LBP|SIGHT

Laboratory measurements for

Bowiq Benelux BV

BoSpray absorption measurements

Commissioning party
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Appendices

1 Introduction

Measurements were performed with regard to the acoustic absorption of the BoSpray material. The measurements were performed in the Kees van Dorsser laboratory reverberation room located at Neherkade 1, The Hague, the Netherlands.
The aim of the measurements was to determine the acoustic absorption coefficient of different types of BoSpray in different thicknesses used on a load-bearing surface.

The performed measurements and the measurement results are elaborated in this report.

2 Product description

BoSpray is an acoustic spray Cellulose that can be applied on load-bearing backgrounds such as walls and ceilings. In this case, the BoSpray material has been applied in accordance with the instructions of the manufacturer on the plasterboard (12.5 mm plasterboard thickness).

For the test, the spray Cellulose was applied well before the measurements were taken on the plasterboard as the base of the Cellulose plaster. These plasterboards have dimensions of 1.5 m by 1.0 m.
The reason being that the material must dry out sufficiently before the measurements are performed so that a good comparison can be made if used in practice.

An overview of the LBP|SIGHT tested variants is given in table 2.1.

Table 2.1

Spray Cellulose type	Thickness of the spray plaster on a plasterboard load-bearing surface
BoSpray	25 mm

3 Measuring set-up

A set-up was created for each variant with a total area of 12 m^2. The spray Cellulose has been applied well before the measurements were taken on a plasterboard load-bearing surface. This concerns 8 plasterboards with a thickness of 12.5 mm and dimensions of 1.5 m by 1.0 m. These plasterboards will be positioned on another layer of plasterboards that also have a thickness of 12.5 mm that lay on the laboratory floor as a matrix. The total thickness of the load-bearing surface is 25 mm. We expect that these load-bearing layers will not have a relevant impact on the absorption measurements.

The boards were positioned one next to each other in a rectangle basically diagonally flat on the concrete floor of the reverberation room and provided with a framework. This timber framework that protected all of the sides was structured using a timber frame with a thickness of 32 mm and a height of 70 mm. Photos are included in figures I.1 to I.2 of appendix I of the structure of the measuring set-up.

Please refer to appendix II for a description of the reverberation room and the used measuring equipment.

4 Measurement results

The measurements of the acoustic absorption were performed in accordance with NEN-EN-ISO 354:2003(E) of 1 July 2003. Please refer to appendix III for a description of the measuring method.

Appendix IV includes the results of the measurements including a graphic representation thereof. Table 4.1 summarizes the results of the measurements.

Table 4.1
Results of the measurements of the acoustic absorption

Plasterboard load bearing surface: 25 mm		Acoustic absorption coefficient [-] per octave band [Hz]						α_w [-]	NRC [-]
	Thickness spray Cellulose	125	250	500	1.000	2.000	4.000		
BoSpray	25 mm	0,20	0,44	0,89	1,01	0,98	0,93	0,7	0,85

The presented results of the measurements of the acoustic absorption apply to the tested samples as described in relation to the measuring set-up.

Acoustic absorption in practice is also influenced by the background on which the material is applied.

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Appendix I.

Measuring set-up photos

Figure I.1

Measuring set-up in the reverberation room

Figure I.2

Detail

Appendix II.

Reverberation room and measuring equipment

Reverberation room

Figure II.1 includes a floor plan of the measurement rooms in the Kees van Dorsser laboratory in The Hague. Measurement room 2, the reverberation room, was used for measuring the acoustic absorption using the reverberation method.

The specifications of measuring room 2 are:
- Height: 5.60 - 6.05 m;
- Floor area: 42 m^2;
- Enclosing area: 240 m^2;
- Empty room volume: 216 m^3.

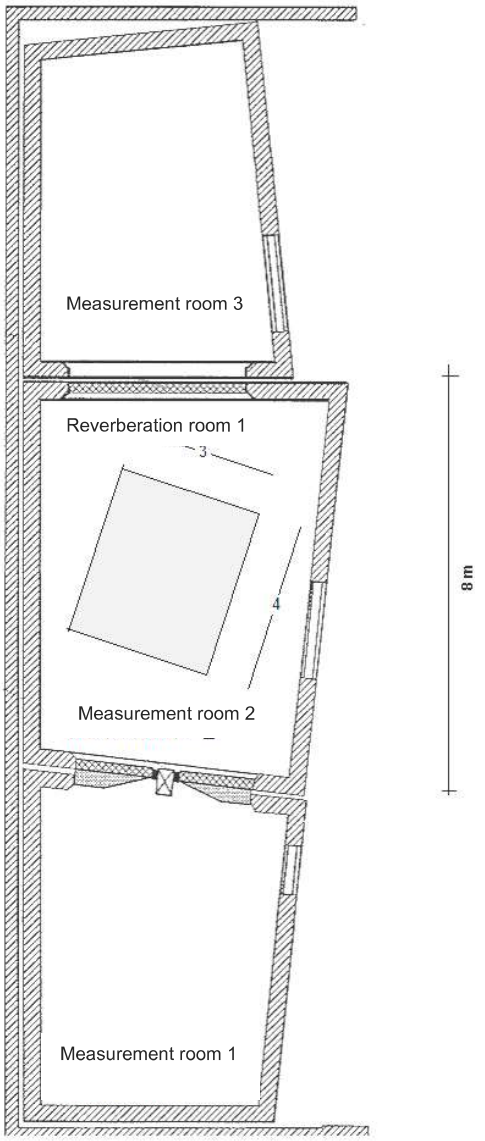


Figure II.1
Floor plan of the measurement rooms in the Kees van Dorsser laboratory with measuring set-up.

