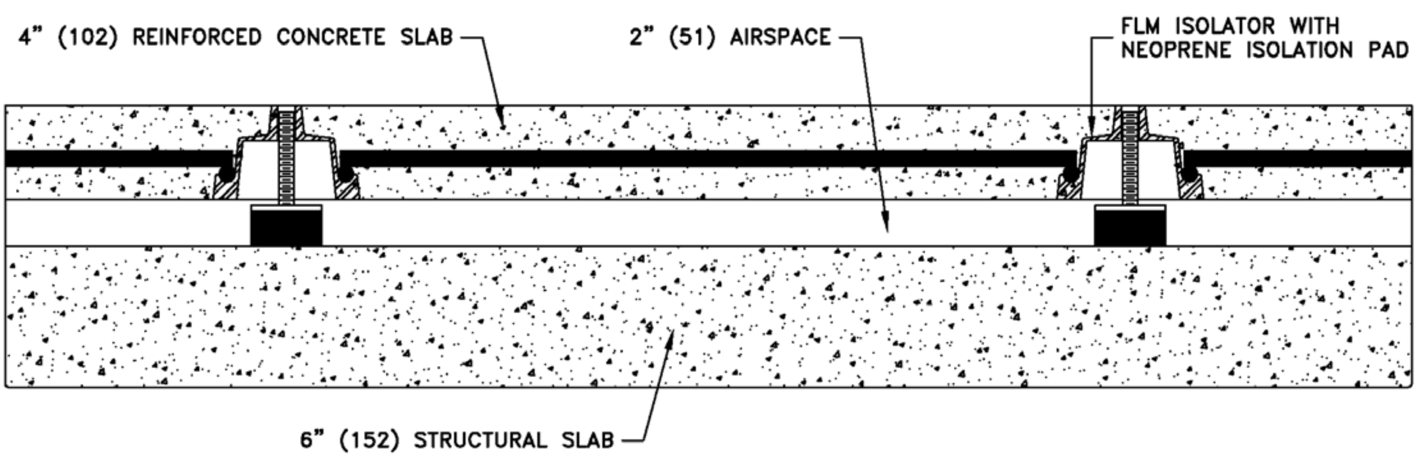
KINETICS NOISE CONTROL TEST REPORT #AT001067

- **KINETICS NOISE CONTROL PRODUCTS:**
  - FLM- NEOPRENE PAD

- **ACOUSTICAL RATINGS:**
  - STC 69
  - IIC 61

- **TESTING AGENCY & REPORT NUMBER:**
  - NATIONAL RESEARCH COUNCIL OF CANADA
  - B-3448.3



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KINETICS Noise Control

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

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Client Report

B-3448.3

Airborne Sound Transmission Loss and Impact Sound Transmission Measurements Performed on One (1) Floor Assembly with Floating Concrete Slab

for

Kinetics Noise Control
6300 Ireland Place
Dublin, OH, USA
43017-0655

01 May 2007

National Research Council Canada
Conseil national de recherches Canada

Canada

Airborne Sound Transmission Loss and Impact Sound Transmission Measurements Performed on One Floor Assembly with Floating Concrete Slab for Kinetics Noise Control

Author

N.L. Brunette

Quality Assurance

J.D. Quirt, Ph.D.
Group Leader

Approved

M.R. Atif, Ph.D.
Director, Indoor Environment

Report No: B3448.3
Report Date: May 1, 2007
Contract No: B3448
Reference: Agreement dated June 26, 2006
Program: Indoor Environment

10 pages
Copy No. 1 of 4 copies

INTRODUCTION

Airborne and impact sound transmission measurements were performed on one floor assembly which comprised the NRC 150 mm reference concrete slab and a 102 mm floating concrete slab. For report purposes, the specimen is identified as Specimen B3192-2. Please note that this floor assembly was tested under contract B3192, but an individual report for this specimen was not requested or issued as part of that contract.

SPECIMEN DESCRIPTION

Construction on the floor assembly began on October 25, 2004. The airborne and impact sound transmission loss tests were performed on the 26th of October, 2004. The following table gives the elements of the specimen, listed from top to bottom.

