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Acoustic Testing of AMC Mechanocaucho SRS-25 + Sylomer Hanger

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Client

AMC Mecanocaucho
Pol. Industrial, Zone A - Pab 35.
Asteasu E-20159, Gipuzkoa. Spain

Specimen

- 150 mm (6") Precast Concrete Slab
- 254 mm (10”) AMC Mecanocaucho SRS-25 + Sylomer Hanger
  * air gap 276 mm (10-7/8”)
- 38 mm (1-1/2”) C-Channel
  * thickness included in air gap above
- 22 mm (7/8”) Furring Channel
  * thickness included in air gap above
- 89 mm (3-1/2”) Glass Fibre Insulation
  * does not contribute to assembly thickness
- 16 mm (5/8") Type X Gypsum Board
- 16 mm (5/8") Type X Gypsum Board

Specimen ID A1-019524-05F

Specimen Description

Structural: The 150 mm (6”) precast concrete slab was installed in the test frame. The perimeter was sealed from below with duct putty. The perimeter was filled from above with glass fibre insulation and sealed with cloth tape.

Ceiling Hangers: The AMC Mecanocaucho SRS-25 + Sylomer hangers were installed at nominal 1.22 m x 1.22 m (48” x 48”) intervals. The hanger depth was set to 254 mm (10”) so that with the addition of the support structure, the total air gap was 276 mm (10-7/8”).

Ceiling Support Structure: 38 mm (1-1/2”) C-channels were installed into the ceiling hanger clamps at 1.22 m (48”) intervals width-wise across the testing frame. 22 mm (7/8”) furring channels were installed and spaced perpendicular to the C-channels every 610 mm (24”) o.c. and attached using two 11 mm (7/16”) long self-drilling screws every 1.22 m (48”) o.c.

Insulation: One layer 89 mm (3-1/2”) thick glass fibre insulation was installed in the ceiling cavity.

Ceiling: Two layers of 16 mm (5/8”) Type X gypsum board were installed for a total thickness of 32 mm (1-1/4”). The first layer (base layer) was installed perpendicular to the furring channels and fastened using 41 mm (1-5/8”) #6 fine thread drywall screws in a 305 mm x 610 mm (12” x 24”) spacing pattern. The second layer (face layer) was installed in the same orientation as the base layer and offset to prevent seams from overlapping. It was installed with 51 mm (2”) #6 fine thread drywall screws using the same screw spacing as the base layer. The perimeter of the face layer was sealed with backer rod and caulking then covered with cloth tape. The seams of the face layer were sealed with caulking and covered with foil tape. Drywall screws on the face layer were covered with foil tape.

