627 RIVERBANK DRIVE
GENEVA, IL 60134

630-232-0104

Test Report

www.riverbankacoustics.com

FOUNDED 1918 BY
WALLACE CLEMENT SABINE

SPONSOR: **Carnegie Fabrics**
Rockville Centre,NY

Sound Absorption
RAL™-A24-488

CONDUCTED: 2024-12-17

ON: 3D Hex Clouds (8 objects, 4 rows of 2 objects each, rows spaced 1” apart, objects in rows spaced 1” apart)

TEST METHODOLOGY

Riverbank Acoustical Laboratories™ is accredited by the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) as an ISO 17025:2017 Laboratory (NVLAP Lab Code: 100227-0) and for this test procedure. The test reported in this document conformed explicitly with ASTM C423-23: "Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method." The specimen mounting was performed according to ASTM E795-23: "Standard Practices for Mounting Test Specimens During Sound Absorption Tests." A description of the measurement procedure and room specifications are available upon request. The results presented in this report apply to the sample as received from the test sponsor.

INFORMATION PROVIDED BY SPONSOR

The test specimen was designated by the sponsor as 3D Hex Clouds (8 objects, 4 rows of 2 objects each, rows spaced 1” apart, objects in rows spaced 1” apart). The following nominal product information was provided by the sponsor prior to testing. The accuracy of such sponsor-provided information can affect the validity of the test results.

Product Under Test

Product Name:	3D Hex Clouds
Manufacturer:	Carnegie Fabrics

SPECIMEN MEASUREMENTS & TEST CONDITIONS

Through a full external visual inspection performed on the test specimen, Riverbank personnel verified the following information:

Test Specimen

Product Type:	Baffles (eight objects)
Baffle Size:	911 mm (35.875 in.) distance between opposite corners
Depth:	122 mm (4.8125 in.)
Overall Weight:	17.46 kg (38.5 lbs)

Physical Measurements (per object)

Dimensions:	0.91 m (35.875 in) wide by 0.91 m (35.875 in) long
Thickness:	0.12 m (4.8125 in)
Weight:	2.18 kg (4.81 lbs)

Test Environment

Room Volume:	291.98 m³
Temperature:	21.2 °C ± 0.0 °C (Requirement: ≥ 10 °C and ≤ 5 °C change)
Relative Humidity:	60.2 % ± 0.0 % (Requirement: ≥ 40 % and ≤ 5 % change)
Barometric Pressure:	99.5 kPa (Requirement not defined)

Each sound absorbing object had an exposed surface area of 1.41 m^2 (15.2 ft^2). The total exposed surface area of all sound-absorbing objects was 11.3 m^2 (122 ft^2). These surface area values are based on a simplification of the object geometry to that of the smallest regular hexagonal prism fully enclosing one object.

MOUNTING METHOD

Type JH-MOD Mounting: The specimen is an array of 8 spaced sound absorbing objects suspended from cables such that the closest face is located approximately 1400 mm (55.125 in.) from the horizontal test surface. This approximates the mounting method of a typical ceiling baffle installation. The objects were evenly distributed in a single row, spaced 305 mm (12 in.) on center. The width of the installed object array was 3721 mm (146.5 in.) and the length of the installed object array was 1607 mm (63.25 in.). The area of extended continuous surface attributed to the object array was 6.11 m^2 (65.8 ft^2).