The 150 mm reference concrete slab, provided by NRC, was installed in the floor test frame. The perimeter of the reference concrete slab was sealed with insulation, mortite, latex caulking and covered with metal tape. The 102 mm floating concrete slab was made off campus at Central Precast and left to cure for 28 days. The floating concrete slab was delivered to our Acoustical Facility on 13-Oct-04. The floating concrete slab had reinforcing bars and 16 encased mounts. The 16 encased mounts provided by the client measured 130 x 130 x 64 mm thick. The mounts weighed 30.1 kg.

Specimen B3192-2

Table 1: Element breakdown of Specimen B3192-2.

Element	Surface weight (kg/m^2)	Mass (kg)
102 mm floating concrete slab with reinforcing bars and encased mounts	239.1	4717.4
54 mm neoprene pad including metal top plate (sixteen pads)		6.1
51 mm air gap		
150 mm NRC reference concrete slab	356.3	7055.6
TOTAL		905.7

Total thickness: 303 mm

Sixteen neoprene pads measuring 86 x 86 x 54 mm thick were inserted in the encased mounts of the floating slab. The floating slab was then placed on top of the reference concrete slab. Once the floating slab was placed on top of the reference concrete slab, sixteen leveling bolts each measuring 89 mm long, that penetrated the floating slab were systematically screwed into the encased mounts pushing onto the metal top plate of the neoprene pads in order to raise the floating slab to an air gap of 51 mm. The gap between the perimeter of the floating slab and the test frame was filled with insulation, backer rod and latex caulking then covered with metal tape. The holes for the eyebolts used to lift the slab were filled with insulation and then covered with metal tape.

Figure 1: Side view of the neoprene pad.

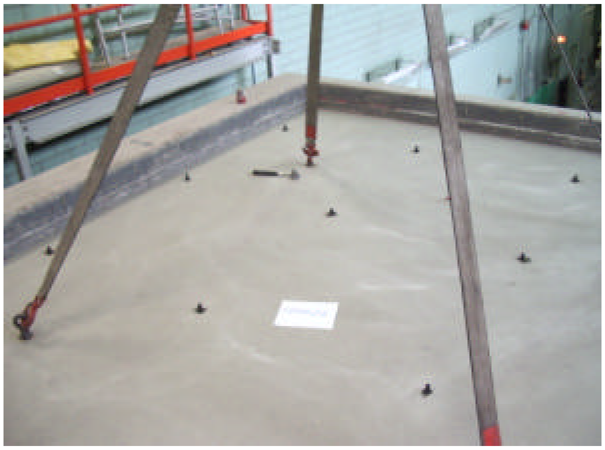

Figure 2: The leveling bolts used to raise the floating slab and the eyebolts to lift the slab.

The test specimen was mounted in the IRC acoustical floor test opening which measures 4.70 x 3.78 m. The area used for the calculations of impact transmission and airborne sound transmission loss was 17.85 m^2.

The measured temperature and relative humidity in the upper chamber during testing were 22.9°C and 29.9%, respectively. The measured temperature and relative humidity in the lower chamber during testing were 20.9°C and 37.5%, respectively.

RESULTS

Results of the airborne sound transmission loss measurements of Specimen B3192-2 are given in Table 2 and Figure 3. Results of the impact sound transmission measurements of this floor construction are given in Table 5 and Figure 4.

The Tables also give the 95% 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 and E492 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 to the differences expected when nominally identical specimens are tested in different laboratories (reproducibility).

Table 2: Airborne sound transmission loss measurements of Specimen B3192-2, TLF-04-049/050.

Frequency (Hz)	Airborne Sound Transmission Loss (dB)	95% Confidence Limit	Deviation Below the STC Contour
50	35		
63	43		
80	47		
100	51		
125	51	± 1.1	2
160	53	± 1.0	3
200	51	± 0.9	8
250	55	± 0.7	7
315	62	± 0.6	3
400	68	± 0.5	
500	74	± 0.4	
630	79	± 0.4	
800	84	± 0.5	
1000	88 *	± 0.4	
1250	88 *	± 0.3	
1600	91 *	± 0.4	
2000	99 *	± 0.2	
2500	101 *	± 0.2	
3150	100 *	± 0.3	
4000	100 *	± 0.4	
5000	99 *		
Sound Transmission Class (STC)[1] = 69			
Weighted Sound Reduction (R_W)[2] = 70			

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.

[1] Sound Transmission Class (STC) calculated according to ASTM E413.

[2] Weighted Sound Reduction (R_w) calculated according to ISO 717.

