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Client Report

June 27, 2012

Measurement of Airborne Sound Transmission Loss in Accordance with ASTM E90 of Classic NR Panel Assemblies

B3504.4

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National Research Council Canada
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Canada

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Measurement of Airborne Sound Transmission Loss in Accordance with ASTM E90 of Classic NR Panel Assemblies

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A Client Report based on the results of the NRC Research Project on:

Acoustic Measurements of Railtech Panel Assemblies

for

Skyfold Custom Powerlift Partitions, Railtech LTD.
Montréal, Québec
H9X 3S3

June 27, 2012

Measurement of Airborne Sound Transmission Loss in Accordance with ASTM E90 of Classic NR Panel Assemblies

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Author

Don MacMillan, Frances King
Technical Officer

Quality Assurance

Bradford Gover, Ph.D.
Senior Research Officer and Acting Group Leader

Approved

Trevor R.T. Nightingale, Ph.D.
Program Director, BSIE

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Client:	Skyfold Custom Powerlift Partitions, Railtech LTD.
Specimen:	Classic NR Panel Assemblies
Specimen ID:	B3504-41W-F3
Construction Date:	March 16, 2012

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Specimen Description:
Panel Assembly F3 – Standard Classic NR Panel - Fabric Finish – Perforated Face - Insulation 1.5"
Specimen Thickness - 11.75"

Specimen B3504-41W-F3 consisted of two 0.61 m X 2.44 m (2'X 8') panel assemblies indicated with the label F3 (placed by the client) mounted on each side of the opening of a filler wall. The panel assemblies were mounted against 25 mm X 25 mm (1" x 1") wood strips around the inside perimeter, with a layer of sill gasket in between the wood and the panel. On both sides of the specimen, backer rod was installed around the outside perimeter of the panels and then caulked and taped.

The composition of the Specimen from one side to the other was:

- Panel Assembly F3: Panel Thickness 19 mm (0.75") - Insulation Thickness 38 mm (1.5")
- Airspace 184 mm (7.25")
- Panel Assembly F3: Panel Thickness 19 mm (0.75") - Insulation Thickness 38 mm (1.5")

The total specimen thickness was 298 mm (11.75"). The masses of the two panel assemblies, including attached insulation, were measured to be 18.10 kg and 18.10 kg, for a total specimen mass of 36.20 kg.

Filler wall TLA-12-009: Since the area of the test specimen was smaller than the facility test opening, the procedures in ASTM E90 Annex A3.2 were followed to build a filler wall that transmitted a negligible amount of sound relative to that through the specimen. The filler wall assembly comprised the following elements, listed from one side of the wall to the other:

- 3 layers of 15.9 mm Type X gypsum board
- 13 mm resilient channels, spaced 610 mm oc
- 65 mm steel studs, spaced 610 mm oc
- 13 mm air space
- 65 mm mineral fibre insulation
- 65 mm steel studs, spaced 610 mm oc
- 38 mm air space
- 95 mm mineral fibre insulation
- 95 mm steel studs, spaced 610 mm oc
- 13 mm resilient channels, spaced 610 mm oc
- 4 layers of 15.9 mm Type X gypsum board

The filler wall was mounted in the wall test opening which measures 3658 mm X 2434 mm. The opening in the filler wall to mount the specimen measured 2452 mm X 623 mm. All gypsum board joints were caulked and sealed with metal tape.

The results in this report apply only to the specimen that was tested. NRC does not represent that the results in this report apply to any other specimen.

Specimen Properties: SKYFOLD
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Element		Actual thickness (mm)	Mass (kg)	Mass/length, area or volume
Panel Assembly	Operable partition panel 19 mm	19	17.4	11.7 kg/m²
Generic	Semi-Rigid fiberglass 38 mm	38	0.7	13.8 kg/m³
Air	184 mm	184	0.0	0.0
Generic	Semi-Rigid fiberglass 38 mm	38	0.7	13.8 kg/m³
Panel Assembly	Operable partition panel 19 mm	19	17.4	11.7 kg/m²
Total		298	36.2	

Test Specimen Installation:
A complete filler wall as described above was mounted in the NRC acoustical wall test opening which measures approximately 3.66 m x 2.44 m. After the transmission loss of the filler wall was measured in accordance with ASTM E90, the part of the filler wall covering the test opening for the specimen was removed and the test specimen was installed. The sound transmission loss of the composite wall was then measured and the sound transmission loss of the test specimen was calculated according to ASTM E90. The area of the specimen under test used for the calculation of the airborne sound transmission loss was 1.49 m^2.

