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Equivalent Sound Absorption Area of Hush Light Round

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ABSTRACT Measurement of the equivalent sound absorption area of Hush Light Round in the University of Canterbury's reverberation room.		
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1. Introduction

The tests described in this report were conducted on the 27th of August, 2014. The tests were performed at the request of IQ Commercial to determine the equivalent sound absorption area of a sample of Hush Light Round.

The tests were carried out following the interrupted noise technique outlined in ISO 354: 2003 *Acoustics -- Measurement of sound absorption in a reverberation room*. The tests were carried out in the reverberation room of the Department of Mechanical Engineering, University of Canterbury.

2. Test Facilities and Procedures

2.1. Facilities

The reverberation room has a right-angled trapezoidal plan with diffusers and structural beams as shown in Figure 1.

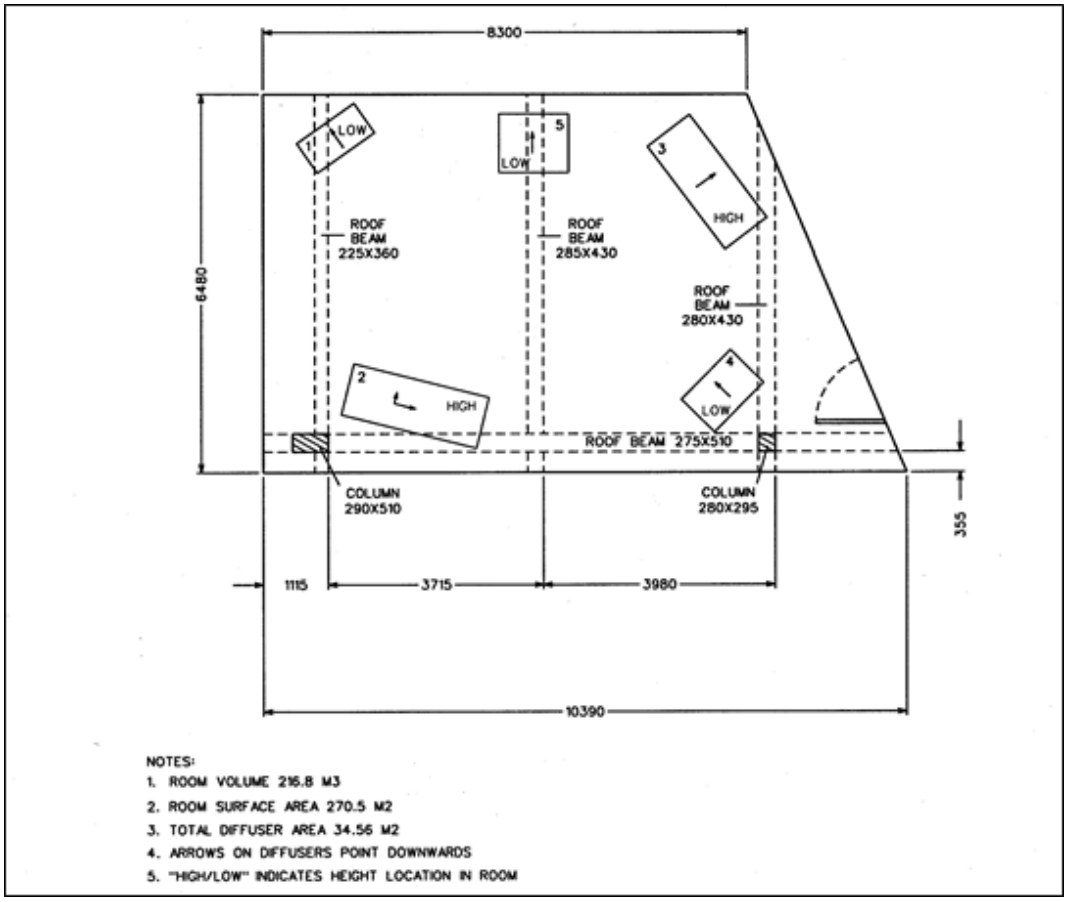

Figure 1: Reverberation room layout

No two room dimensions are equal or in the ratio of small whole numbers. The volume of the room is 216.8 m^3. A sufficiently diffuse sound field is established by the inclusion of 5 stationary diffusing panels of galvanized steel faced medium density fibreboard, each of one-sided area of 2.88m^2 and suspended with random orientation. The total two-sided area of the diffusing elements is 0.13 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 305.06 m^2.

2.2. Generation of the sound field

The test signals used were random pink noise, band limited to a frequency range of 100Hz to 5000Hz and were generated by a Brüel & Kjær PULSE Multi Analyser System. Two individual loudspeaker positions were used to excite the sound field in the reverberation chamber. The signal was fed to each loudspeaker position in turn.

2.3. Receipt of signals

The sound field was measured using six microphones connected to a Brüel & Kjær PULSE Multi Analyser System. The reverberation times were determined for the empty room and for the room containing the test specimen. This was achieved by analysis of three decays of the sound field in twelve statistically independent microphone/loudspeaker configurations, giving 36 decays for each frequency band.

