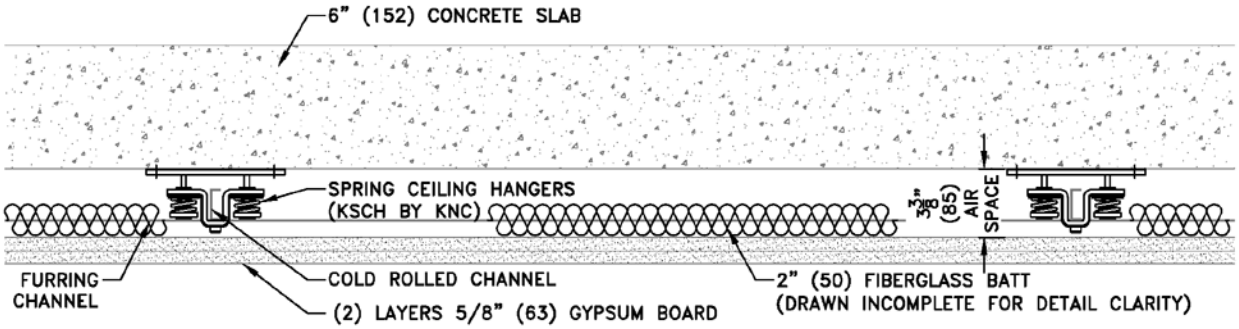
KINETICS NOISE CONTROL TEST REPORT #AT001111

- **KINETICS NOISE CONTROL PRODUCTS:**
  - KSCH

- **ACOUSTICAL RATINGS:**
  - STC 69
  - IIC 54

- **TESTING AGENCY & REPORT NUMBER:**
  - NRC-CANADA
  - REPORT NO. A1-010601.4
  - DATED: MAY 17, 2018



KINETICS DRAWING NUMBER: AT001111

KINETICS Noise Control

6300 IRELAN PLACE, DUBLIN OH
PHONE: 800.959.1229
FAX: 614.889.0540
WEB: WWW.KINETICSNOISE.COM
EMAIL: ARCHSALES@KINETISNOISE.COM

National Research Council Canada | Conseil national de recherches Canada

NRC·CNRC

17 May 2018

Reports A1-010601.4
A1-010601.8
A1-010601.13

Kinetics Noise Control Inc.
6300 Irelan Place
Dublin OH 43107

Attention: Jason Ehrlich

Re: Reissue of Report A1-010601.4, A1-010601.8, and A1-010601.13

Dear Mr. Ehrlich:

We are enclosing 1 copy of reissued Client Report No. A1-010601.4, .8 and .13 part of the work carried out by NRC Construction as requested in the Agreement dated 2 December 2016.

We trust everything is to your complete satisfaction. Should you have any questions regarding this report, you may contact Ivan Sabourin at (613) 993-9741. We appreciate the opportunity to be of service to you.

Sincerely,

Richard Tremblay, Director General, NRC Construction
Richard Tremblay, directeur général, CNRC Contruction

FOR

Philip Rizcallah, P. Eng.
Program Leader
Building Regulations for Market Access
Construction, NRC

cc: Ivan Sabourin

NRC·CNRC CONSTRUCTION

Acoustic Testing of a Concrete Floor Assembly with Kinetics® KSCH Ceiling Hangers (Small Air Space)

Kinetics Noise Control Inc.
Report No. A1-010601.4
17 May 2018 (revised)

National Research Council Canada
Conseil national de recherches Canada
Canada

Acoustic Testing of a Concrete Floor Assembly with Kinetics® KSCH Ceiling Hangers (Small Air Space)

Author

Ivan Sabourin
Technical Officer

Approved

Richard Tremblay, Director General, NRC Construction
Richard Tremblay, directeur général, CNRC Contruction
FOR

Philip Rizcallah, P. Eng.
Program Leader, Building Regulations for Market Access
NRC Construction

Report No: A1-010601.4
Report Date: 17 May 2018 (revised*)
Contract No: A1-010601
Agreement date: 2 December 2016
Program: Building Regulations for Market Access

8 pages

Copy no. 1 of 4

*This revised report corrects the fiberglass batts thickness found on pages 3 and 4, and supersedes the previous version of 25 July 2017.