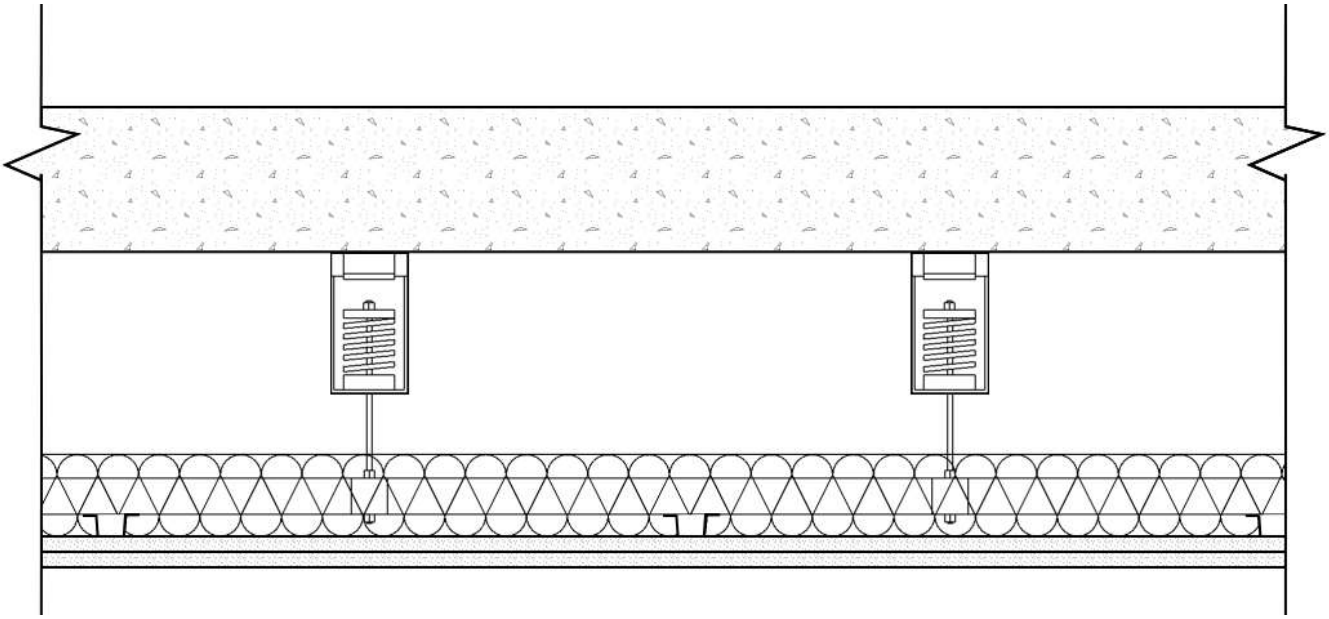


Figure 1 Cross section of A1-019524-05F.

Specimen Properties

Element	Actual Thickness (mm)	Mass/Length, Area or Volume
150 mm (6”) Precast Concrete Slab	155.6	370.6 kg/m^2
254 mm (10”) AMC Mecanocaucho SRS-25 + Sylomer Hanger	**276.0	1.0 kg/ hanger
38 mm (1-1/2”) C-Channel	*38.0	0.5 kg/m
22 mm (7/8”) Furring Channel	*23.0	0.4 kg/m
89 mm (3-1/2”) Glass Fibre Insulation	*89.0	9.3 kg/m^3
16 mm (5/8”) Type X Gypsum Board	16.0	10.9 kg/m^2
16 mm (5/8”) Type X Gypsum Board	16.0	10.9 kg/m^2
Total	**463.6**	

* The thicknesses of these elements do not contribute to the total specimen thickness.
** Total cavity space thickness of the ceiling hangers and support structure.

Test Specimen Installation

- The exposed area of the floor specimen used for the calculations of the airborne sound transmission loss was 17.85 m^2 (4.71 m x 3.79 m).
- The total area of the floor assembly resting on top of the lip was 19.32 m^2 (4.88 m x 3.96 m).
- The mass per area of the elements above the lip was calculated using the total area (19.32 m^2).
- The mass per area of the ceiling elements was calculated using the exposed area (17.85 m^2).

ASTM E90 Test Results – Airborne Sound Transmission Loss

Client: AMC Mecanocaucho **Test ID:** TLF-22-021

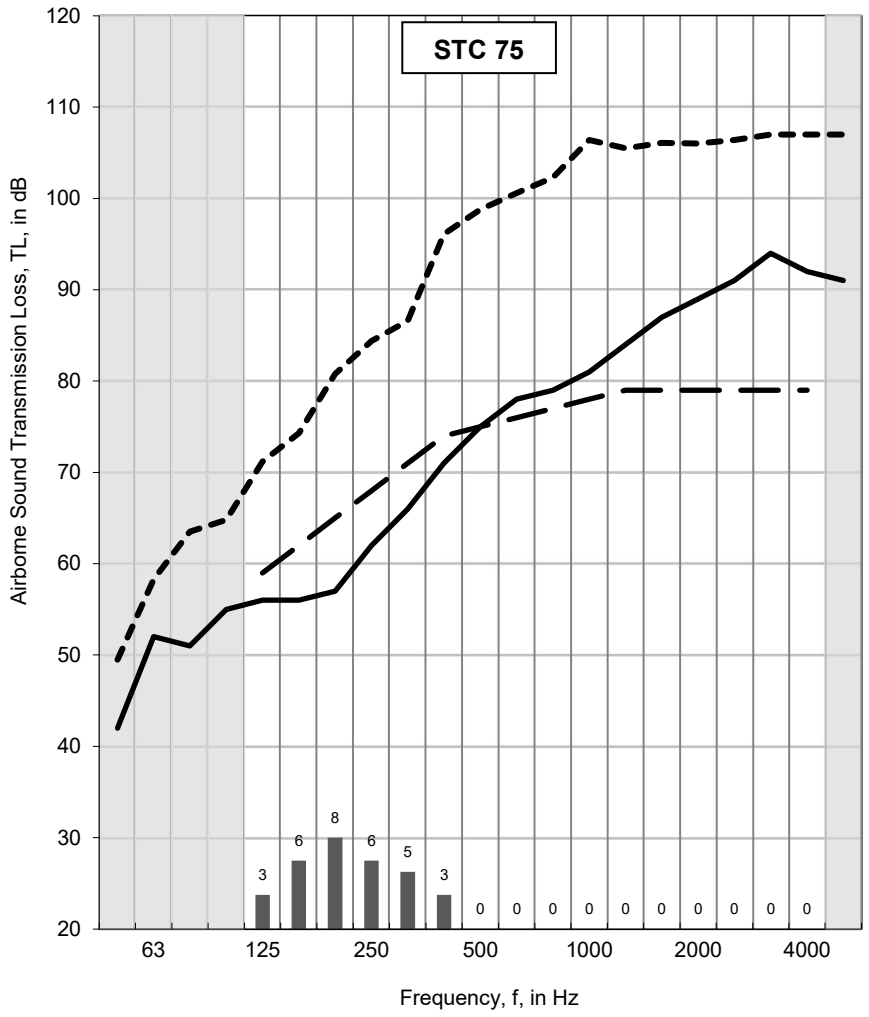
Specimen ID: A1-019524-05F **Date of Test:** 2022-04-29

