



UNIVERSITY OF ALBERTA

**DATA-REPORT ON :
LABORATORY MEASUREMENT OF
SOUND ABSORPTION OF**

- (1) 2in-THICK FABRIC-WRAPPED BAFFLES**
- (2) 1in-THICK FABRIC-WRAPPED PANELS**
- (3) 2in-THICK FABRIC-WRAPPED PANELS**
- (4) 4in-THICK FABRIC-WRAPPED PANELS**

Prepared for:

WESTERN NOISE CONTROL Ltd.
15108 – 118 Avenue NW
Edmonton, AB, Canada
T5V 1B8

Prepared by:
THE UNIVERSITY OF ALBERTA
MECHANICAL ENGINEERING ACOUSTICS AND NOISE UNIT
Corjan Buma, M.Sc., P. Eng.

JOB NUMBER: 18-06

18 January 2019

EXECUTIVE SUMMARY

Sound absorption measurements were conducted at the request of **WESTERN NOISE CONTROL Ltd.** of Edmonton, AB, in the small reverberation chamber (227 m³) at the Mechanical Engineering Acoustics and Noise Unit (the “MEANU”) of the University of Alberta in Edmonton, Alberta, Canada. These measurements were conducted in accordance with ASTM C423-09a “Standard Test Method for Sound Absorption And Sound Absorption Coefficients By The Reverberation Room Method”.

Western Noise Control Ltd. had requested the generation of sound absorption data for :

1. 2in thick fabric-wrapped baffles; and
2. fabric-wrapped panels in 1in, 2in and 4in thickness.

Testing of the Baffles was done using the J-mounting (per ASTM E795), with the baffles suspended from clothesline strung diagonally across the reverberation chamber.

Testing of the various thicknesses of wall-panel were done using the A-mounting (per ASTM E795), with the panels laid directly on the Reverberation Chamber floor and their outer perimeter enclosed with aluminum angle, the outer leg of which had been duct-taped to the Chamber floor (so as to have only the exposed horizontal surface factor in to the calculation of sound absorption). For the 4in thick test specimen two 2-in thick fabric-wrapped panels were laid directly atop two un-wrapped 2in thick panels.

The various test specimens were tested “as-received” (no on-site modifications to product).

The **Noise Reduction Coefficients** (“NRC”) and **Sound Absorption Averages** (“SAA”) as determined for the four test specimens were :

Test 18-06 – sound absorption of Western Noise Control fabric-wrapped test specimens :

2-in thick baffles	NRC = 0.80 / SAA = 0.77
1-in thick panels	NRC = 0.80 / SAA = 0.78
2-in thick panels	NRC = 1.00 / SAA = 1.02
4-in thick panels	NRC = 1.05 / SAA = 1.02