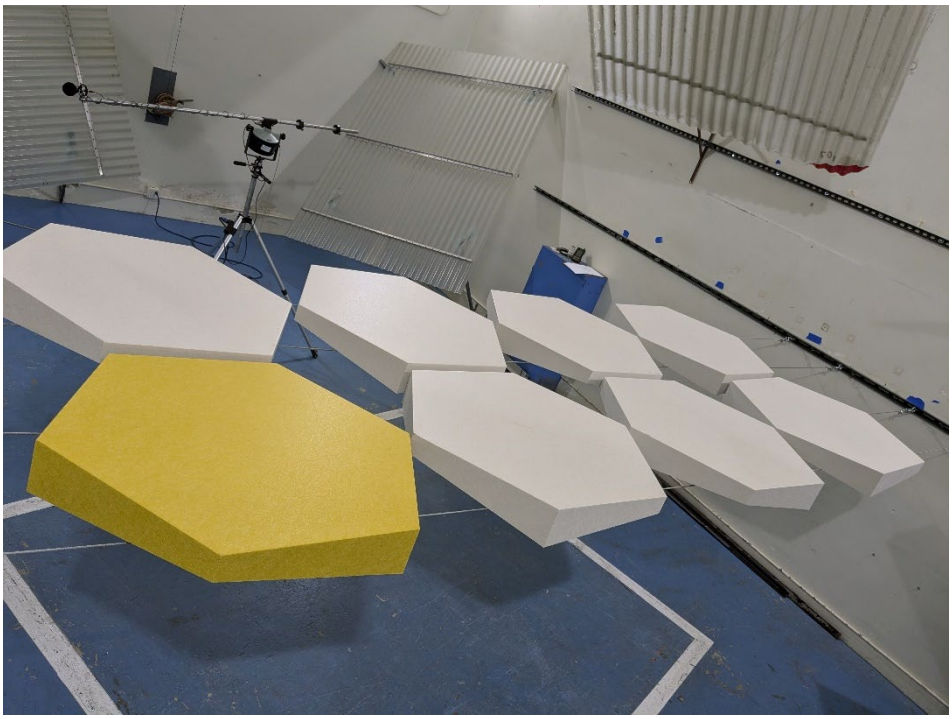

Figure 1 – Specimen mounted in test chamber

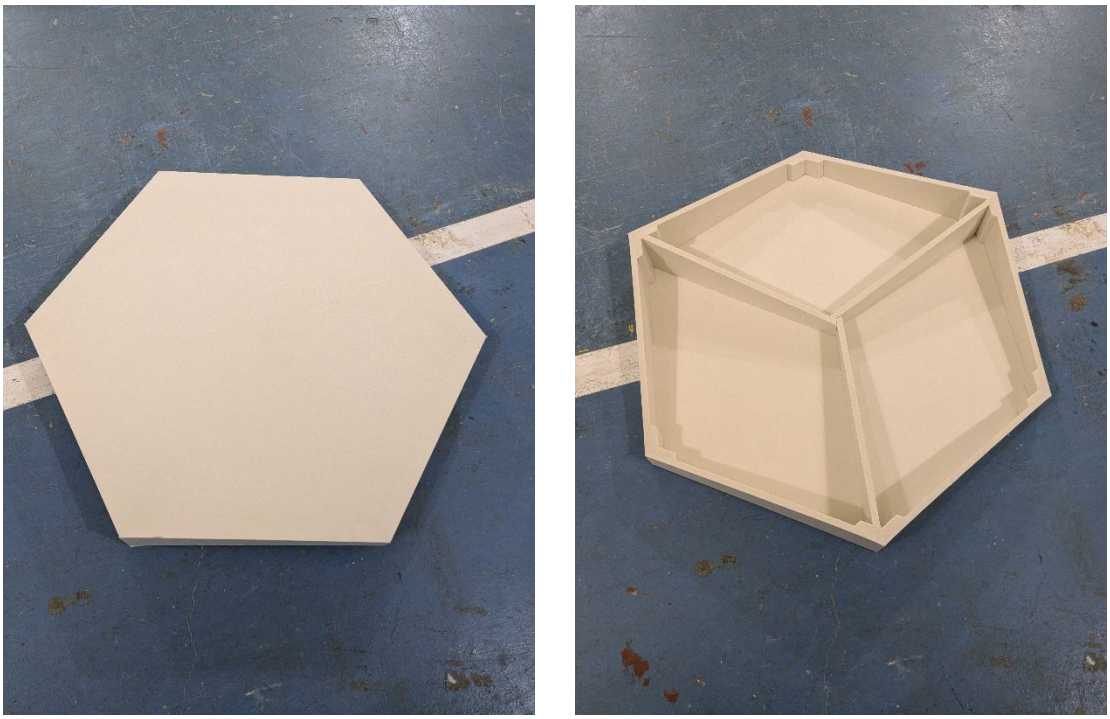

Figure 2 – Individual specimen baffle

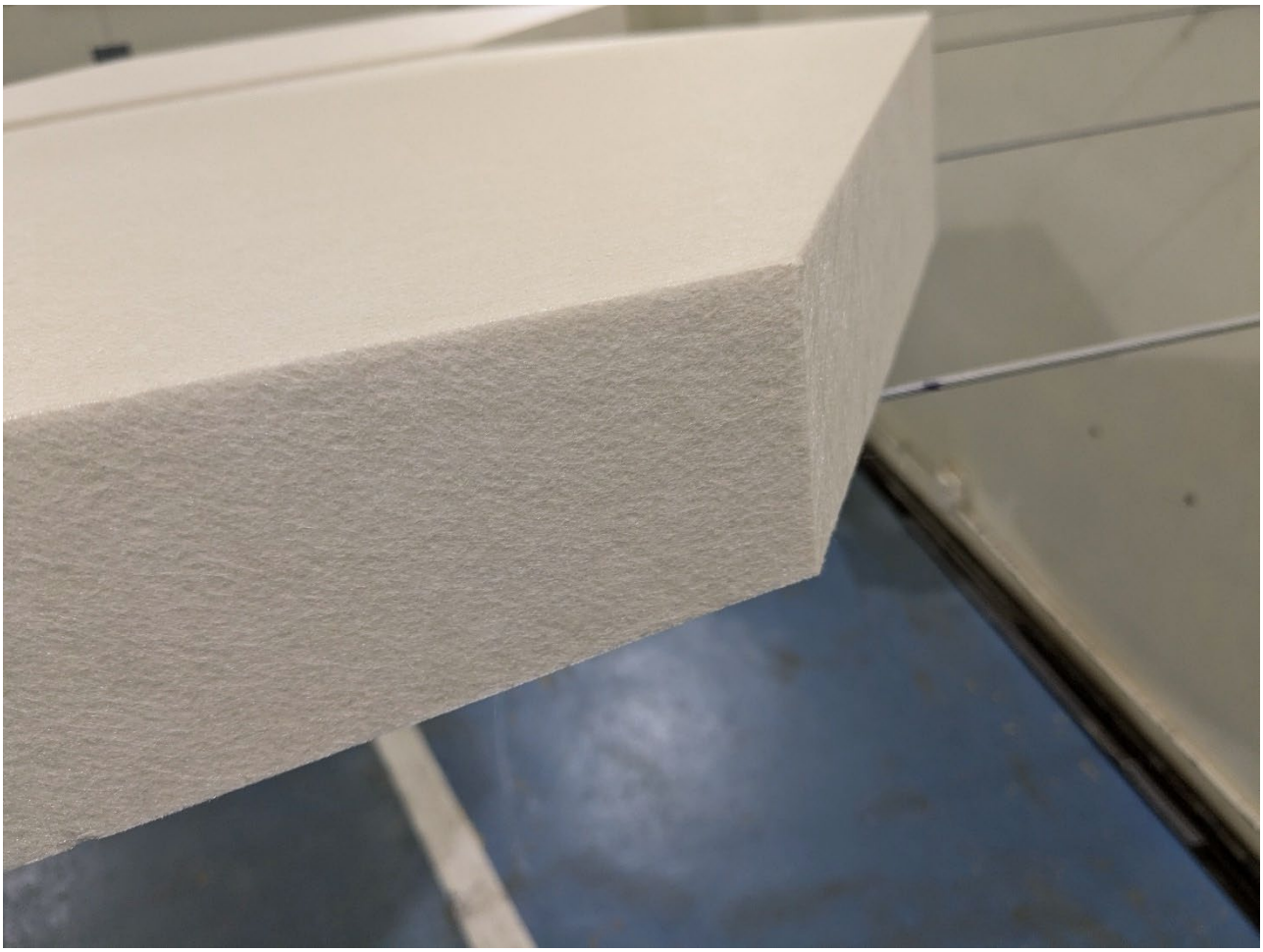

Figure 3 – Detail of baffle material

TEST RESULTS

The preferred presentation of sound absorption test results for arrays of spaced objects is sound absorption (m^2) per object and total sound absorption (m^2) at each one-third-octave band

ASTM C423-23 Appendix X2 allows calculation of sound absorption per m^2 (SA/m^2) based on the projected horizontal surface area attributable to an array of objects. The extended continuous surface area used in this calculation is to be determined using the following procedure:

> $S_{array} = (w + w_1) \times (l + l_1)$ If the set of objects consists of a rectangular array of equal sized objects with equal space between each object in a row and equal space between rows. (ASTM E423-23 X.2.3.1)

Where:
S_{array} = area of extended continuous surface attributed to the test specimen, m^2
w = the measured width of the installed object array, in meters
w_1 = the space between objects in the array along the width, in meters
l = the measured length of the installed object array, in meters
l_1 = the space between objects in the array along the length, in meters

The sound absorption per m^2 (SA/m^2) is calculated based on the following formula:

$$\alpha_{array} = (A_2 - A_1)/S_{array}$$

Where:

α_{array} = sound absorption per m^2 (SA/m^2) of extended continuous surface, no units,
A_1 = absorption of the empty reverberation room, m^2 and
A_2 = absorption of the room after the specimen has been installed, m^2.
S_{array} = area of extended continuous surface attributed to the test specimen, m^2

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TEST RESULTS (continued)