Airborne sound transmission loss measurements were conducted in accordance with the requirements of ASTM E90-09, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"

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Client: Skyfold Custom Powerlift Partitions, Railtech LTD.

Specimen ID: B3504-41W-F3

Test ID: TLA-12-070

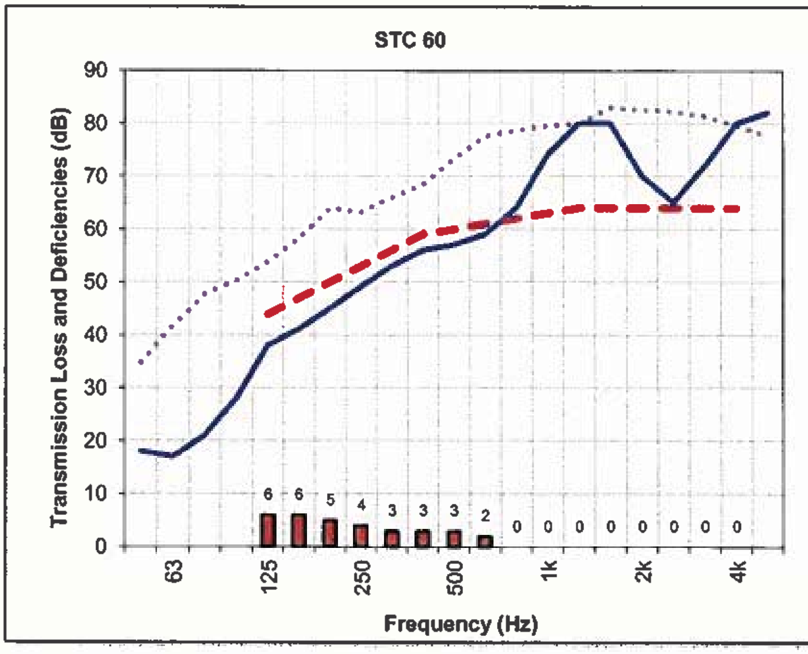
Date Tested: March 16, 2012

Large Chamber Volume: 255.0 m³

Small Chamber Volume: 139.6 m³

Measured Temperature and Relative Humidity During Testing

	Temperature, °C		Humidity %	
Room	Min	Max	Min	Max
Large	**21.0**	**21.1**	**52.7**	**56.2**
Small	**19.6**	**19.7**	**45.8**	**46.4**



Frequency (Hz)	Airborne Sound Transmission Loss (dB)	95% Confidence Limits (dB)
50	18 c,clc	± 5.9
63	17 clc	± 3.4
80	21 clc	± 3.6
100	28 clc	± 3.1
125	38 clc	± 1.8
160	41 clc	± 2.1
200	45 clc	± 1.4
250	49 clc	± 1.5
315	53 clc	± 0.9
400	56 clc	± 0.7
500	57	± 0.6
630	59	± 0.5
800	64	± 0.5
1000	74 c,clc	± 0.4
1250	80 *,min	± 0.5
1600	80 *,clc	± 1.2
2000	70	± 0.4
2500	65	± 0.4
3150	72 c	± 0.3
4000	80 *,clc	± 0.4
5000	82 *,min	± 0.7
Sound Transmission Class (STC) =		60

In the graph:

Solid line is the measured sound transmission loss for this specimen. Dashed line is the STC contour fitted to the measured values according to ASTM E413-04. The dotted line is 10 dB below the flanking limit established for this facility. Where measured transmission loss is above the dotted line, the reported value is potentially limited by vibration transmission via laboratory surfaces, and the true value may be higher than that measured. Bars at bottom of graph show deficiencies. At each frequency the difference between the shifted reference contour value and the measured data is calculated. Only deficiencies, that is, where the measured data are less than the reference contour, are counted in the fitting procedure for the STC, defined in ASTM E413-04.