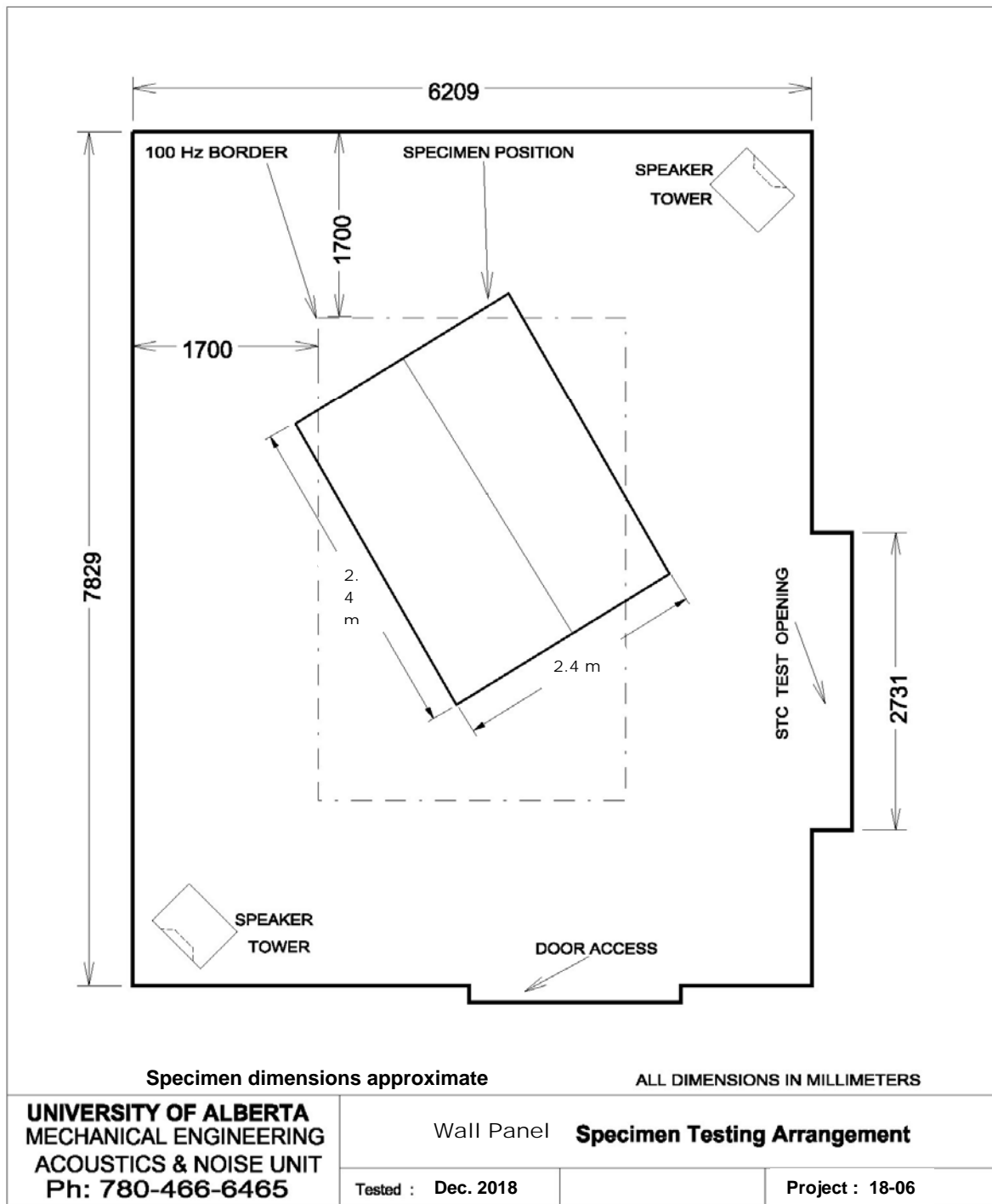


Figure 1 – Test Layout of Wall Panel Specimens Within Reverberation Chamber



Figure 2 – Specimen Set Up For Fabric-Wrapped Baffles

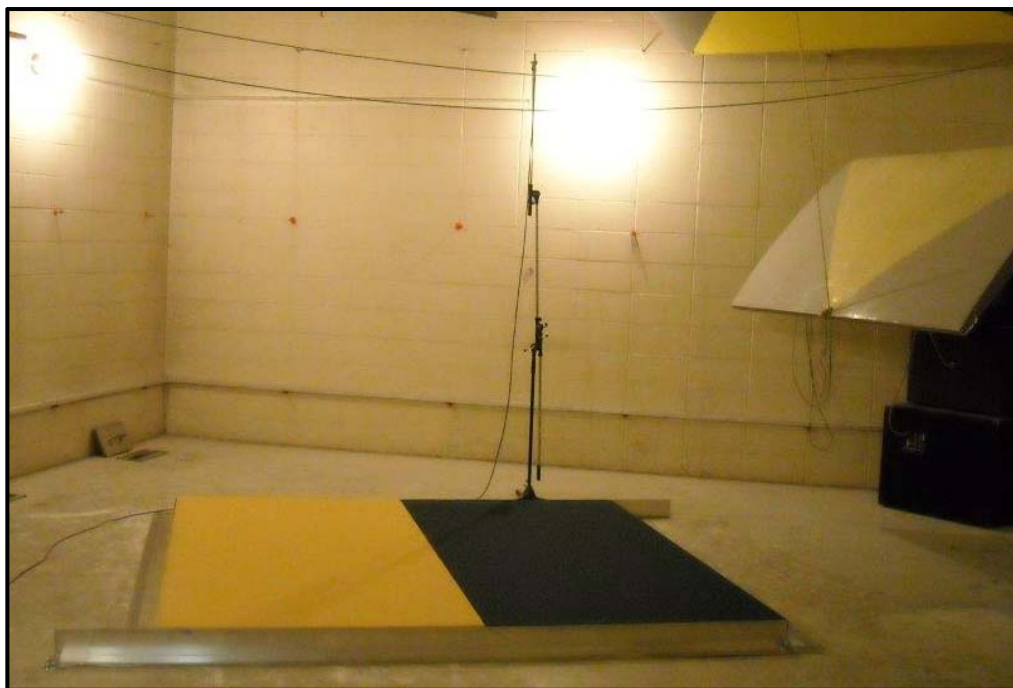


Figure 3 – Specimen Set Up For Fabric-Wrapped Panels (typical)

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MECHANICAL ENGINEERING ACOUSTICS AND NOISE UNIT
EDMONTON, ALBERTA, CANADA

DETERMINATION OF NOISE REDUCTION COEFFICIENT (NRC)
ACCORDING TO ASTM STANDARD: C423-09a

DATE: 12 Dec. 2018, Wdn
CLIENT: Western Noise Control

TEST NO: 1
TEST PERFORMED BY:
CJ Buma, M.Sc., P.Eng.

REVERB ROOM VOLUME: 228.3621 Cubic Meters
MICROPHONE PLACED AT 6 FIXED POSITIONS

ENVIRONMENT:	TIME	DATE	TEMP (C)	RH (%)	ATMOSPHERIC PRESSURE (KPa)
# 1 EMPTY ROOM:	18:51	12-12-18	11.07	36.66	92.46 (695.4 mm Hg @ 21.2 C)
# 6 EMPTY ROOM:	18:27	12-12-18	12.05	34.92	92.46 (695.4 mm Hg @ 21.2 C)
# 1 SAMPLE ROOM:	17:48	12-12-18	15.20	28.37	92.43 (695.5 mm Hg @ 23.9 C)
# 6 SAMPLE ROOM:	18:14	12-12-18	12.60	34.54	92.43 (695.5 mm Hg @ 23.9 C)

TEST SAMPLE SURFACE AREA : 15.031 Sq m [3.877 m wide by 3.877 m high]