The frequency band decay data was exported onto a personal computer where it was analysed with a program that allowed the determination of the reverberation time from the sound decays.

2.4. Location of sample in the reverberation room

Figure 2 shows the approximate location of the sample in the reverberation room.

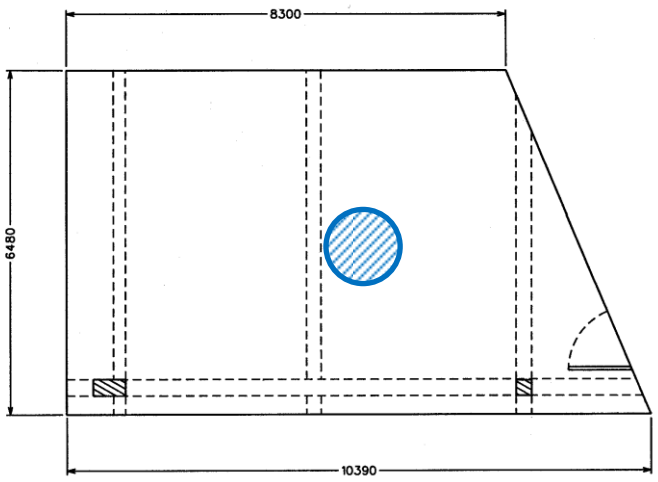

Figure 2: Location of sample in the reverberation room

3. Description of Sample

Sample: Hush Light Round

Material:	Polyester fibre
Object dimensions:	Diameter = 1400mm, height = 650mm
Colour:	White

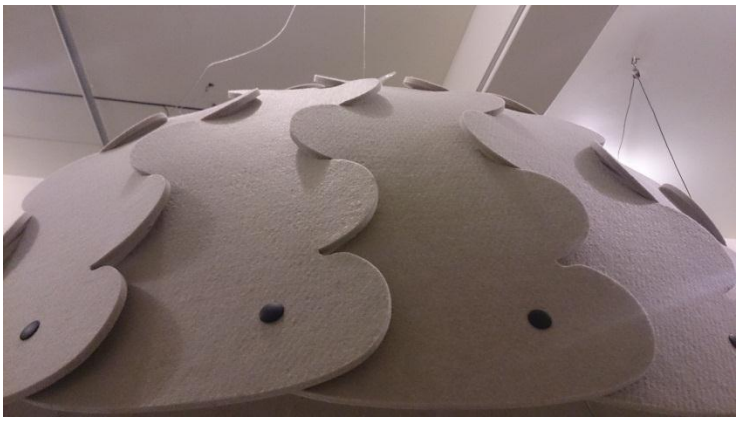

Figure 3: Surface detail of Hush Light Round

The sample tested consisted of twenty interlocking fibre panels, centred on a reinforcing plate. Lights were housed flush with the base of the plate and the metal cable used to hang the light was attached to the centre of the plate. The underside of the sample is shown in Figure 4.

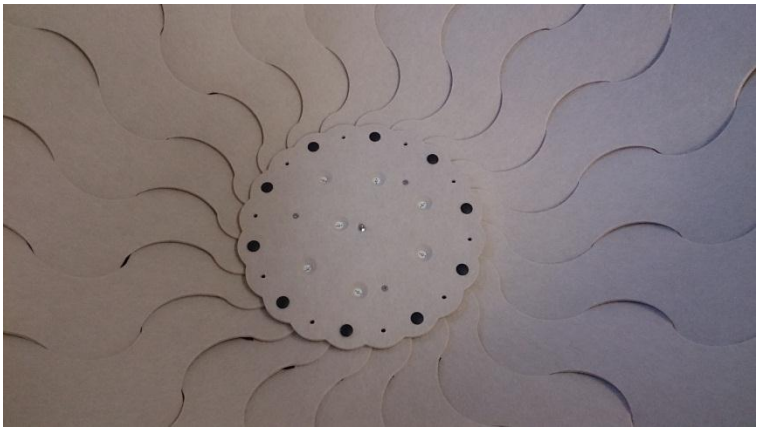

Figure 4: Underside detail of Hush Light Round

The sample was tested suspended from the ceiling of the reverberation room. The bottom edge of the light was located 1800mm above the floor of the reverberation room as shown in Figure 5.

Figure 5: Hush Light Round installed in the reverberation room

4. Results

The mean reverberation times at each frequency for the empty room, $T60_{empty}$, the room with the sample installed, $T60_{empty+sample}$, the equivalent sound absorption area, A_{obj}, and the 95% confidence interval are provided in Table 1. The results for equivalent absorption area are rounded to 0.1m^2. The 95% confidence interval for each frequency was determined from the standard deviation of the equivalent absorption area found at each of the measurement locations.

The results for the sample are detailed in Table 1 and Figure 6.

4.1. Test conditions

Empty Room	Air Temperature	18.1°C
	Relative Humidity	55.2%
	Barometric Pressure	103.12 kPa
Room with Sample	Air Temperature	17.0°C
	Relative Humidity	57.5%
	Barometric Pressure	103.14 kPa

Table 1: Test room reverberation times and equivalent absorption area of Hush Light Round.

