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BER SCHOOL PROJECTS

SOUND ABSORPTION TEST OF VARIOUS PERFORATED MATERIALS

TE601-01F04 (REV 0) SOUND ABSORPTION LABORATORY REPORT - 5MM CIRCULAR PERFORATION.DOC

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1 INTRODUCTION

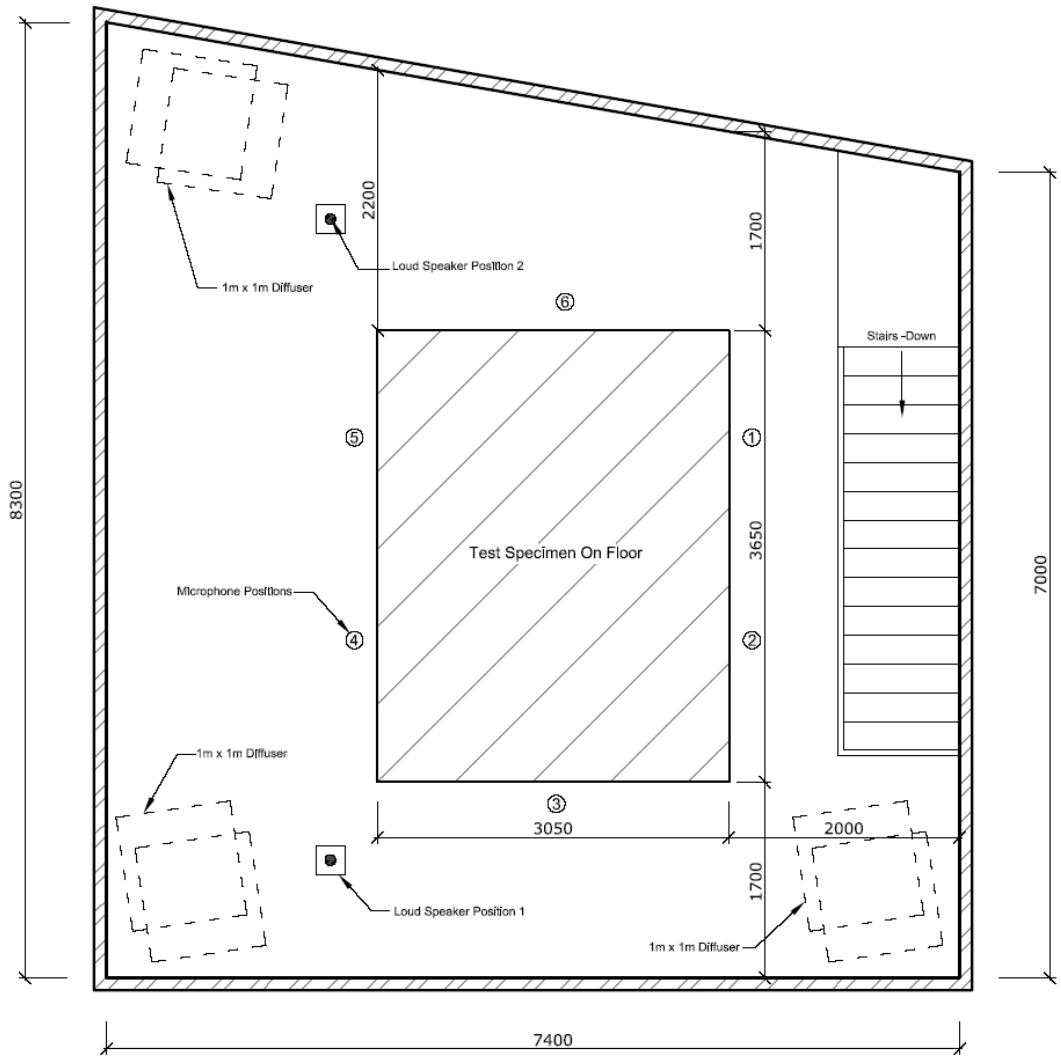
Renzo Tonin & Associates was engaged to conduct sound absorption testing of perforated plasterboard and fibre cement sheeting with polyester insulation backing. The acoustic tests were carried in the reverberation chamber of the Boral laboratory at Prospect on the 18/09/2009. This report described the test specimens, its installation methods, measurement results and calculated sound absorption coefficients in accordance to the AS ISO standard 354-2066 & ISO 9613-1. In addition the noise reduction coefficient NRC of the test sample is computed in accordance to ASTM C423-08a.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 REVERBERATION CHAMBER AND TEST SPECIMENS

2.1 Reverberation Chamber

The Boral reverberation chamber is approximately rectangular in shape with one edge wider than the other by 1.3m. The test room has a set of two 1 x 1 m plywood diffuser panels at three corners of the room and access door/stairs on the fourth corner. Figure 1 below shows the dimensions of the chamber, locations of the fixed microphone position and sound source.