MOUNTING CONFIGURATION : 'J'

TEST SAMPLE DESCRIPTION :

Five baffles (nom. 1230x1210mm) hung across Small Reverb Chamber; support cables hung diagonal across width of Chamber; two baffles on each of two cables, one baffle on third cable; baffle spacing 0.7m (nom.), cable spacing 1.1m (nom.); baffles suspended from built-in grommets; baffle-area calculation includes perimeter thickness.

FREQ (Hz)	EMPTY RT60 (sec)	SAMPLE RT60 (sec)	TOTAL METRIC SABINE	ABSORB COEFF	COEFF UNCERTAINTY (+/-)
50	1.96	1.75	2.06	0.14	0.16
63	2.53	2.39	0.55	0.04	0.49
80	3.67	2.97	2.40	0.16	0.18
100	4.03	3.34	1.85	0.12	0.11
125	3.69	2.78	3.28	0.22	0.10
160	4.43	3.20	3.13	0.21	0.04
200	4.89	3.07	4.48	0.30	0.06
250	5.15	2.65	6.76	0.45	0.04
315	5.20	2.34	8.68	0.58	0.04
400	5.05	2.12	10.12	0.67	0.05
500	4.90	1.91	11.84	0.79	0.04
630	4.63	1.79	12.70	0.84	0.04
800	4.43	1.69	13.56	0.90	0.04
1000	3.90	1.57	14.00	0.93	0.03
1250	3.51	1.51	14.02	0.93	0.04
1600	3.11	1.41	14.46	0.96	0.04
2000	2.80	1.34	14.47	0.96	0.05
2500	2.40	1.26	14.03	0.93	0.04
3150	1.96	1.13	13.88	0.92	0.04
4000	1.56	0.97	14.38	0.96	0.06
5000	1.22	0.83	14.26	0.95	0.08