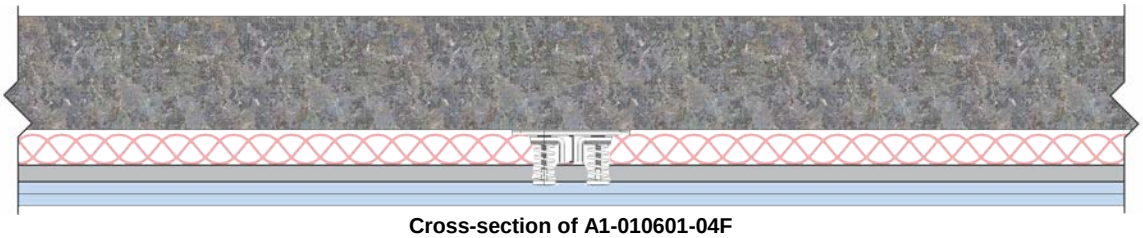
Client	Kinetics Noise Control Inc. 6300 Irelan Place Dublin OH 43107
Specimen	150 mm (6 in) precast concrete floor with deck-suspended ceiling with Kinetics® KSCH Ceiling Hangers (Small Air Space)
Specimen ID	A1-010601-04F
Construction Date:	May 17, 2017 to May 24, 2017

Specimen Description

Precast Concrete Slab: The precast concrete reference floor slab of size 150 mm x 4010 mm x 4920 mm (6 in x 157.8 in x 193.7 in) was installed in the test frame. The upper gap between the specimen and the test frame was filled with fibrous insulation and sealed with cloth tape. The lower gap between the specimen and test frame was filled with putty and taped.

Deck-Suspended Ceiling with Kinetics® KSCH Ceiling Hanger: The **Kinetics® KSCH Ceiling Hangers** were attached directly to the underside of the precast concrete slab using bolts into concrete inserts. The nominal spacing of the KSCH ceiling hangers was approximately 1220 mm (48 in) in both directions – see attached diagram for isolator type and spacing. The assembly comprised a total of 20 KSCH isolators: four KSCH-35, ten KSCH-48, four KSCH-73 and two KSCH-90 isolators (see *Figure 1* for isolator type and layout). A 16 gauge C-channel was inserted into the channel caddie. The C-channels were nominally spaced 1220 mm (48 in) on centre. Metal furring channels (20 ga) were screwed perpendicularly to the C-channels and spaced 406 mm (16 in) on centre. Fiberglass batts insulation with nominal thickness of 50 mm (2 in) was inserted in the cavity.

Two layers of 16 mm (5/8 in) Type X gypsum board with nominal dimensions 1220 mm wide x 2440 mm long (4’ x 8’) was installed with the long dimension perpendicular to the furring channels. The base layer of gypsum boards were screwed using #6 Type “S” drywall screws 42 mm (1-5/8 in) long at 406 mm (16 in) on centre spacing to the furring channels. The face layer of gypsum boards were screwed using #6 Type “S” drywall screws 50 mm (2 in) long at 305 mm (12 in) on centre spacing to the furring channels. Kinetics CPT (self-adhesive foam) 6 mm (1/4 in) thick was placed around the perimeter of the gypsum board layer. Exposed joints between the gypsum board panels were caulked and covered with an aluminum foil tape. **The air space between the slab and the top of the gypsum board was approximately 85 mm (3-3/8 in).**



Cross-section of A1-010601-04F

Specimen Properties

Element	Actual thickness (mm)	Mass (kg)	Mass/length, area or volume
150 mm (6 in) precast concrete slab	150	7 460	378.0 kg/m^2
Air space (from slab to gypsum board)	85	-	- -
KSCH Ceiling Hangers	*43	7	0.4 kg/ea
C-channels 16 ga	*38	19	0.5 kg/m
22 mm (7/8 in) 20 ga metal furring channels	*22	47	1.4 kg/m
50 mm (2 in) fiberglass batts insulation	*50	7	0.4 kg/m^2
16 mm (5/8 in) Type X gypsum board	16	193	10.8 kg/m^2
16 mm (5/8 in) Type X gypsum board	16	193	10.8 kg/m^2
Total	**267**	**7 926**	**402.1 kg/m^2**

* The thicknesses of these elements are not included in the total specimen thickness.

