal Melbourne Institute of Technology Limited. 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 1191-1985, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. The measuring facilities and method have been registered for certification by the National Association of Testing Authorities, Australia (NATA) Registration No. 1421, and testing has been conducted fully in accordance with those terms of registration.

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. PROCEDURES

Testing has been conducted in accordance with the methods of AS 1191-1985 - 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 100 to 5000 hertz, the mean sound pressure level in each room is found by the use of a microphone connected to a Bruel & Kjaer 2133 real time analyzer. Six independent locations of the microphone are used in each room, with the signals temporally averaged for the sampling time of 128 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. Six microphone positions are chosen, with six decays obtained at each position, between 100 and 5000 hertz. The microphone signal is relayed via a microphone amplifier, to a Bruel & Kjaer 2133 Real Time Analyzer. The analyzer 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 1045.

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

4. SAMPLE DESCRIPTION.

The test specimen is a single layer, 80 mm thick wall consisting of Ultrapanel extruded cellulose fibre-reinforced concrete panels. Appendix I contains a schematic diagram for the cross-section of an Ultrapanel extruded cellulose fibre-reinforced concrete panel, as supplied by the client. The wall was installed using wooden skirting on both sides of the wall. The wood occupied negligible relevant surface area on both the send and receive sides of the sample. The panels were fastened together using steel reinforced mortar joint and set flush with elastomeric acrylic.

Construction Material:	Extruded cellulose fibre-reinforced concrete
Dimensions of Sample:	3.750 x 2.850 m
Size of sample including frame:	10.69 m^2
Nominal surface density:	52 kg/m^2.
Sample wall thickness:	80 mm.

5. RESULTS

The measured airborne sound transmission loss, R dB, at each one-third octave bandwidth of centre frequencies between 100 – 5000 Hz 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 100 and 3150 hertz 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 1276.1-1999.

The precision in the results is expressed as the 95% confidence interval in the determined sound transmission loss. This interval is estimated from the 95% confidence interval in each of the source room levels, the receiving room levels and the receiving room reverberation times. These values are included in the table of results.

Sample - Test Conditions

Temperature:	Receive Room	: 18.5 ^{0}C
	Send Room	: 18.5 ^{0}C
Humidity:	Receive Room	: 65%
	Send Room	: 64%
Room Volumes	Receive room	: 119.90 m^3
	Source room	: 116.68 m^3
Date of test	18/10/2000	

Sound Transmission Loss Results and Weighted Sound Reduction Index R_w.

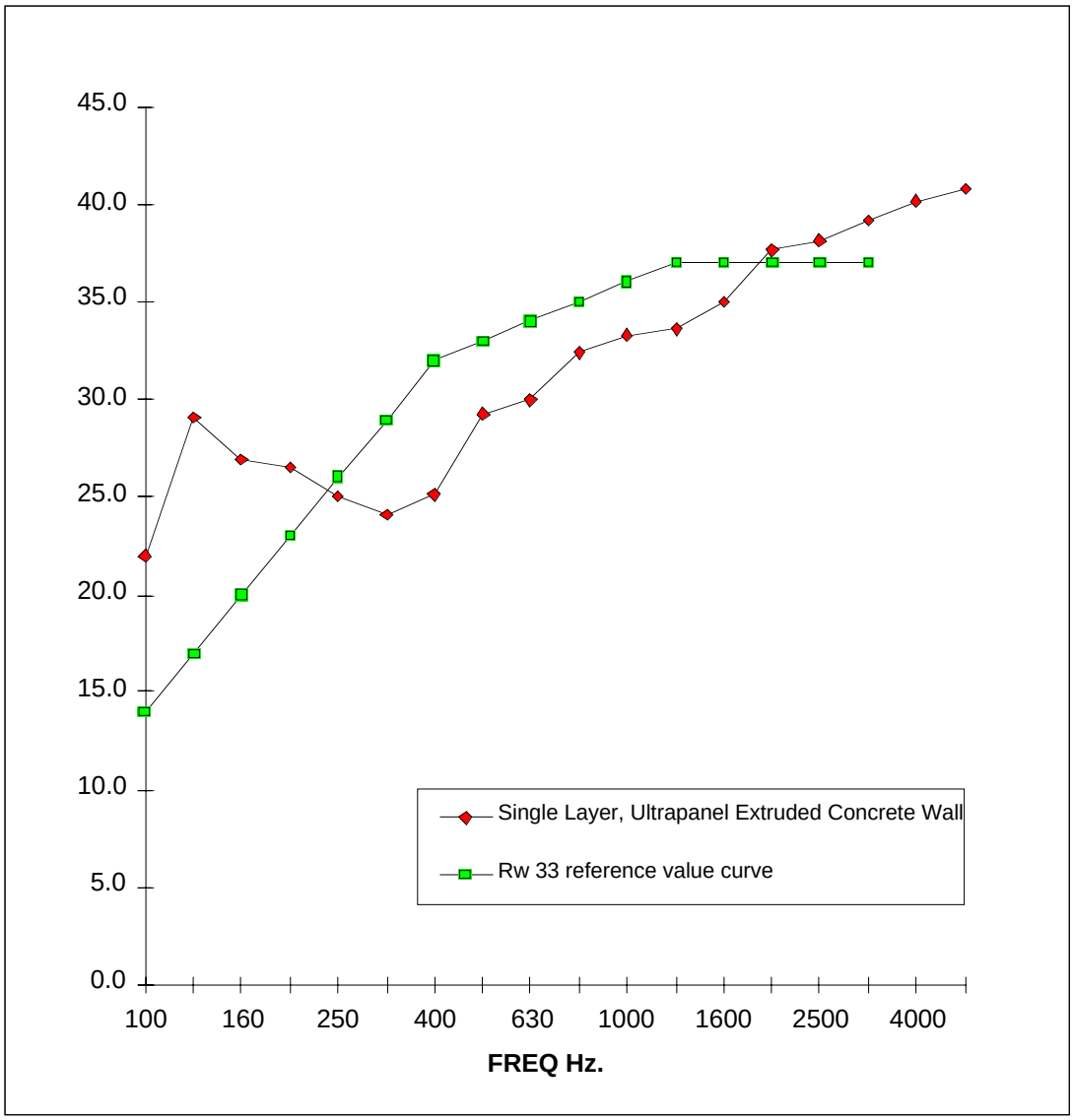
The Weighted Sound Reduction Index of the test wall is $R_w (C;C_{tr}) = 33(-1;-3)$ dB.

Rating determined in accordance with ISO 717 (AS/NZS 1276.1: 1999).

Table I: Based on laboratory measurements, table of results for an Ultrapanel extruded panel concrete wall.

1/3 Octave Centre Frequency Hz	Sound Transmission Loss : R dB	R_w 33 Reference Curve	95% Confidence levels, dB.
100	22	14	5.3
125	29	17	2.8
160	27	20	1.9
200	27	23	1.7
250	25	26	1.9
315	24	29	0.8
400	25	32	0.9
500	29	33	0.8
630	30	34	0.7
800	32	35	0.8
1000	33	36	0.6
1250	34	37	0.6
1600	35	37	0.5
2000	38	37	1.0
2500	38	37	0.6
3150	39	37	0.8
4000	40	-	0.8
5000	41	-	0.8

Chart I: Graph of results for an Ultrapanel extruded panel concrete wall.



Appendix I: Cross-section of an Ultrapanel extruded cellulose fibre-reinforced concrete panels as supplied by client