Room	Volume (m³)	Air Temperature (°C)	Humidity (%)
Upper	174.3	20.5	39.0 - 39.2
Lower	173.7	18.2	38.7 - 39.2

Area S of test specimen:	17.85	m^2

f (Hz)	Airborne TL (dB)	
50	42	
63	52	
80	51	
100	55	
125	56	
160	56	
200	57	
250	62	
315	66	
400	71	
500	75	
630	78	
800	79	
1000	81	
1250	84	c
1600	87	c
2000	89	c
2500	91	c
3150	94	*
4000	92	*
5000	91	*
Sound Transmission Class (STC)	**75**	

Sum of Deficiencies (dB)
31
Max. Deficiency (dB)
8 dB at 200 Hz



For a description of the test specimen and mounting conditions see text pages before. The results in this report apply only to the specific sample submitted for measurement. No responsibility is assumed for performance of any other specimen. **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".**

In the graph:
The solid line is the measured sound transmission loss for this specimen. The dashed line is the STC contour fitted to the measured values according to ASTM E413-16. The dotted line (may be above the displayed range) is the flanking limit established for this facility. For any frequency band where the measured transmission loss is less than 10 dB lower than the dotted line, the reported value is potentially limited by flanking transmission via laboratory surfaces, and the true value may be higher than that measured. Bars at the bottom of the graph show deficiencies where the measured data are less than the reference contour as described in the fitting procedure for the STC, defined in ASTM E413-16. The shaded cells in the table and areas in the graph are outside the STC contour range.

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, in which case, the corrected values provide an estimate of the lower limit of airborne sound transmission loss.

ASTM E492 Test Results – Normalized Impact Sound Pressure Levels

Client: AMC Mecanocaucho **Test ID:** IIF-22-013

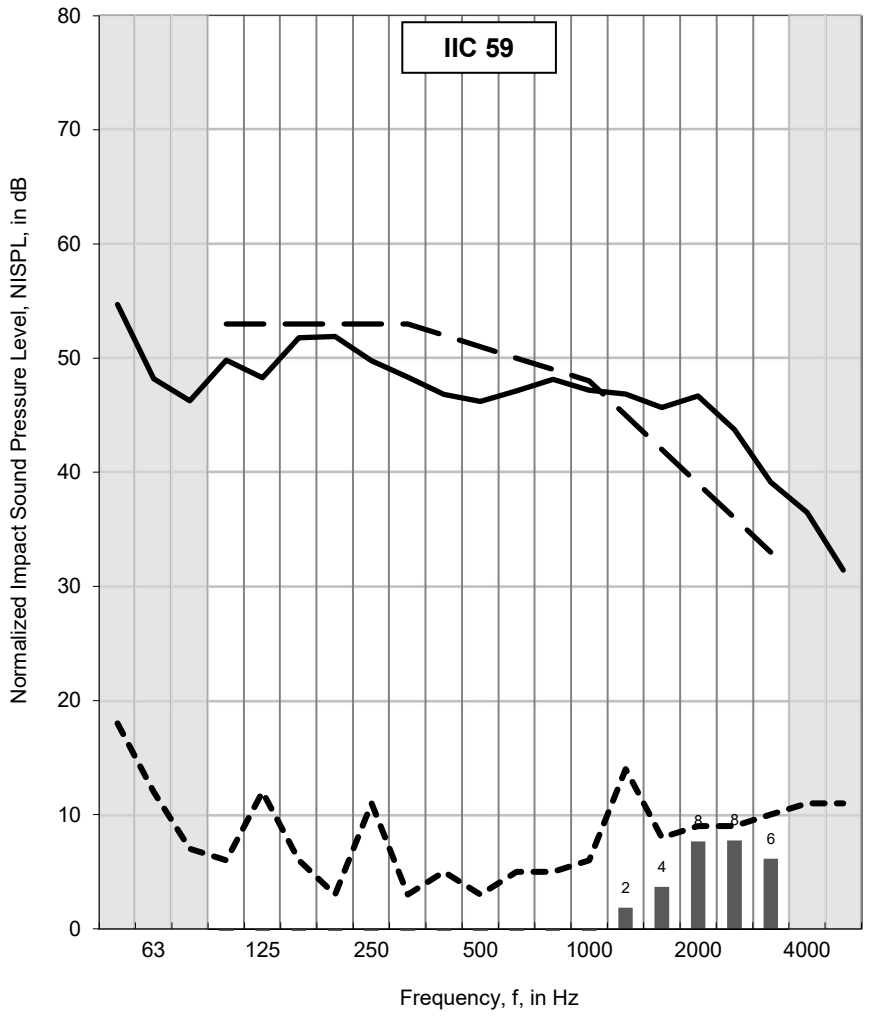
Specimen ID: A1-019524-05F **Date of Test:** 2022-04-28