NRC = 0.80

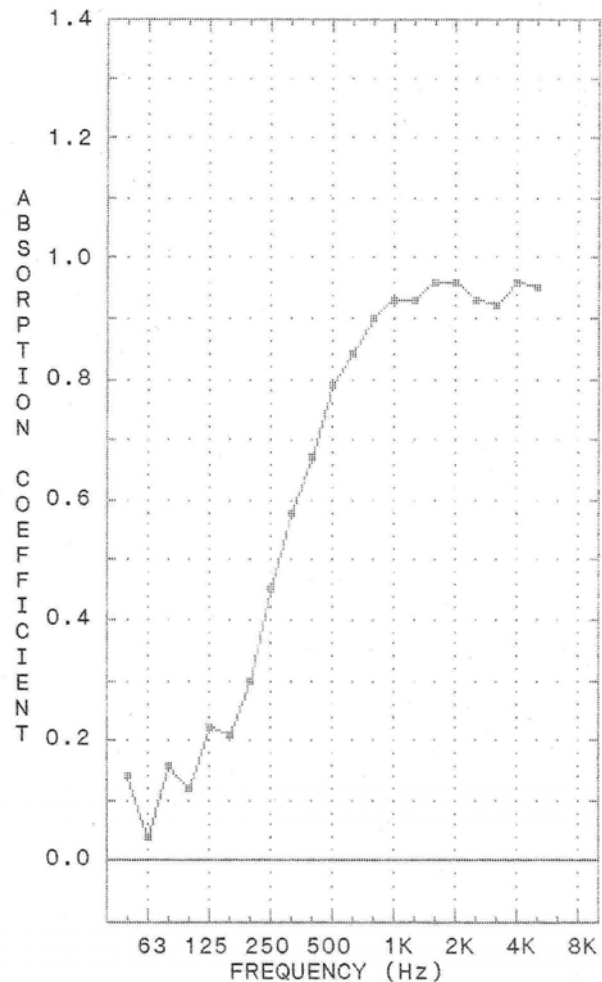


Figure 5 – Sound Absorption of 2in Thick Baffles

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MECHANICAL ENGINEERING ACOUSTICS AND NOISE UNIT
EDMONTON, ALBERTA, CANADA

DETERMINATION OF NOISE REDUCTION COEFFICIENT (NRC)
ACCORDING TO ASTM STANDARD: C423-09a

DATE: 13 Dec. 2018, Thrs
CLIENT: Western Noise Control

TEST NO: 2
TEST PERFORMED BY:
CJ Buma, M.Sc., P.Eng.

REVERB ROOM VOLUME: 228.3621 Cubic Meters
MICROPHONE PLACED AT 6 FIXED POSITIONS

ENVIRONMENT:	TIME	DATE	TEMP(C)	RH(%)	ATMOSPHERIC PRESSURE (KPa)
# 1 EMPTY ROOM:	18:12	12-13-18	14.47	34.33	92.51 (696.0 mm Hg @ 22.8 C)
# 6 EMPTY ROOM:	17:50	12-13-18	15.58	31.50	92.51 (696.0 mm Hg @ 22.8 C)
# 1 SAMPLE ROOM:	17:20	12-13-18	18.70	24.32	92.49 (695.9 mm Hg @ 23.3 C)
# 6 SAMPLE ROOM:	17:43	12-13-18	16.00	30.34	92.49 (695.9 mm Hg @ 23.3 C)

TEST SAMPLE SURFACE AREA : 5.712 Sq m [2.39 m wide by 2.39 m high]
MOUNTING CONFIGURATION : 'A'

TEST SAMPLE DESCRIPTION :
1in thick fabric-wrapped panels (four) in A-mounting; enclosed in 1in aluminum angle surround, outer edge duct-taped to Chamber floor; joints between panels not covered; joint of panels at alum-angle not covered.