Measuring equipment

The following measuring equipment was used for the measurements:

- Brüel & Kjær 1/2" microphones, type 4165.
- Brüel & Kjær real time analyser, type 2131.
- Quad amplifier, type 405.
- Bose speakers, type 802.

Appendix III.

Measuring method

Measurement and calculation results

The acoustic absorption coefficient is determined based on:

$$\alpha_s = \frac{\frac{V_2}{6T_2} - \frac{V_1}{6T_1}}{S}$$

Where:

α_s	=	the acoustic absorption coefficient of the structure to be tested per third-octave band;
V_1	=	the volume of the empty reverberation room in m^3;
V_2	=	the volume of the empty reverberation room with the structure to be tested in m^3;
S	=	the area of the structure to be tested (in this case, 10.5 m^2);
T_1	=	the reverberation time of the empty reverberation room;
T_2	=	the reverberation time of the reverberation room with the structure to be tested.

The empty reverberation room has a volume of 216 m^3. The reverberation room including the structure has a minimum volume of approximately 215 m^3.

In addition to the acoustic absorption coefficient per third octave band, it is the norm to also indicate the one-figure values such as the α_w and NRC.

Acoustic absorption coefficient α_w
The α_w term is one method for expressing the average absorption coefficient of a material.
The weighted acoustic absorption α_w is determined in accordance with the NEN-EN-ISO 11654 standard based on the measurements in accordance with the NEN-EN-ISO 354 standard.

The weighted acoustic absorption α_w is, next, determined by the measured values in octave bands by comparing the medium frequencies 250 to 4,000 Hz with a shifted reference curve where the total of the negative deviations may not be more than 0.10. The value that the shifted reference curve indicates at 500 Hz is α_w rounded off to the closest multiple of 0.05.

Noise Reduction Coefficient
A different term that can be used to express the acoustic absorbing effect of a material is the Noise Reduction Coefficient (NRC). In accordance to the American ASTM C423-09A standard, the NRC can be established by determining the computational average of the octave bands with medium frequencies 250 to 2,000 Hz and rounding the obtained figure off to the closest multiple of 0.0

Appendix IV.

Measurement results

ACOUSTIC ABSORPTION IN ACCORDANCE WITH ISO 354:2003(E) measurement 1

Kees van Dorsser laboratory (LBP|SIGHT)

Commissioning party:	Bowiq Benelux BV	**Framing type**	MDF
Project number:	060906ab	**Area:**	12 m²
Measurement date:	April 20, 2021	**Measurement room volume:**	216 m^3

Structure description: **BoSpray**

Average thickness spray/fibre plaster of 25mm

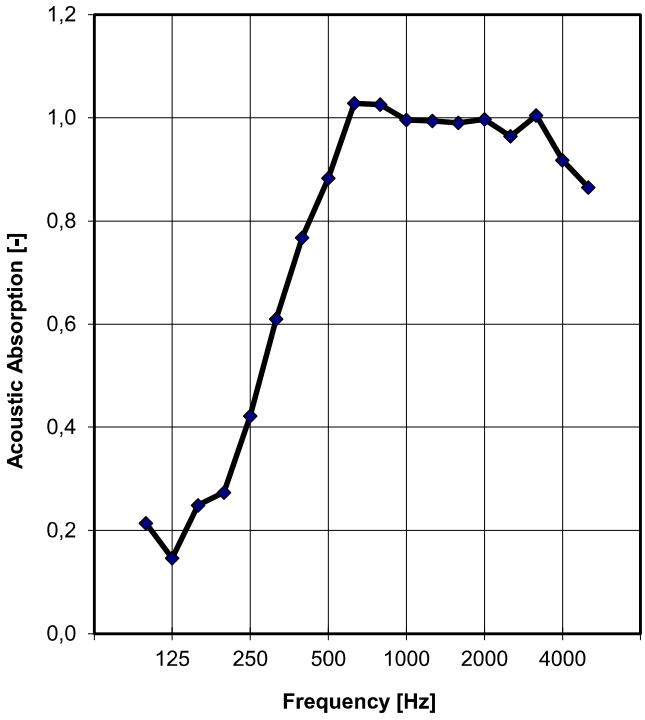
Load-bearing background of plaster

Structure set-up:

Total thickness:	50mm	**Temperature**	16°C
Air gap thickness:	-	**Relative humidity**	60%
Absorption thickness			

Manufacturer Bowiq Benelux BV

Freq	T_{leeg}	T_{vol}	α_s	α_p
100	5,33	3,85	0,21	
125	4,86	3,92	0,15	0,20
160	4,97	3,51	0,25	
200	4,80	3,33	0,27	
250	4,32	2,68	0,42	0,44
315	5,20	2,52	0,61	
400	5,34	2,25	0,77	
500	5,61	2,11	0,88	0,89
630	5,57	1,91	1,03	
800	5,30	1,88	1,03	
1000	5,26	1,91	1,00	1,01
1250	4,95	1,87	0,99	
1600	4,59	1,82	0,99	
2000	4,04	1,72	1,00	0,98
2500	3,40	1,62	0,96	
3150	2,91	1,47	1,00	
4000	2,40	1,38	0,92	0,93
5000	1,89	1,22	0,86	



Designations in accordance with ISO 11654

Weighted sound absorption α_w :	0,7 (MH)	Noise Reduction Coefficient, NRC:	0,85
Sound Absorption Class :	C	Sound Absorption Average, SAA:	0,83

Designations in accordance with ASTM C423-99