Room	Volume (m³)	Air Temperature (°C)	Humidity (%)
Upper	174.3	21.2 – 21.2	55.8 – 57.3
Lower	173.7	18.5 – 18.6	42.6 – 43.2

Area S of test specimen:	17.85	m^2

f (Hz)	NISPL (dB)
50	55
63	48
80	46
100	50
125	48
160	52
200	52
250	50
315	48
400	47
500	46
630	47
800	48
1000	47
1250	47
1600	46
2000	47
2500	44
3150	39
4000	36
5000	31
Impact Insulation Class (IIC)	**59**

Sum of Positive Differences (dB)
28
Max. Positive Difference (dB)
8 dB at 2000 Hz & 2500 Hz



For a description of the test specimen and mounting conditions see text pages before. The results in this report apply only to the specific sample submitted for measurement. No responsibility is assumed for performance of any other specimen. **Measurements of normalized impact sound pressure level (NISPL) were conducted in accordance with the requirements of ASTM E492-09, "Standard Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine".**

In the graph:

The solid line is the measured normalized impact sound pressure level (NISPL) for this specimen. The dashed line is the IIC contour fitted to the measured values according to ASTM E989-21. The dotted line is the background sound level measured in the receiving room during this test (may be below the displayed range). For any frequency where the measured NISPL is less than 10 dB above the dotted line, the reported values were adjusted as noted below. Bars at the bottom of the graph show positive differences; where the measured data are greater than the reference contour as defined in ASTM E989-21. Shaded cells in the table and areas in the graph are outside the IIC contour range.

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. Values marked "*" indicate that the measured background level was less than 5 dB below the combined receiving room level and background level and the reported values of NISPL provide an estimate of the upper limit of normalized impact sound pressure level, according to the procedure outlined in ASTM E492-09. The reported values of NISPL have been corrected according to the procedure outlined in ASTM E492-09.

Fast Weighted Peak Levels – Heavy/Soft Impact Source (Ball)