1/3 Octave Center Frequency (Hz)	Total Absorption (m^2)	Total Absorption (Sabins)	Absorption per Object (m^2 / Object)	Absorption per Object (Sabins / Object)	α_{array} (Sabins/ft^2) (SA/m^2)
100	2.49	26.76	0.31	3.35	0.41
** 125	2.36	25.40	0.29	3.18	0.39
160	2.66	28.60	0.33	3.58	0.43
200	3.27	35.21	0.41	4.40	0.53
** 250	3.48	37.44	0.43	4.68	0.57
315	4.56	49.11	0.57	6.14	0.75
400	5.25	56.49	0.66	7.06	0.86
** 500	5.82	62.60	0.73	7.83	0.95
630	6.23	67.04	0.78	8.38	1.02
800	6.78	73.02	0.85	9.13	1.11
** 1000	7.17	77.20	0.90	9.65	1.17
1250	7.56	81.33	0.94	10.17	1.24
1600	7.80	83.99	0.98	10.50	1.28
** 2000	8.25	88.84	1.03	11.11	1.35
2500	8.75	94.20	1.09	11.77	1.43
3150	9.04	97.30	1.13	12.16	1.48
** 4000	9.34	100.56	1.17	12.57	1.53
5000	9.79	105.33	1.22	13.17	1.60

Array-NRC 1.00 over 6.11 m^2 of extended continuous surface area
Array-SAA 1.02 over 6.11 m^2 of extended continuous surface area

Digitally signed by Eric P Wolfram
Date: 2024.12.19 09:53:01 -06'00'

Tested by: Marc Sciaky, *Senior Experimentalist*

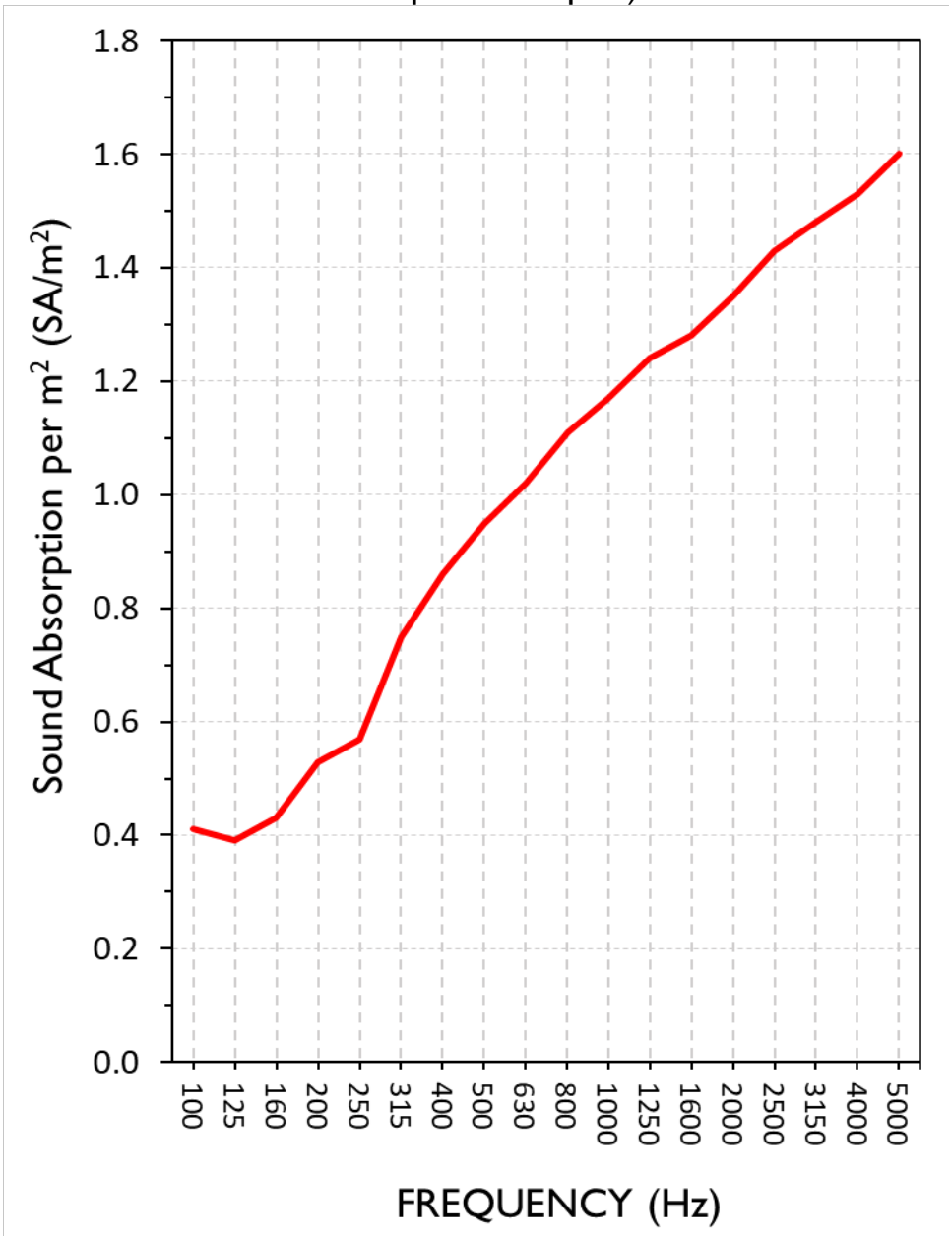
Report by: Keith Kimberling, *Test Engineer*

