SPONSOR: **TURF Design**
Elgin, IL

Sound Absorption
RAL™-A20-108

CONDUCTED: 2020-02-20

ON: Metro (2 panels arranged in single continuous cloud)

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 C423-17: "Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method." The specimen mounting was performed according to ASTM E795-16: "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 Metro (2 panels arranged in single continuous cloud). 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

Trade Name:	Metro
Exposed Surface Area:	5.10 m^2 (54.87 ft^2) per panel
Manufacturer:	TURF Design

SPECIMEN MEASUREMENTS & TEST CONDITIONS

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

Test Specimen

Materials:	Notched and folded semirigid felt paneling
Dimensions:	2 @ 1219.2 mm (48 in.) x 1981.2 mm (78 in.)
Thickness:	Maximum @ 53 mm (2.087 in.)
	Minimum @ 18 mm (0.709 in.)
	Felt panel layers @ 9 mm (0.354 in.) each
Key Geometry:	Three (3) rectangular tuboid channels per panel
	Channel interior widths @ 233 mm (9.173 in.), 135 mm (5.315 in.), and 189 mm (7.441 in.)
	Channel interior thickness @ 25 mm (0.984 in.)
Overall Weight:	22.68 kg (50 lbs)

Physical Measurements (per unit)

Dimensions:	2.44 m (96.0 in) wide by 1.98 m (78.0 in) long
Thickness:	0.05 m (2.087 in)
Weight:	22.68 kg (50.0 lbs)

Test Environment

Room Volume:	291.98 m³
Temperature:	21.0 °C ± 0.1 °C (Requirement: ≥ 10 °C and ≤ 5 °C change)
Relative Humidity:	55.35 % ± 0.9 % (Requirement: ≥ 40 % and ≤ 5 % change)
Barometric Pressure:	101.1 kPa (Requirement not defined)

From sponsor-provided area calculations, the total absorptive area (all exposed surfaces) of all sound-absorbing units was 10.19 m^2 (109.74 ft^2). The array of units covered 4.83 m^2 (52.0 ft^2) of the horizontal test surface (total treated area).

MOUNTING METHOD

Type J Mounting: The specimen is an array of 2 spaced sound absorbing panels suspended from cables such that the closest face of the panels is located approximately 1517.65 mm (59.75 in.) from the horizontal test surface. This approximates the mounting method of a typical ceiling baffle installation. The panels were arranged in a single rectangular cloud, with no space between panels.

Figure 1 – Specimen mounted in test chamber

Figure 2 – Individual specimen panel

Figure 3 – Detail of panel material, rectangular channel feature

Figure 4 – Underside of installed specimen

TEST RESULTS

Note: There is currently no standardized method for calculating Absorption Coefficients from spaced object absorbers. The sound absorption performance of spaced object absorbers should not be compared directly with specimens tested as a single rectangular area (e.g. mounting types A, E, etc.).

1/3 Octave Center Frequency	**Total Absorption**		**Absorption per Unit**	
(Hz)	(m^2)	(Sabins)	(m^2 / Unit)	(Sabins / Unit)
100	1.71	18.38	1.71	18.38
** 125	2.12	22.85	2.12	22.85
160	2.16	23.28	2.16	23.28
200	2.66	28.67	2.66	28.67
** 250	3.05	32.86	3.05	32.86
315	3.74	40.27	3.74	40.27
400	4.40	47.34	4.40	47.34
** 500	4.87	52.44	4.87	52.44
630	5.35	57.60	5.35	57.60
800	6.17	66.45	6.17	66.45
** 1000	6.83	73.48	6.83	73.48
1250	7.50	80.73	7.50	80.73
1600	8.00	86.09	8.00	86.09
** 2000	8.42	90.60	8.42	90.60
2500	8.80	94.69	8.80	94.69
3150	8.70	93.68	8.70	93.68
** 4000	8.90	95.77	8.90	95.77
5000	9.27	99.83	9.27	99.83