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).

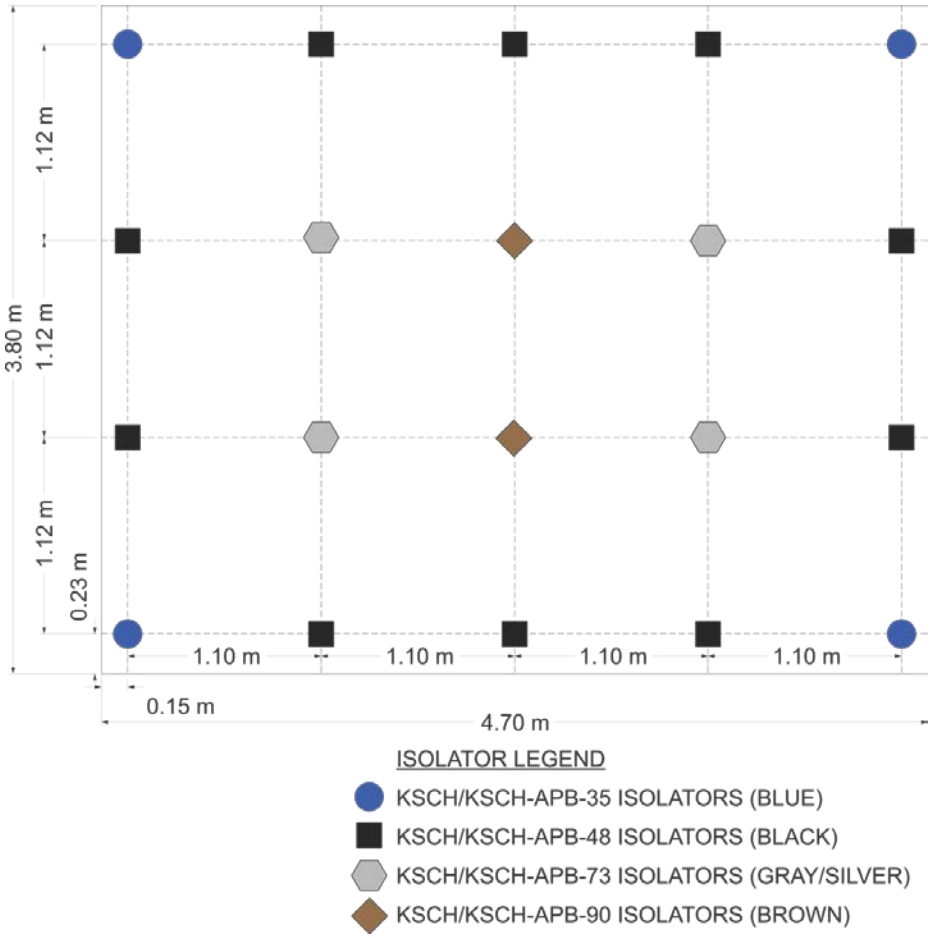


Figure 1: Type and Location of Kinetics® KSCH Ceiling Hangers

ASTM E90 Test Results – Airborne Sound Transmission Loss

Client: Kinetics Noise Control Inc. **Test ID:** TLF-17-030

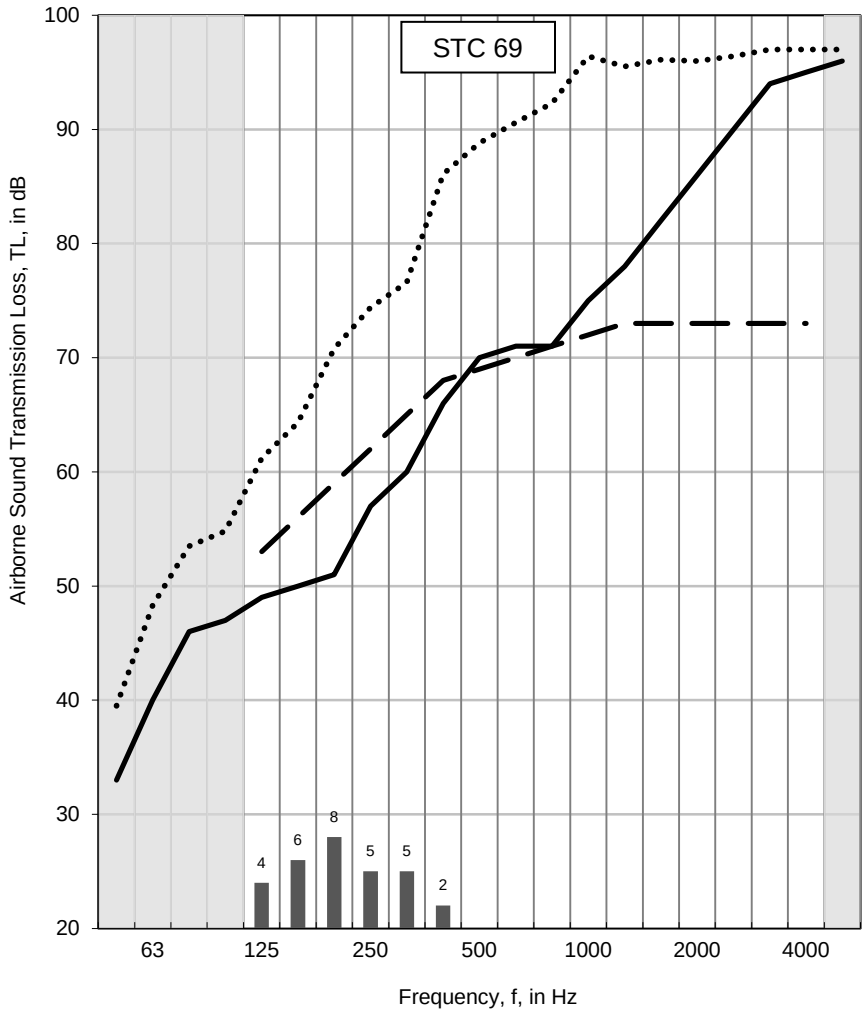
Specimen ID: A1-010601-04F **Date of Test:** May 26, 2017

Room	Volume (m³)	Air Temperature (°C)	Humidity (%)
Upper	176.2	23.5 to 23.6	30.6 to 31.1
Lower	175.0	19.7 to 19.7	42.5 to 42.5

Area S of test specimen:	17.85 m^2
Mass per unit area:	402.1 kg/m^2

f (Hz)	Airborne TL (dB)	
50	33	
63	40	
80	46	
100	47	
125	49	
160	50	
200	51	
250	57	
315	60	
400	66	
500	70	
630	71	
800	71	
1000	75	
1250	78	
1600	82	
2000	86	c
2500	90	*
3150	94	*
4000	95	*
5000	96	*
Sound Transmission Class (STC)	**69**	

Sum of Deficiencies (dB)
30
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