Approved by: Eric P. Wolfram, *Laboratory Manager*

Note: Sound absorption per m^2 (SA/m^2), and therefore the reported Single Number Ratings, are highly dependent on the exact sample shape, size, spacing, and extended continuous surface area present in the test and subsequent calculations. Changes to any of these parameters will change the resulting values. These presented results are valid only for the specific configuration present in this test.

SOUND ABSORPTION REPORT

3D Hex Clouds (8 objects, 4 rows of 2 objects each, rows spaced 1" apart, objects in rows spaced 1" apart)



Array-NRC 1.00 over 6.11 m^2 of extended continuous surface area
Array-SAA 1.02 over 6.11 m^2 of extended continuous surface area

APPENDIX A: Extended Frequency Range Data

Specimen: 3D Hex Clouds (8 objects, 4 rows of 2 objects each, rows spaced 1" apart, objects in rows spaced 1" apart) (See Full Report)

The following non-accredited data were obtained in accordance with ASTM C423-23, but extend beyond the defined frequency range of 100Hz to 5,000Hz. These unofficial results are representative of the RAL test environment only and intended for research & comparison purposes.

1/3 Octave Band Center Frequency	Total Absorption		Absorption per Object		α_{array} (Sabins/ft^2)
(Hz)	(m^2)	(Sabins)	(m^2 / Object)	(Sabins / Object)	(SA/m^2)
31.5	0.34	3.64	0.04	0.45	0.06
40	-0.23	-2.43	-0.03	-0.30	-0.04
50	4.08	43.89	0.51	5.49	0.67
63	0.21	2.29	0.03	0.29	0.03
80	3.02	32.52	0.38	4.06	0.49
100	2.49	26.76	0.31	3.35	0.41
125	2.36	25.40	0.29	3.18	0.39
160	2.66	28.60	0.33	3.58	0.43
200	3.27	35.21	0.41	4.40	0.53
250	3.48	37.44	0.43	4.68	0.57
315	4.56	49.11	0.57	6.14	0.75
400	5.25	56.49	0.66	7.06	0.86
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800	6.78	73.02	0.85	9.13	1.11
1000	7.17	77.20	0.90	9.65	1.17
1250	7.56	81.33	0.94	10.17	1.24
1600	7.80	83.99	0.98	10.50	1.28
2000	8.25	88.84	1.03	11.11	1.35
2500	8.75	94.20	1.09	11.77	1.43
3150	9.04	97.30	1.13	12.16	1.48
4000	9.34	100.56	1.17	12.57	1.53
5000	9.79	105.33	1.22	13.17	1.60
6300	9.79	105.35	1.22	13.17	1.60
8000	9.51	102.35	1.19	12.79	1.56
10000	9.74	104.88	1.22	13.11	1.59
12500	10.38	111.72	1.30	13.96	1.70

APPENDIX B: Instruments of Traceability

Specimen: 3D Hex Clouds (8 objects, 4 rows of 2 objects each, rows spaced 1" apart, objects in rows spaced 1" apart) (See Full Report)

Description	Model	Serial Number	Date of Certification	Calibration Due
System 1	Type 3160-A-042	3160-106974	2024-08-15	2025-08-15
Bruel & Kjaer Mic And Preamp G	Type 4943-B-001	2525858	2024-05-07	2025-05-07
Bruel & Kjaer Pistonphone	Type 4228	2781248	2024-07-19	2025-07-19
EXTECH Hygro 959	SD700	A099959	2024-03-29	2025-03-29

APPENDIX C: Revisions to Original Test Report

Specimen: 3D Hex Clouds (8 objects, 4 rows of 2 objects each, rows spaced 1" apart, objects in rows spaced 1" apart) (See Full Report)

Date	Revision
2024-12-19	Original report issued

END