⅓ Octave band centre frequency (Hz)	Average RT's for empty room $T60_{empty}$ (s)	Average RT's for room with sample $T60_{empty+sample}$ (s)	Equivalent sound absorption area A_{obj} (m^2)	95% Confidence interval for A_{obj}
100	6.254	6.382	0.0	0.74
125	6.206	5.377	0.9	0.48
160	7.643	6.516	0.8	0.16
200	8.065	6.503	1.1	0.20
250	8.503	6.601	1.2	0.10
315	9.102	6.580	1.5	0.23
400	8.172	6.173	1.4	0.09
500	7.637	5.643	1.6	0.20
630	6.706	5.037	1.8	0.15
800	6.369	4.617	2.1	0.21
1000	5.999	4.369	2.2	0.14
1250	5.343	3.899	2.5	0.23
1600	4.556	3.398	2.7	0.14
2000	4.243	3.161	2.9	0.16
2500	3.959	2.931	3.1	0.16
3150	3.476	2.625	3.3	0.20
4000	2.959	2.279	3.6	0.13
5000	2.409	1.930	3.7	0.35

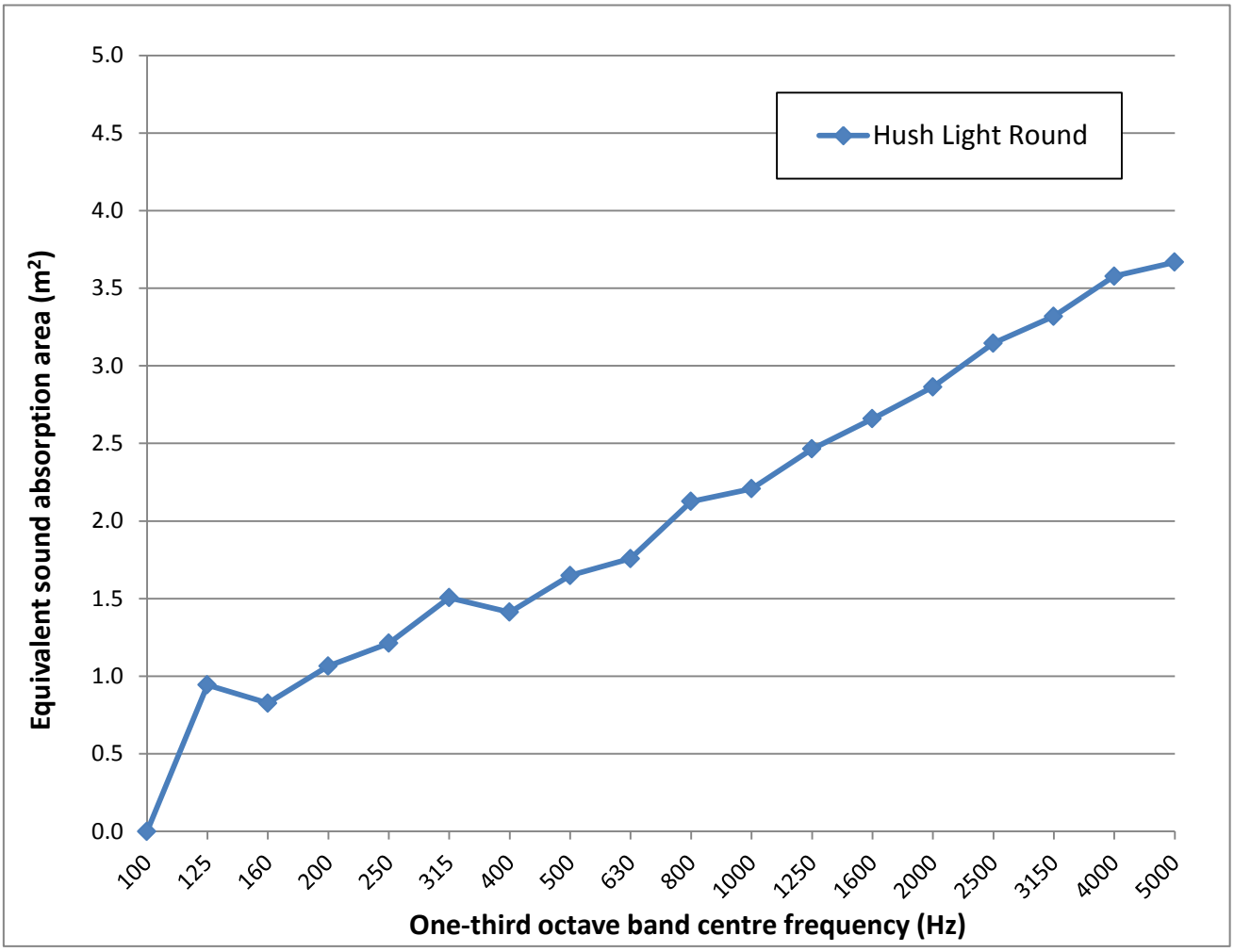

Figure 6: Equivalent sound absorption area of Hush Light Round

4.2. Remarks

The determined test results only refer to the test specimens and prevailing conditions on the day of the measurements.