FREQ (Hz)	EMPTY RT60 (sec)	SAMPLE RT60 (sec)	TOTAL METRIC SABINE	ABSORB COEFF	COEFF UNCERTAINTY (+/-)
50	2.09	2.02	0.63	0.11	0.68
63	2.12	2.12	-0.01	0.00	0.76
80	3.45	3.18	0.63	0.11	0.42
100	4.12	3.87	0.49	0.09	0.22
125	3.84	3.58	0.62	0.11	0.23
160	4.30	3.96	0.67	0.12	0.18
200	4.81	4.30	0.87	0.15	0.07
250	5.05	4.23	1.40	0.24	0.09
315	5.25	3.80	2.64	0.46	0.07
400	5.06	3.38	3.56	0.62	0.06
500	4.86	3.12	4.17	0.73	0.07
630	4.60	2.83	4.93	0.86	0.03
800	4.42	2.59	5.82	1.02	0.07
1000	3.93	2.39	5.90	1.03	0.08
1250	3.55	2.22	6.06	1.06	0.07
1600	3.13	2.03	6.17	1.08	0.06
2000	2.83	1.88	6.27	1.10	0.09
2500	2.42	1.72	5.65	0.99	0.09
3150	2.03	1.51	5.52	0.97	0.09
4000	1.60	1.27	4.97	0.87	0.12
5000	1.26	1.03	4.76	0.83	0.14

NRC = 0.80

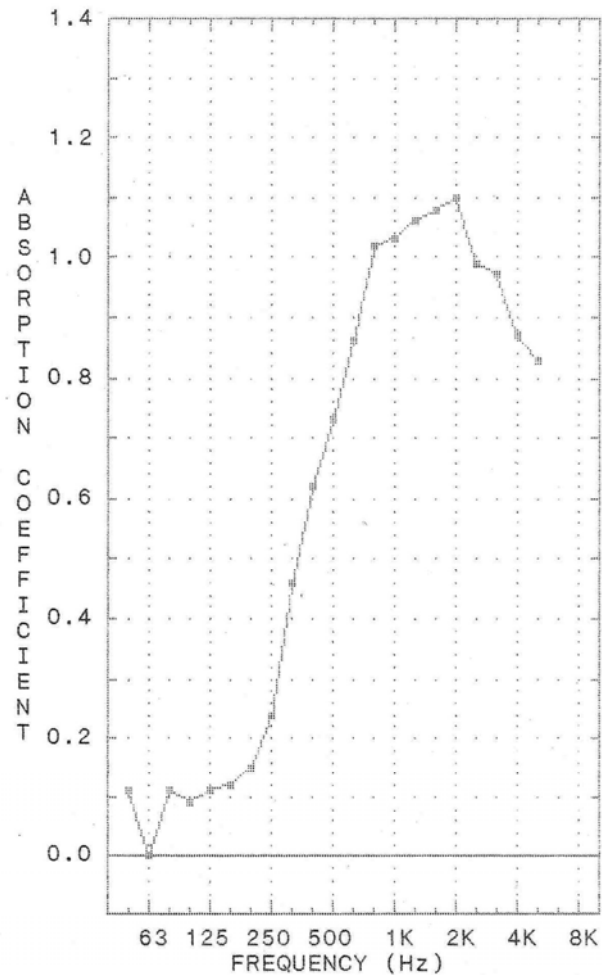


Figure 6 – Sound Absorption of 1-inch Wall Panel

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DETERMINATION OF NOISE REDUCTION COEFFICIENT (NRC)
ACCORDING TO ASTM STANDARD: C423-09a

DATE: 2018 Dec. 14, Fri
CLIENT: Western Noise Control

TEST NO: 4
TEST PERFORMED BY:
CJ Buma, M.Sc., P.Eng.