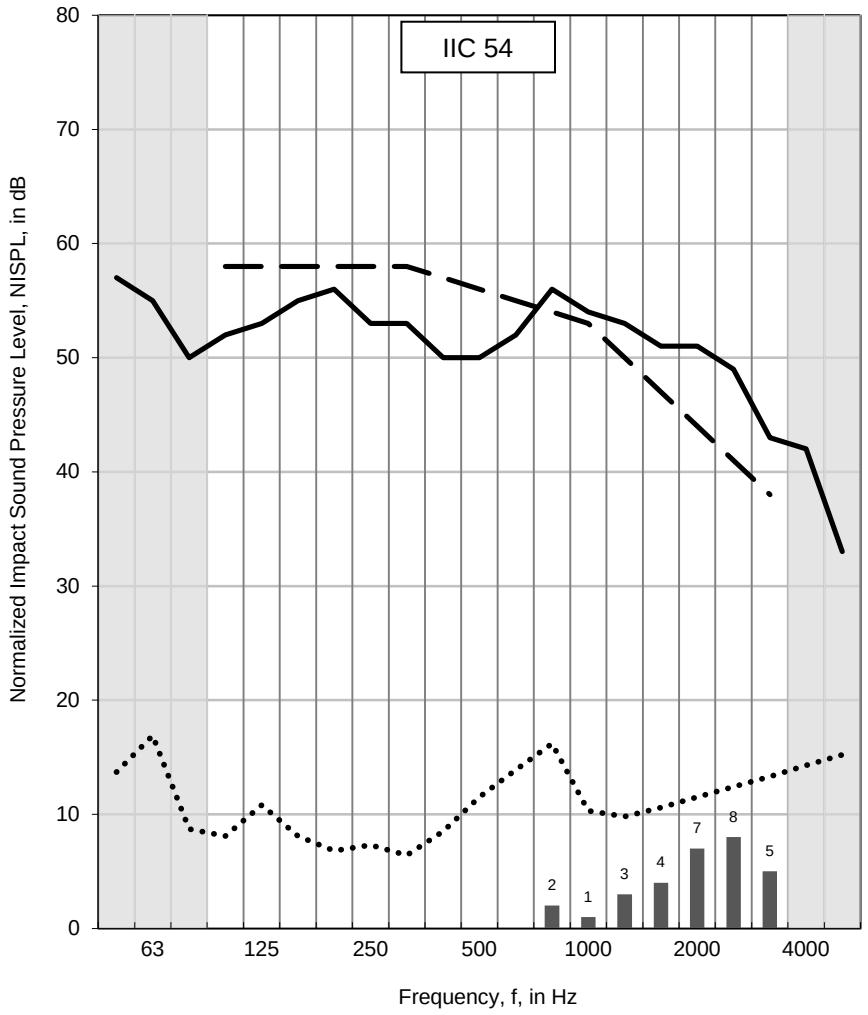
Client: Kinetics Noise Control Inc. **Test ID:** IIF-17-020

Specimen ID: A1-010601-04F **Date of Test:** May 25, 2017

Room	Volume (m^3)	Air Temperature (°C)	Humidity (%)
Upper	176.2	24.4 to 24.6	31.9 to 32.5
Lower	175.0	20.2 to 20.3	42.2 to 42.5

Area S of test specimen:	17.85 m^2
Mass per unit area:	402.1 kg/m^2

f (Hz)	NISPL (dB)
50	57
63	55
80	50
100	52
125	53
160	55
200	56
250	53
315	53
400	50
500	50
630	52
800	56
1000	54
1250	53
1600	51
2000	51
2500	49
3150	43
4000	42
5000	33
Impact Insulation Class (IIC)	**54**



Sum of Positive Differences (dB)
30
Max. Positive Difference (dB)
8 dB at 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 E989-06. 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 E989-06. 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.

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, 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 NI-4472 system installed in a 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 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 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 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 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 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. A calibrated Bruel & Kjaer condenser microphone (type 4166 or 4165) with preamp is moved under computer control to nine positions, and measurements are made using an 8-channel National Instrument NI 4472 system installed in a computer. The room has 4 bi-amped loudspeakers driven by separate amplifiers and incoherent noise sources. To increase randomness of the sound field, there are fixed diffusing panels in the 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. Five sound decays were averaged to get the reverberation time at each of the nine microphone positions in the receiving room; these nine reverberation times were averaged to get the spatial average reverberation times for the room. The spatial average sound pressure levels and reverberation times of the receiving room were used to calculate the Normalized Impact Sound Pressure Levels.

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 E989-06, "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.