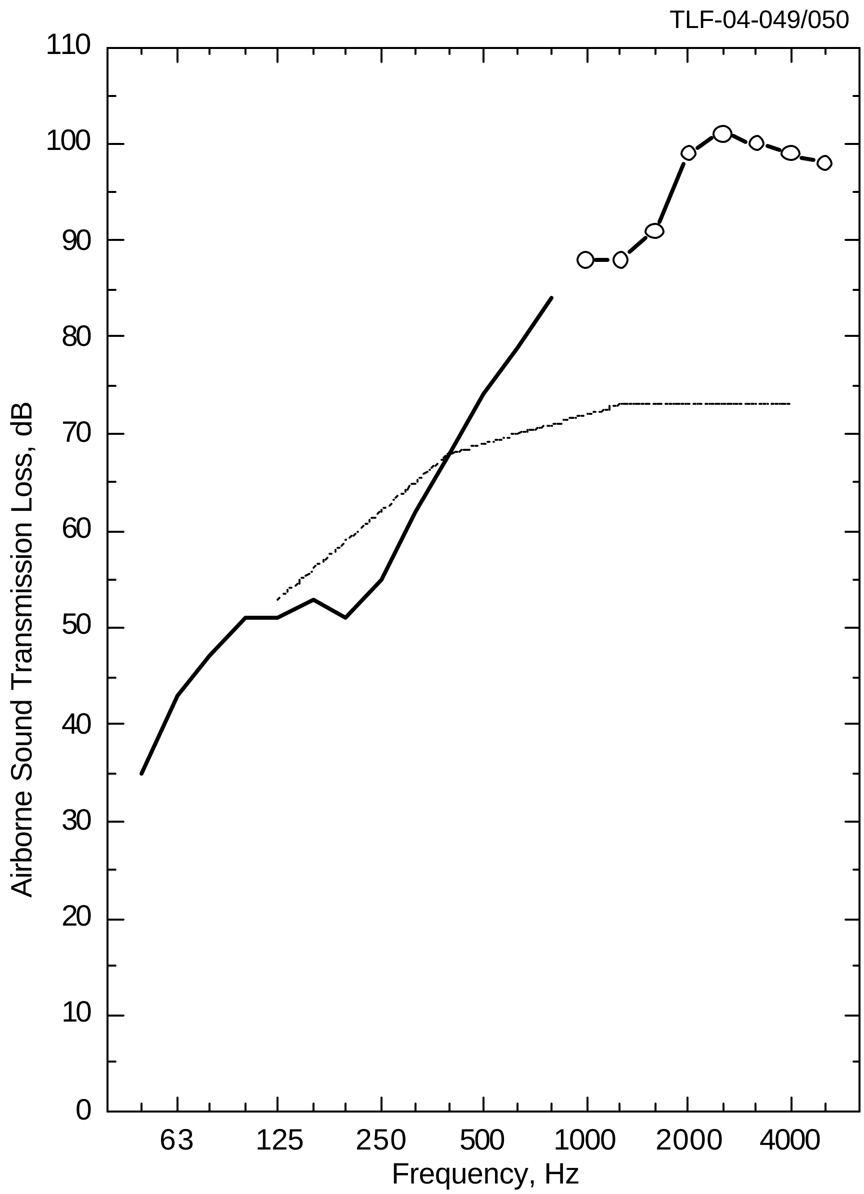

Figure 3: Airborne sound transmission loss measurements of Specimen B3192-2. The solid line is the experimental data and the dotted line is the STC 69 contour. The line with open circles shows the lower limit of the airborne sound transmission loss.

Table 3: Impact sound transmission measurements of Specimen B3192-2, IIF-04-027.

Frequency (Hz)	Normalized Impact Sound Pressure Level (dB)	95% Confidence Limit[1]	Deviation Above the IIC Contour
50	53		
63	47		
80	48		
100	46	± 1.1	
125	50	± 0.7	
160	53	± 1.0	2
200	59	± 0.4	8
250	55	± 0.4	4
315	50	± 0.3	
400	48	± 0.2	
500	45	± 0.2	
630	44	± 0.2	
800	43	± 0.3	
1000	42	± 0.1	
1250	45	± 0.2	2
1600	38	± 0.2	
2000	33	± 0.1	
2500	31	± 0.1	
3150	38	± 0.2	7
4000	31		
5000	25 *		

Impact Insulation Class (IIC)[3] = 61

Weighted Normalized Impact Sound Pressure Level ($L_{n,w}$)[4] = 48

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 upper limit of the impact sound pressure level.