Plan View of Test Room

Notes: ① to ⑥ Measurement Microphone Position at 1.5m Above Floor

Loud Speaker Location

Height of Test Room is 3.9m

Figure 1 - Boral Reverberation Chamber Dimensions

Test Room Volume	**V** = 211.8m^3
Test Room Surface Area (walls, floor and ceiling)	$\mathbf{S_t}$ = 223 m^2

2.2 Test Specimens Installation Method

The perforated specimen was tested in the Boral reverberation chamber. The specimen was seated on the ledge of a 3m x 3.65m timber frame approximately on centre of the test room floor. The timber frame provided the specified 50mm cavity between the test room floor and inner surface of the specimen. 75mm thick Polymax Prime polyester insulation compressed and installed in this cavity. Edges between specimen panels and timber frame were taped with duct tape, and caulking was applied to the outer edge of the timber frame where it rests on the concrete floor.

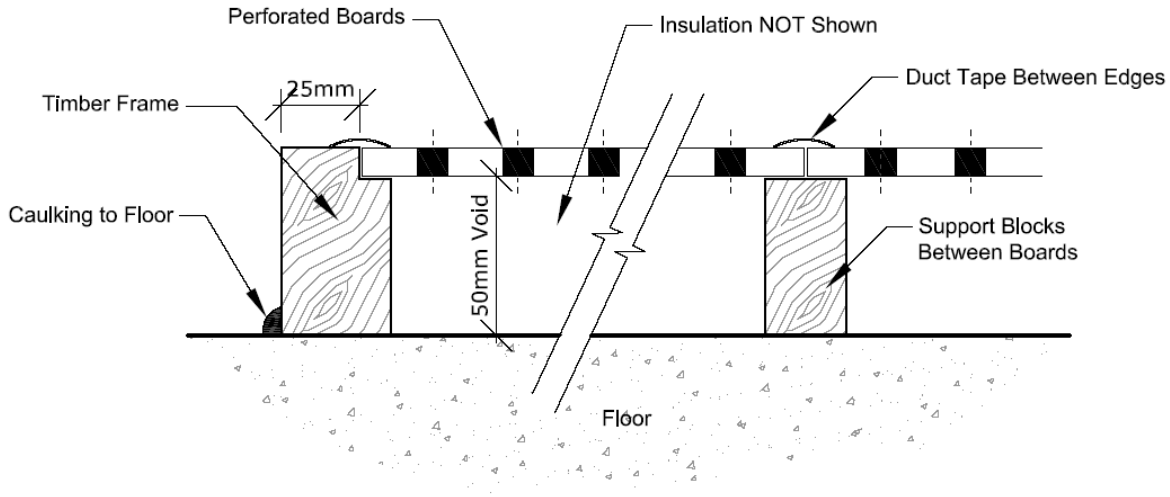


Figure 2 – Sectional View Showing Specimen Mounting Method

Surface area of each test specimen (excluding timber frame) **S** = 10.8m^2

Air plenum between specimen inner surface and floor **h** = 50mm

2.3 Test Specimen

6mm thick fibre cement sheeting with 5mm circular perforation. 75mm thick Polymax Prime polyester insulation was compress and fitted in the 50mm air plenum between specimen and floor. The sample consists of three panels of 1.2m x 2.4m and three of panels 1.2m x 0.6m perforated boards.