REVERB ROOM VOLUME: 228.3621 Cubic Meters
MICROPHONE PLACED AT 6 FIXED POSITIONS

ENVIRONMENT:	TIME	DATE	TEMP(C)	RH(%)	ATMOSPHERIC PRESSURE (KPa)
# 1 EMPTY ROOM:	16:36	12-14-18	14.35	38.68	91.51 (688.5 mm Hg @ 23.5 C)
# 6 EMPTY ROOM:	16:15	12-14-18	15.30	36.86	91.51 (688.5 mm Hg @ 23.5 C)
# 1 SAMPLE ROOM:	16:56	12-14-18	13.70	39.72	91.47 (688.2 mm Hg @ 23.5 C)
# 6 SAMPLE ROOM:	17:09	12-14-18	13.34	40.35	91.47 (688.2 mm Hg @ 23.5 C)

TEST SAMPLE SURFACE AREA : 5.698 Sq m [2.387 m wide by 2.387 m high]
MOUNTING CONFIGURATION : 'A'

TEST SAMPLE DESCRIPTION :

Wall panel 2-inch; two fabric-wrapped 2in panels laid side-by-side (abutting joint = long edge); panel-pair enclosed with 4in aluminum angle surround, outer edge of alum-angle duct-taped to chamber floor; abutting joint btwn exposed panels not covered, perimeter joint at alum-angle surround not covered.

FREQ (Hz)	EMPTY RT60 (sec)	SAMPLE RT60 (sec)	TOTAL METRIC SABINE	ABSORB COEFF	COEFF UNCERTAINTY (+/-)
50	2.25	2.16	1.00	0.18	0.92
63	2.32	2.24	0.34	0.06	0.90
80	3.51	3.23	0.72	0.13	0.48
100	3.97	3.56	1.08	0.19	0.26
125	3.84	3.28	1.65	0.29	0.15
160	4.41	3.34	2.70	0.47	0.15
200	4.84	3.18	4.05	0.71	0.12
250	5.04	2.88	5.58	0.98	0.06
315	5.17	2.69	6.67	1.17	0.08
400	5.13	2.66	6.76	1.19	0.12
500	4.98	2.73	6.23	1.09	0.05
630	4.60	2.60	6.27	1.10	0.06
800	4.40	2.54	6.24	1.09	0.07
1000	3.87	2.47	5.49	0.96	0.06
1250	3.42	2.28	5.50	0.97	0.07
1600	3.07	2.09	5.73	1.01	0.05
2000	2.83	1.98	5.74	1.01	0.06
2500	2.46	1.81	5.51	0.97	0.06
3150	2.06	1.60	5.29	0.93	0.07
4000	1.64	1.33	5.50	0.97	0.10
5000	1.29	1.08	5.73	1.01	0.11