In the table:

Values marked "c" indicate that the measured background level was between 5 dB and 10 dB below the combined receiving room level and background level. The reported values have been corrected according to the procedure outlined in ASTM E90-09.

Values marked "*" indicate that the measured background level was less than 5 dB below the combined receiving room level and background level. The reported values provide an estimate of the lower limit of airborne sound transmission loss.

Values marked with "clc" indicate a correction applied for transmission that occurs through the filler wall.

Values marked "min" indicate transmission through the filler wall was within 6 dB.

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National Research Council Canada
Construction Portfolio
Acoustics Laboratory
1200 Montreal Road, Ottawa, Ontario K1A 0R6
Tel: 613-993-2305 Fax: 613-954-1495

Facility and Equipment: The acoustics test facility comprises two reverberation rooms (referred to in this report as the small and large rooms) with a moveable test frame between the two rooms. In each room, a calibrated Bruel & Kjaer condenser microphone (type 4166 or 4165) with preamp is moved under computer control to nine positions, and measurements are made in both rooms using an 8-channel National Instrument NI4472 system installed in a desktop PC-type computer. Each room has four bi-amped loudspeakers driven by separate amplifiers and noise sources. To increase randomness of the sound field, there are fixed diffusing panels in each room.

Test Procedure: Airborne sound transmission measurements were conducted in accordance with the requirements of ASTM E90-09, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions". Airborne sound transmission loss tests were performed in the forward (receiving room is the large room) and reverse (receiving room is the small room) directions. Results presented in this report are the average of the tests in these two directions. In each case, sound transmission loss values were calculated from the average sound pressure levels of both the source and receiving rooms and the average reverberation times of the receiving room. One-third octave band sound pressure levels were measured for 32 seconds at nine microphone positions in each room and then averaged to get the average sound pressure level in each room. Five sound decays were averaged to get the reverberation time at each microphone position in the receiving room; these times were averaged to get the average reverberation times for the room. A complete description of the test procedure, information on the flanking limit of the facility and reference specimen test results are available on request.

Significance of Test Results: ASTM E90-09 requires measurements in 1/3-octave bands in the frequency range 100 Hz to 5000 Hz. Within those ranges, reproducibility has been assessed by inter-laboratory round robin studies. The standards recommend making measurements and reporting results over a larger frequency range, and this report presents such results, which may be useful for expert evaluation of the specimen performance. The precision of results outside the 100 to 5000 Hz range has not been established, but is expected to depend on laboratory-specific factors.

Sound Transmission Class (STC): was determined in accordance with ASTM E413-04, "Classification for Rating Sound Insulation". The Sound Transmission Class (STC) is a single-figure rating scheme intended to rate the acoustical performance of a partition element separating offices or dwellings. The higher the value of the rating, the better the performance. The rating is intended to correlate with subjective impressions of the sound insulation provided against the sounds of speech, radio, television, music, and similar sources of noise characteristic of offices and dwellings. The STC is of limited use in applications involving noise spectra that differ markedly from those referred to above (for example, heavy machinery, power transformers, aircraft noise, motor vehicle noise). Generally, in such applications it is preferable to consider the source levels and insulation requirements for each frequency band.

Confidence Limits: Acoustical measurement in rooms is a sampling process and as such has associated with it a degree of uncertainty. By using enough microphone and loudspeaker positions, the uncertainty can be reduced and upper and lower limits assigned to the probable error in the measurement. These limits are called 95% confidence limits. They are calculated for each test according to the procedures in ASTM E90-09 and must be less than upper limits given in the standards. These confidence limits do not relate directly to the variation expected when a nominally identical specimen is built, installed and tested (repeatability). Nor do they relate directly to the differences expected when nominally identical specimens are tested in different laboratories (reproducibility).

In Situ Performance: Ratings obtained by this standard method tend to represent an upper limit to what might be measured in a field test, due to structure-borne transmission ("flanking") and construction deficiencies in actual buildings.