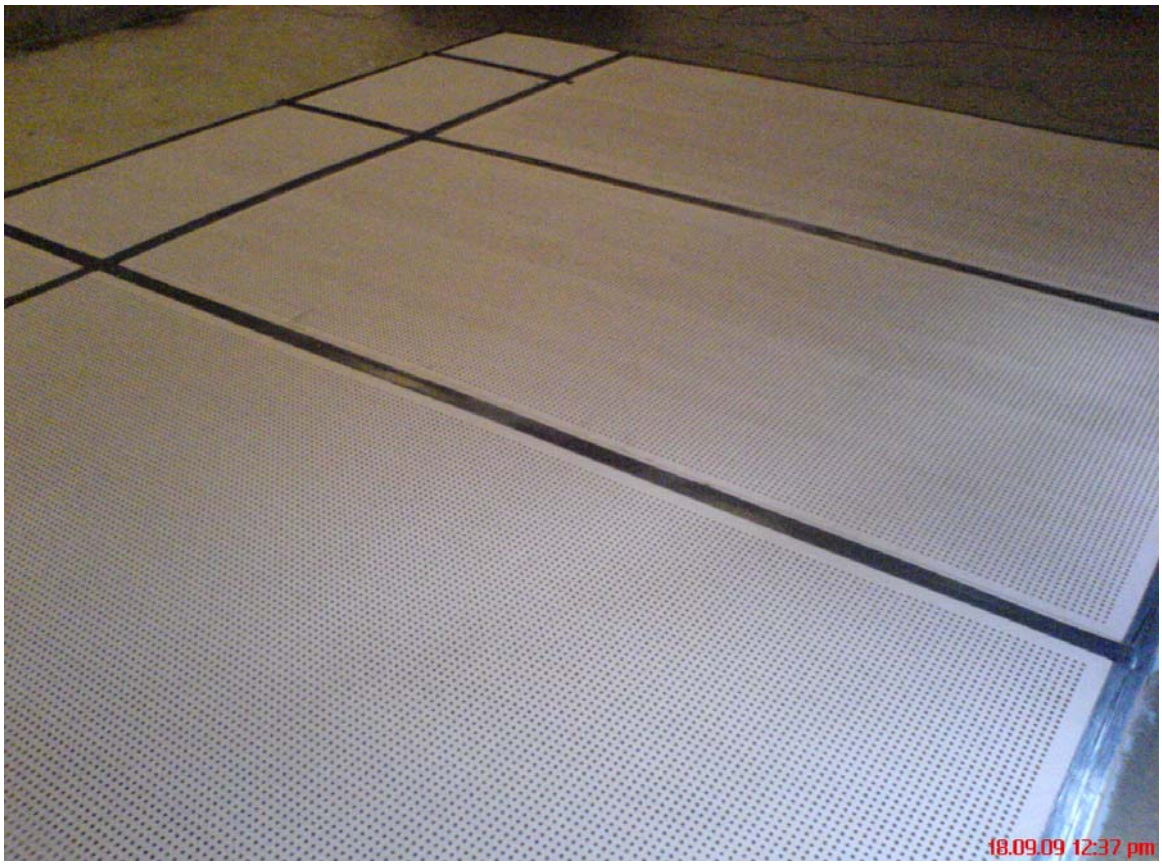


Figure 3 – Sample 2, 5mm round perforated fibre cement sheeting installed on test room floor

3 RESULTS

The measured reverberation times of the empty room (T_1) and room with absorptive specimen installed (T_2) is shown in Table 1 . The sound absorption coefficient, α, of test specimen is calculated in accordance to AS ISO 354-2006 & ISO 9613-1 from difference in measured reverberation time. These results and its 95% Confidence Interval are also tabulated in these tables.

Table 1 – Reverberation Time and Sound Absorption Coefficient of Test Sample (5mm round perforated fibre cement sheeting, 50mm plenum with 75mm thick Polymax Prime polyester insulation)

Frequency Band, Hz	Average Reverberation Time of Empty Room, T_1	Average Reverberation Time of Room with Test Sample, T_2	Sound Absorption Coefficient, α	95% Confidence Interval, α
100	7.23	5.4	0.15	0.07
125	7.6	4.7	0.26	0.05
160	7.96	4.23	0.35	0.06
200	7.09	3.37	0.50	0.04
250	5.79	2.7	0.63	0.03
315	5.42	2.24	0.83	0.05
400	4.48	1.92	0.94	0.02
500	3.84	1.72	1.02	0.01
630	3.26	1.61	1.00	0.02
800	3.06	1.65	0.89	0.01
1000	2.85	1.65	0.81	0.01
1250	2.63	1.68	0.69	0.01
1600	2.6	1.75	0.59	0.01
2000	2.49	1.76	0.53	0.01
2500	2.31	1.66	0.54	0.01
3150	2.07	1.48	0.61	0.01
4000	1.82	1.38	0.56	0.01
5000	1.64	1.30	0.50	0.01