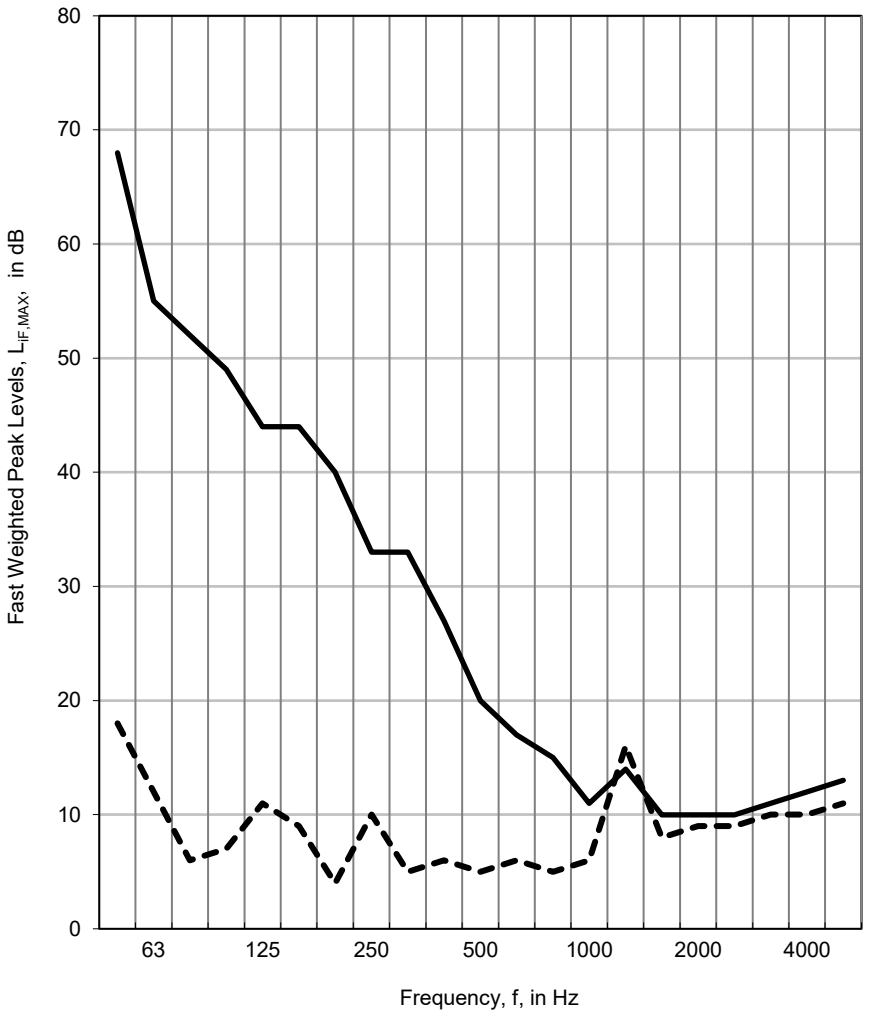
Client: AMC Mecanocaucho **Test ID:** HVF-22-012

Specimen ID: A1-019524-05F **Date of Test:** 2022-04-28

	Volume (m³)	Air Temperature (°C)	Humidity (%)
Upper	174.3	21.1	50.0 to 51.1
Lower	173.7	18.5	40.7 to 41.5

Area S of test specimen:	17.85	m^2

f (Hz)	$L_{iF,MAX}$ (dB)	
50	68	
63	55	
80	52	
100	49	
125	44	
160	44	
200	40	
250	33	
315	33	
400	27	
500	20	c
630	17	c
800	15	c
1000	11	*
1250	14	*
1600	10	*
2000	10	*
2500	10	*
3150	11	*
4000	12	*
5000	13	*



For a description of the test specimen and mounting conditions see text pages before. The results in this report apply only to the specific sample submitted for measurement. No responsibility is assumed for performance of any other specimen. See appendix "Heavy Impact Sound Transmission – Floor Facility" for more details on the test procedure.

In the graph:
The solid line is the measured fast weighted peak levels ($L_{iF,MAX}$) for this specimen using a heavy/soft impact source as described in Annex F of ISO 10140-5:2010. The dotted line is the background sound level measured in the receiving room during this test (may be below displayed range). For any frequency where measured $L_{iF,MAX}$ is less than 15 dB above the dotted line, the reported values were adjusted as noted below.

In the table:
Values marked "c" indicate that the measured background level was between 6 dB and 15 dB below the combined receiving room level and background level. The marked values of $L_{iF,MAX}$ have been corrected according to the procedure outlined in ISO 10140-4 section 4.3. Values marked "*" indicate that the measured background level was less than 6 dB below the combined receiving room level and background level, in which case, the corrected values provide an estimate of the upper limit of $L_{iF,MAX}$.

APPENDIX: ASTM E90-09 – Airborne Sound Transmission – Floor Facility

Facility and Equipment: The NRC Construction Floor Sound Transmission Facility comprises two reverberation rooms (referred to in this report as the upper and lower rooms) with a moveable test frame between the rooms. Both rooms have an approximate volume of 175 m^3. In each room, there are 8 pre-polarized diffuse-field ½" microphones, Brüel & Kjær Type 4942. Measurements are made in both rooms simultaneously using a NI PXI-4499 DAQ system with LabVIEW measurement software. Each room has four bi-amped loudspeakers driven by separate amplifiers and noise sources. To increase diffusivity 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 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements." Airborne sound transmission loss tests were performed in the forward (receiving room is the lower room) and reverse (receiving room is the upper 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 eight microphone positions in each room and then averaged to get the average sound pressure level in each room. Ten sound decays were averaged for each microphone (8) located in the respective receiving rooms; these eight reverberation times were averaged to get the average reverberation times for each room. 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 one-third octave bands in the frequency range 100 Hz to 5000 Hz. The standard recommends 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 Hz to 5000 Hz range has not been established, but is expected to depend on laboratory-specific factors.