Tested by Marc Sciaky
Senior Experimentalist

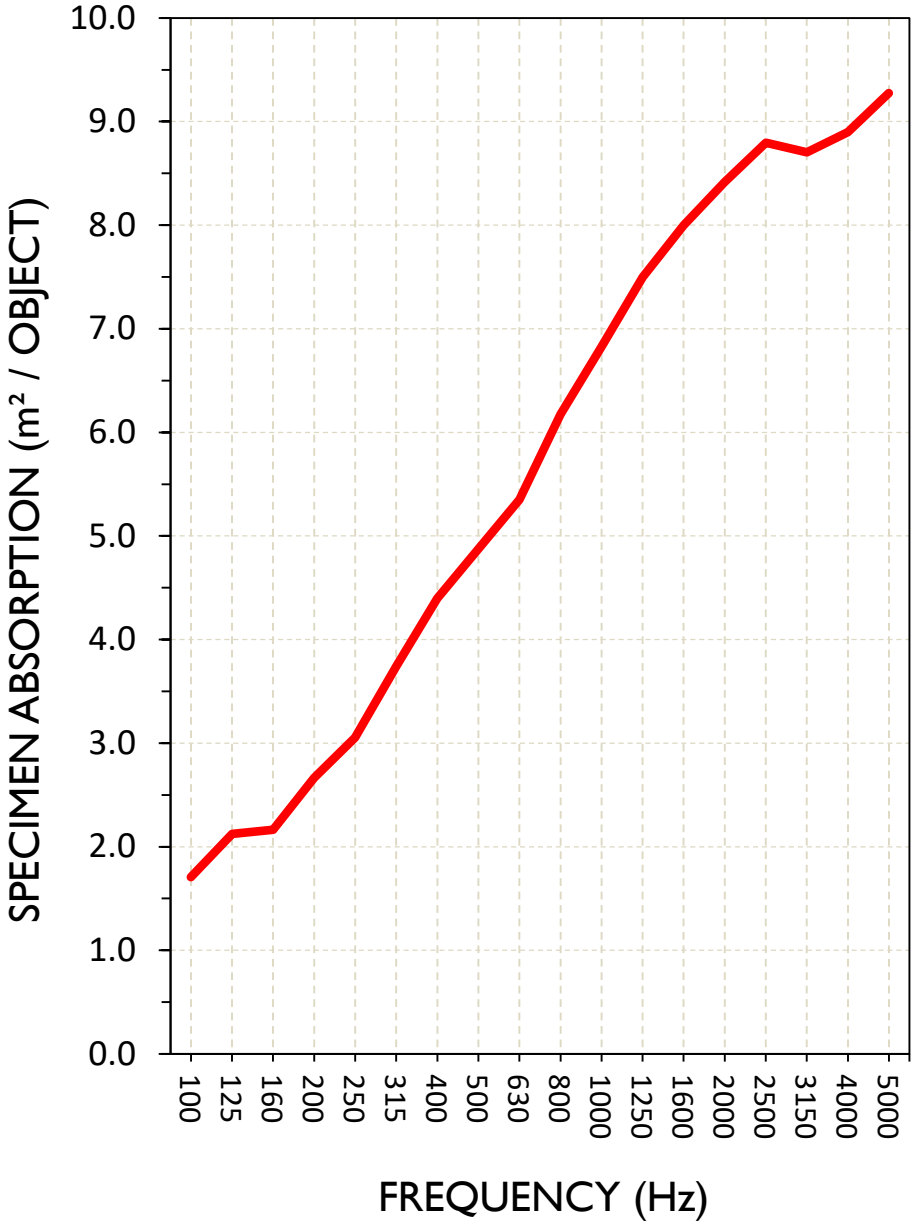
Report by Malcolm Kelly
Test Engineer, Acoustician

Approved by Eric P. Wolfram
Laboratory Manager

Digitally signed by Eric P Wolfram
Location: Geneva, IL
Date: 2020.03.11 10:20:56 -05'00'

SOUND ABSORPTION REPORT

Metro (2 panels arranged in single continuous cloud)



APPENDIX A: Extended Frequency Range Data

Specimen: Metro (2 panels arranged in single continuous cloud) (See Full Report)

The following non-accredited data were obtained in accordance with ASTM C423-17, 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 (Hz)	Total Absorption (m^2)	Total Absorption (Sabins)	Absorption per Unit (m^2 / Unit)	Absorption per Unit (Sabins / Unit)
31.5	0.15	1.64	0.15	1.64
40	0.08	0.90	0.08	0.90
50	-0.71	-7.68	-0.71	-7.68
63	0.34	3.63	0.34	3.63
80	0.34	3.67	0.34	3.67
100	1.71	18.38	1.71	18.38
125	2.12	22.85	2.12	22.85
160	2.16	23.28	2.16	23.28
200	2.66	28.67	2.66	28.67
250	3.05	32.86	3.05	32.86
315	3.74	40.27	3.74	40.27
400	4.40	47.34	4.40	47.34
500	4.87	52.44	4.87	52.44
630	5.35	57.60	5.35	57.60
800	6.17	66.45	6.17	66.45
1000	6.83	73.48	6.83	73.48
1250	7.50	80.73	7.50	80.73
1600	8.00	86.09	8.00	86.09
2000	8.42	90.60	8.42	90.60
2500	8.80	94.69	8.80	94.69
3150	8.70	93.68	8.70	93.68
4000	8.90	95.77	8.90	95.77
5000	9.27	99.83	9.27	99.83
6300	9.54	102.74	9.54	102.74
8000	9.54	102.66	9.54	102.66
10000	9.68	104.23	9.68	104.23
12500	9.91	106.71	9.91	106.71

APPENDIX B: Instruments of Traceability

Specimen: Metro (2 panels arranged in single continuous cloud) (See Full Report)