Notes:

1. Average Reverberation Time is arithmetic average of measured reverberation time inside laboratory test room

2. .Sound Absorption Coefficient is calculated accordance to AS ISO 354-2006 & ISO 9613-1

3. NRC calculated in accordance ASTM C423-08a - arithmetic average of sound absorption coefficient at 100, 250, 500, 1000 & 2000Hz

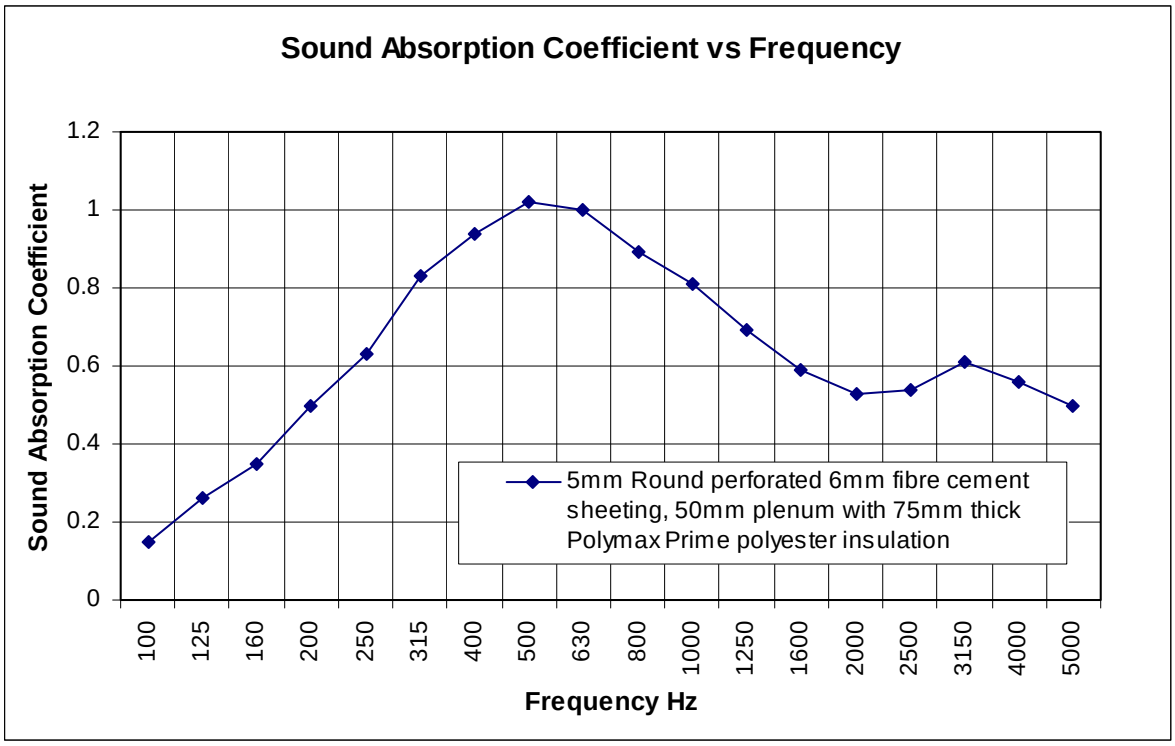


Figure 4 - Reverberation Time and Sound Absorption Coefficient of Sample 2

The Practical Sound Absorption Coefficient of the test sample in octave band frequencies are shown in Table 2 below.

Table 2 – Practical Sound Absorption Coefficient in Octave Band Frequency

Frequency Band, Hz	125	250	500	1000	2000	4000
Practical Sound Absorption Coefficient, α_s	0.25	0.65	1.00	0.80	0.55	0.55

The Noise Reduction Coefficient (**NRC**) of test sample in accordance with ASTM C423-8a is **0.75**

The atmospheric conditions of the reverberation chamber during the tests were:

Table 3 – Test Conditions

	Test Room Conditions		
	Empty	Sample 1 Installed	Sample 2 Installed
Air temperature	18.4 °C	18.7 °C	19.3 °C
Relative Humidity	84 %	89 %	86 %