NRC = 1.00

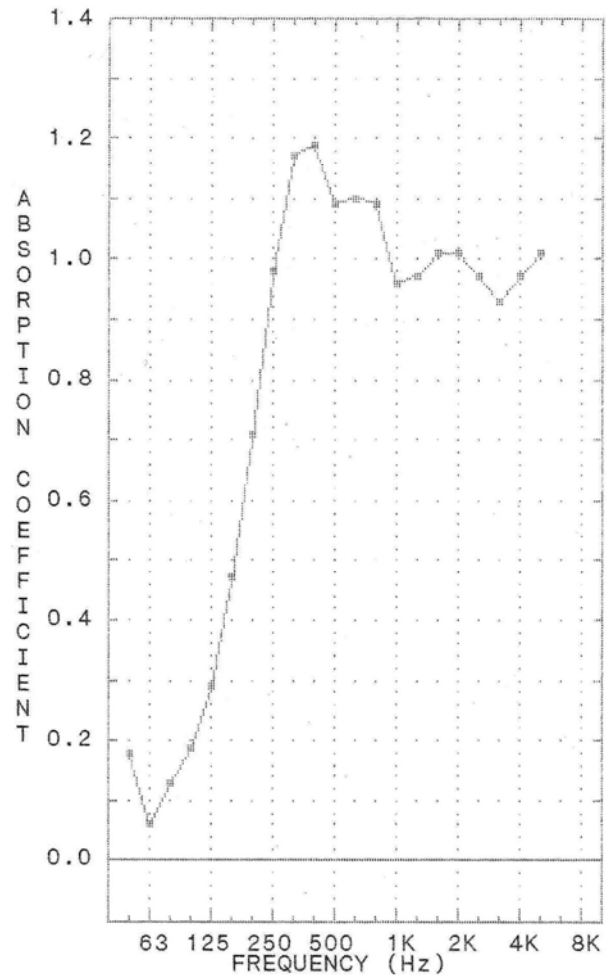


Figure 7 – Sound Absorption of 2-inch Wall Panel

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DETERMINATION OF NOISE REDUCTION COEFFICIENT (NRC)
ACCORDING TO ASTM STANDARD: C423-09a

DATE: 2018 Dec. 14, Fri
CLIENT: Western Noise Control

TEST NO: 3
TEST PERFORMED BY:
CJ Buma, M.Sc., P.Eng.

REVERB ROOM VOLUME: 228.3621 Cubic Meters
MICROPHONE PLACED AT 6 FIXED POSITIONS

ENVIRONMENT:	TIME	DATE	TEMP (C)	RH (%)	ATMOSPHERIC PRESSURE (KPa)
# 1 EMPTY ROOM:	16:36	12-14-18	14.35	38.68	91.51 (688.5 mm Hg @ 23.5 C)
# 6 EMPTY ROOM:	16:15	12-14-18	15.30	36.86	91.51 (688.5 mm Hg @ 23.5 C)
# 1 SAMPLE ROOM:	15:39	12-14-18	18.37	29.59	91.55 (688.9 mm Hg @ 23.9 C)
# 6 SAMPLE ROOM:	16:01	12-14-18	15.66	35.77	91.55 (688.9 mm Hg @ 23.9 C)

TEST SAMPLE SURFACE AREA : 5.698 Sq m [2.387 m wide by 2.387 m high]
MOUNTING CONFIGURATION : 'A'

TEST SAMPLE DESCRIPTION :

Wall panel 4-inch; two fabric-wrapped 2in panels laid side-by-side (abutting joint = long edge), on top of two not-wrapped (raw) 2in panels; upper pair laid at right angles to lower pair; panel-set enclosed with 4in aluminum angle surround, outer edge of alum-angle duct-taped to chamber floor; abutting joint btwn exposed panels not covered, perimeter joint at alum-angle surround not covered.

FREQ (Hz)	EMPTY RT60 (sec)	SAMPLE RT60 (sec)	TOTAL METRIC SABINE	COEFF ABSORB COEFF	UNCERTAINTY (+/-)
50	2.25	2.11	1.24	0.22	0.90
63	2.32	1.91	2.88	0.51	0.82
80	3.51	2.17	6.17	1.08	0.48
100	3.97	2.28	6.98	1.22	0.46
125	3.84	2.52	5.08	0.89	0.32
160	4.41	2.59	5.88	1.03	0.22
200	4.84	2.76	5.73	1.01	0.11
250	5.04	2.74	6.15	1.08	0.09
315	5.17	2.78	6.12	1.07	0.06
400	5.13	2.75	6.19	1.09	0.08
500	4.98	2.77	5.89	1.03	0.06
630	4.60	2.65	5.85	1.03	0.07
800	4.40	2.55	6.05	1.06	0.07
1000	3.87	2.41	5.68	1.00	0.06
1250	3.42	2.26	5.41	0.95	0.05
1600	3.07	2.10	5.45	0.96	0.05
2000	2.83	1.95	5.67	1.00	0.07
2500	2.46	1.78	5.51	0.97	0.05
3150	2.06	1.55	5.53	0.97	0.08
4000	1.64	1.31	5.22	0.92	0.10
5000	1.29	1.08	4.88	0.86	0.14