Description	Model	Serial Number	Date of Certification	Calibration Due
System 1	Type 3160-A-042	3160-106968	2019-06-25	2020-06-25
Bruel & Kjaer Mic And Preamp A	Type 4943-B-001	2311428	2019-09-27	2020-09-27
Bruel & Kjaer Pistonphone	Type 4228	2781248	2019-08-09	2020-08-09
EXTECH Hygro 959	SD700	A099959	2020-02-14	2021-02-14

APPENDIX C: Revisions to Original Test Report

Specimen: Metro (2 panels arranged in single continuous cloud) (See Full Report)

Date	Revision
2020-03-11	Original report issued

END

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ON: Metro (2 panels arranged in single continuous cloud) (See Full Test Report for Details)

Appendix D to ASTM C423 Sound Absorption Test
Non-standard calculation of equivalent NRC Rating and Absorption Coefficients from spaced absorbers

At this time ASTM C423 does not provide a standard method for determining absorption coefficients of spaced object absorbers. Tests of a set of sound absorbing objects spaced apart from each other will yield higher absorption rates than a specimen joined together as a single patch (A-Mount or E-Mount). For this reason it is unfair to provide NRC or absorption coefficient ratings for specimens that consist of a spaced set of absorbers. Despite this, the architectural industry has expressed great demand for a simple "single number" rating for these treatments. Likewise, acoustical consultants desire equivalent absorption coefficient data for use in acoustical modeling software. The following is an attempt to appease these demands until ASTM develops a standard method for calculation. Several alternate non-standard calculation methods are provided. Riverbank Acoustical Laboratories prefers method 1.

Method 1) Apparent Sound Absorption Coefficient calculated from total test surface area covered
The total sound absorption yielded by the specimen is divided by the total surface area of the test surface covered by an array of units, including intermediate spaces. The resulting calculations for Apparent Noise Reduction Coefficient and Apparent Sound Absorption Average provide a means to compare the absorption performance of arrays with a variety of spacings. In tests of a single continuous unit, no array spacing can be inferred, thus rendering this method unusable.

Method 2) Apparent Sound Absorption Coefficient calculated from total exposed surface area of specimen
The total sound absorption yielded by the specimen is divided by the total surface area of all exposed specimen faces, as determined from sponsor-provided area calculations (10.19 m^2 (109.74 ft^2) total surface area). Apparent Noise Reduction Coefficient (NRC) rating and Sound Absorption Average (SAA) figures are calculated from this data based on the methods described in ASTM C423-17. This method shows the actual absorption occurring at the exposed surfaces, but does not provide a fair comparison with materials mounted as a uniform patch (in A-mount or E-mount).

Method 3) Apparent Sound Absorption Coefficient calculated from one face per unit
The total sound absorption yielded by the specimen is divided by the surface area of one side of one large face of the specimen (4.83 m^2 (52.0 ft^2) total surface area). Apparent Noise Reduction Coefficient (NRC) rating and Sound Absorption Average (SAA) figures are calculated from this data based on the methods described in ASTM C423-17. This method is favored by some material manufacturers since it yields very high NRC figures, but does not provide a fair comparison with other ceiling tile or wall panel products. Riverbank Acoustical Laboratories recommends that results obtained from this method be used for research and comparison purposes only; such results should not be used for marketed claims of product performance.

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Appendix D: Data Note: See full test report for details of mounting position, spacing, and configuration, as these parameters greatly affect sound absorption performance.

Specimen Absorption			Method 1	Method 2	Method 3
Freq. (Hz)	**Sabins**	**Sabins / Unit**	Apparent Abs. Coefficient From Total Coverage Area	Apparent Abs. Coefficient From Total Exposed Surface Area	Apparent Abs. Coefficient From One Face/Baffle
31.5	1.64	1.64		0.01	0.03
40	0.90	0.90		0.01	0.02
50	-7.68	-7.68		-0.07	-0.15
63	3.63	3.63		0.03	0.07
80	3.67	3.67		0.03	0.07
100	18.38	18.38		0.17	0.35
125	22.85	22.85		0.21	0.44
160	23.28	23.28		0.21	0.45
200	28.67	28.67		0.26	0.55
250	32.86	32.86		0.30	0.63
315	40.27	40.27		0.37	0.77
400	47.34	47.34		0.43	0.91
500	52.44	52.44		0.48	1.01
630	57.60	57.60		0.52	1.11
800	66.45	66.45		0.61	1.28
1,000	73.48	73.48		0.67	1.41
1,250	80.73	80.73		0.74	1.55
1,600	86.09	86.09		0.78	1.66
2,000	90.60	90.60		0.83	1.74
2,500	94.69	94.69		0.86	1.82
3,150	93.68	93.68		0.85	1.80
4,000	95.77	95.77		0.87	1.84
5,000	99.83	99.83		0.91	1.92
6,300	102.74	102.74		0.94	1.98
8,000	102.66	102.66		0.94	1.97
10,000	104.23	104.23		0.95	2.00
12,500	106.71	106.71		0.97	2.05
		Apparent NRC:	N/A	**0.55**	**1.20**
		Apparent SAA:	N/A	**0.57**	**1.20**

Prepared by
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