[3] Impact Insulation Class (IIC) calculated according to ASTM E989.

[4] Weighted Normalized Impact Sound Pressure Level ($L_{n,w}$) calculated according to ISO 717.

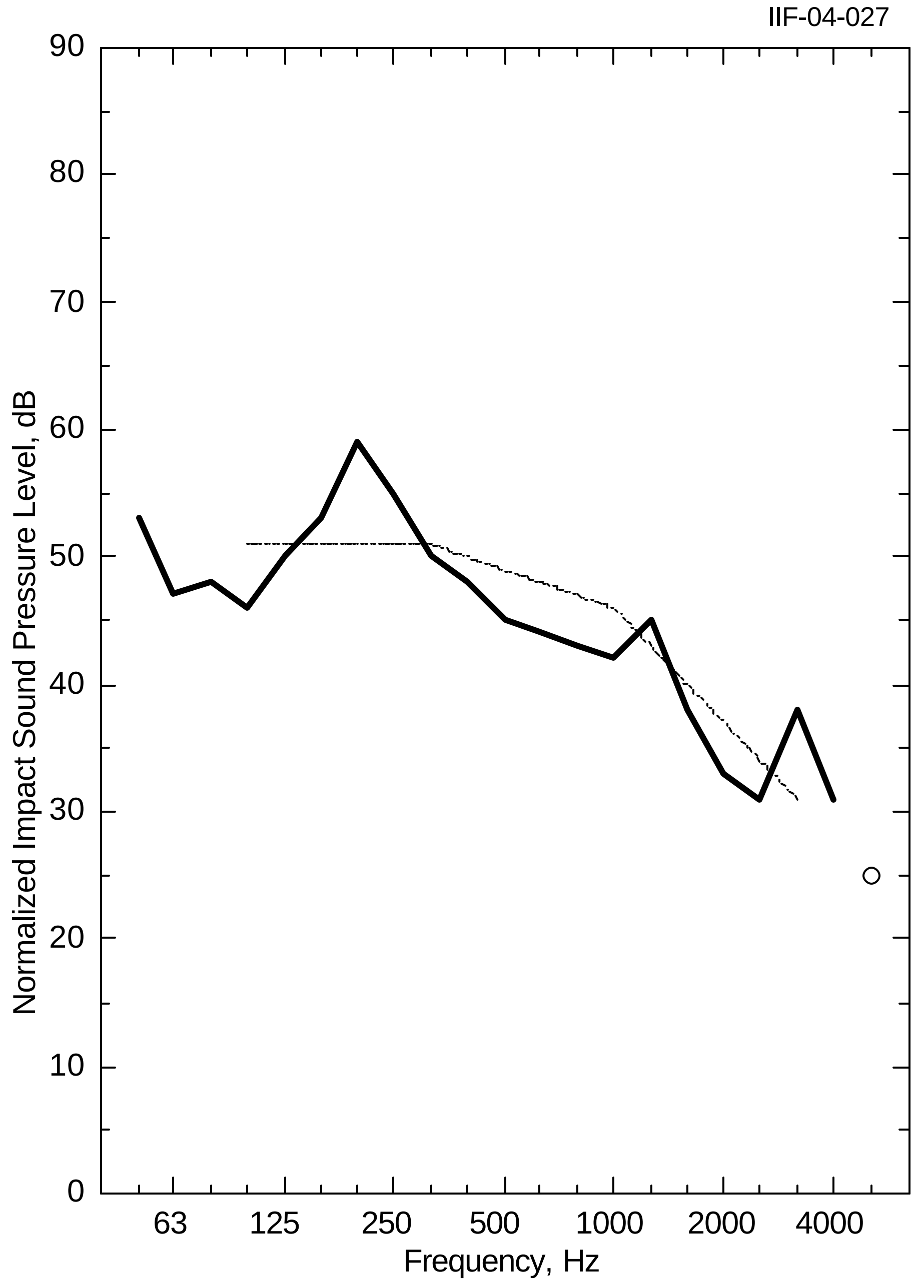

Figure 4: Impact sound transmission measurements of Specimen B3192-2. The solid line is the experimental data and the dotted line is the IIC 61 contour. The open circle symbol is an estimate of the upper limit of the impact sound pressure level.