NRC = 1.05

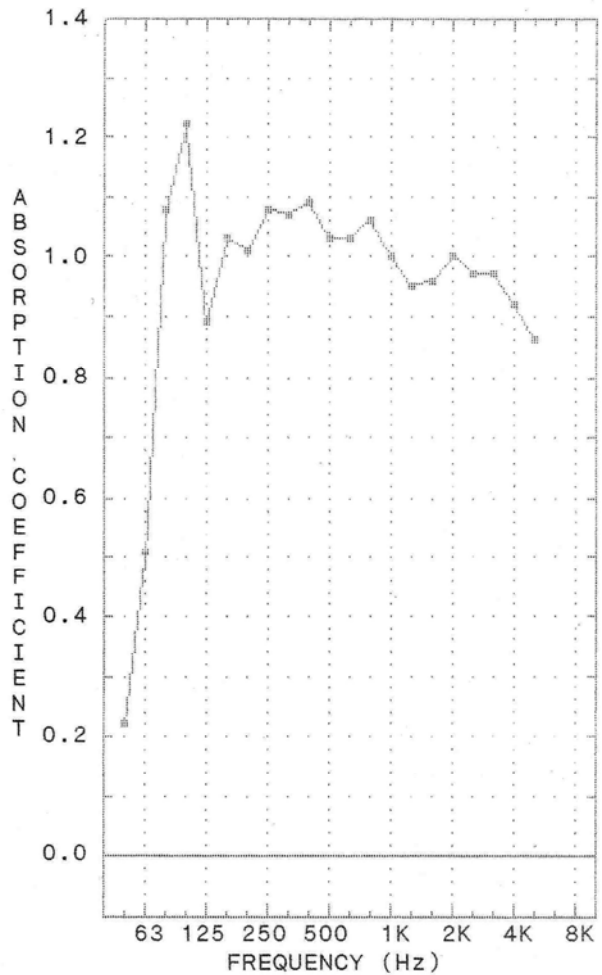


Figure 8 – Sound Absorption of 4-inch Wall Panel

APPENDIX

DECLARATION OF COMPLIANCE

Every effort has been made to conduct and report the measurements and derived results in accordance with the requirements of ASTM Standard Test Method C423-09a, along with ASTM Standard Mounting Practices E795-05 except where noted. While test procedure C423-09a requires the use of at least five microphone positions with at least 10 reverberation decays per microphone position, the procedure as applied in this study exceeds the minimum requirements.

DISCLAIMER

The MECHANICAL ENGINEERING ACOUSTICS AND NOISE UNIT (MEANU) has absolutely no financial or managerial interests vested in the Client named in this report nor does the Client so-mentioned have any vested interests in the MEANU.

Although every effort has been made to comply with all aspects of the standards referred to in this report, as of this writing the MEANU has no recognized certification.

REFERENCES

- [1] ASTM C423 – 08: “Standard Test Method for SOUND ABSORPTION AND SOUND ABSORPTION COEFFICIENTS BY THE REVERBERATION ROOM METHOD”; American Society for Testing and Materials, Volume 04.06, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
- [2] ASTM E795 – 05: “Standard Practices for MOUNTING TEST SPECIMENS DURING SOUND ABSORPTION TESTS”; American Society for Testing and Materials, Volume 04.06, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
- [3] ANSI S1.26, “Method for the Calculation of the Absorption of Sound by the Atmosphere”, American National Standards Institute, 1430 Broadway, New York, NY, USA 10018.