Sound Transmission Class (STC): The Sound Transmission Class (STC) was determined in accordance with ASTM E413-16, "Classification for Rating Sound Insulation". It is a single-number 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.

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.

APPENDIX: ASTM E492-09 – Light Impact Sound Transmission – Floor Facility

Facility and Equipment: The NRC Construction Floor Sound Transmission Facility comprises two reverberation rooms (referred to in this report as the upper and lower rooms) with a moveable test frame between the two rooms. Both rooms have an approximate volume of 175 m^3. For impact sound transmission, only the lower room is used. In each room, there are 8 pre-polarized diffuse-field 1/2" microphones, Brüel & Kjær Type 4942. Measurements are made in both rooms simultaneously using a NI PXI-4499 DAQ system with LabVIEW measurement software. Each room has four bi-amped loudspeakers driven by separate amplifiers and noise sources. To increase diffusivity of the sound field, there are fixed diffusing panels in each room.

Test Procedure: Impact sound transmission measurements were conducted in accordance with ASTM E492-09, "Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine." This method uses a standard tapping machine placed at four prescribed positions on the floor. One-third octave band sound pressure levels were measured for 32 seconds at each microphone position in the receiving room and then averaged to get the average sound pressure level in the room. Ten sound decays were averaged for each microphone (8) located in the respective receiving rooms; these eight reverberation times were averaged to get the average reverberation times for each room. Information on the flanking limit of the facility and reference specimen test results are available on request. The spatial average sound pressure levels and reverberation times of the receiving room were used to calculate the Normalized Impact Sound Pressure Levels. Information on the flanking limit of the facility and reference specimen test results are available on request.

Significance of Test Results: ASTM E492-09 requires measurements in one-third octave bands in the frequency range 100 Hz to 3150 Hz. The standard recommends 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 standard ranges has not been established, and is expected to depend on laboratory-specific factors such as room size and specimen dimensions.

Impact Insulation Class (IIC): The Impact Insulation Class (IIC) was determined in accordance with ASTM E989-21, "Standard Classification for Determination of Impact Insulation Class (IIC)". It is a single-number rating scheme intended to rate the effectiveness of floor-ceiling assemblies at preventing the transmission of impact sound from the standard tapping machine. A higher IIC value indicates a better floor performance.

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.

APPENDIX: Heavy Impact Sound Transmission – Floor Facility

Facility and Equipment: The NRC Construction Floor Sound Transmission Facility comprises two reverberation rooms (referred to in this report as the upper and lower rooms) with a moveable test frame between the two rooms. Both rooms have an approximate volume of 175 m^3. For impact sound transmission, only the lower room is used. In each room, there are 8 pre-polarized diffuse-field 1/2" microphones, Brüel & Kjær Type 4942. Measurements are made in both rooms simultaneously using a NI PXI-4499 DAQ system with LabVIEW measurement software. Each room has four bi-amped loudspeakers driven by separate amplifiers and noise sources. To increase diffusivity of the sound field, there are fixed diffusing panels in each room.

Test Procedure: Impact tests were conducted following the recommendations in ISO 10140-3:2010 Annex A. A heavy/soft impact source described in Annex F of ISO 10140-5:2010 was dropped from a height of 100 cm over 5 different positions, on quarter lengths of both floor diagonals and in the centre of the room. Receive levels in the room below were measured simultaneously at 8 different microphone positions as fast-weighted (125 ms) peak levels in one-third octave bands ($L_{iF,MAX}$). The $L_{iF,MAX}$ values measured at the different microphone positions were energy averaged for each excitation position. Then, the calculated fast weighted peak levels of all excitation positions were also energy averaged. One-third octave band background sound pressure levels were measured for 32 seconds at each microphone position in the receiving room and then averaged to get the average background sound pressure level in the room.

Significance of Test Results: The precision of results has not been established, and is expected to depend on laboratory-specific factors such as room size, sound absorption and specimen dimensions. The results are specific to the room in which they were measured, and an increase in volume and/or sound absorption reduces the measured fast weighted levels.

In Situ Performance: Levels obtained by this method tend to represent an upper limit to what might be measured in a field test with the same volume and absorption, due to structure-borne transmission (“flanking”) and construction deficiencies in actual buildings.