NOTES ON THE SIGNIFICANCE OF TEST RESULTS

Sound Transmission Class And Weighted Sound Reduction Index

The Sound Transmission Class (STC) and Weighted Sound Reduction Index (R_w) are single-figure rating schemes intended to rate the acoustical performance of a partition element under typical conditions involving office or dwelling separation. The higher the value of either rating, the better the floor performance. Thus, the rating is intended to correlate with subjective impressions of the sound insulation provided against the sounds of speech, radio, television, music, office machines and similar sources of noise characteristic of offices and dwellings. In applications involving noise spectra that differ markedly from those referred to above (for example, heavy machinery, power transformers, aircraft noise, motor vehicle noise), the STC and R_w are of limited use. Generally, in such applications it is desirable to consider explicitly the noise spectra and the insulation requirements.

Impact Insulation Class And Weighted Normalized Impact Sound Pressure Level

The Impact Insulation Class (IIC) (ASTM E989) and the Weighted Normalized Impact Sound Pressure Level ($L_{n,w}$) (ISO 717-2) are single-figure rating schemes intended to rate the effectiveness of floor-ceiling assemblies at preventing the transmission of impact sound from the standard tapping machine. The higher the value of the rating, the better the floor performance.

The ASTM E989 and the ISO 717 rating curves are identical. The major difference in the fitting procedure is that the ISO standard allows unfavorable deviations to exceed 8 dB; the ASTM E989 standard does not. When this 8 dB requirement is not invoked, the two ratings are related by the equation

$$IIC = 110 - L_{n,w}$$

Extended Frequency Range

Standard test procedures require measurements in 1/3-octave bands over a specified frequency range (125 to 4000 Hz for ASTM E90 and 100 to 3150 Hz for ASTM E492). 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 standard ranges has not been established, and is expected to depend on laboratory-specific factors such as room size and specimen dimensions.

FACILITIES AND EQUIPMENT

The acoustics floor test facility comprises two reverberation rooms with a moveable test frame between the two rooms. Both rooms have a volume of 175 m^3.

Measurements are controlled by a desktop PC-type computer interfaced to a Norwegian Electronics type 830 real time analyser. Each room has a calibrated Bruel & Kjaer condenser microphone with a type 4166 cartridge that is moved under computer control to nine positions used for the acoustical measurements. Each room has four loudspeakers driven by separate amplifiers and noise sources. To increase the randomness of the sound field, there are also fixed diffusing panels in each room.

TEST PROCEDURE

Airborne Sound Transmission Loss

Airborne sound transmission measurements were conducted in accordance with the requirements of ASTM E90, “Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions”, and of ISO 140-3, “Laboratory Measurement of Airborne Sound Insulation of Building Elements”.

The Sound Transmission Class (STC) was determined in accordance with ASTM E413, “Classification for Rating Sound Insulation”. The Weighted Sound Reduction Index (R_w) was determined in accordance with ISO 717-1, “Rating of Sound Insulation in Buildings and of Building Elements, Part 1: Airborne Sound Insulation”.

One-third octave band sound pressure levels were measured for 30 seconds at each microphone position in each 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 microphone position in the receiving room. These times were averaged to get the average reverberation times for the room.

The average sound pressure levels of both the source and receiving rooms and the average reverberation times of the receiving room were used to calculate sound transmission loss values.

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.

A complete description of the test procedure, information on the flanking limit of the facility and reference specimen test results are available on request.

Impact Sound Transmission

Impact sound transmission measurements were made in accordance with ASTM E492, "Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine". This test used the standard tapping machine and the prescribed four impact positions on the floor. The Impact Insulation Class (IIC) was determined in accordance with ASTM E989, "Standard Classification for Determination of Impact Insulation Class (IIC)".

These measurements are also in accordance with ISO 140-6, "Laboratory Measurements of Impact Sound Insulation of Floors", except that the tapping machine positions are not randomly selected. This difference is believed to be insignificant. The Weighted Normalized Impact Sound Pressure Level ($L_{n,w}$) was determined in accordance with ISO 717-2, "Acoustics — Rating of Sound Insulation in Buildings and of Building Elements - Part 2: Impact Sound Insulation".

One-third octave band sound pressure levels were measured for 30 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 microphone position in the receiving room. These times were averaged to get the spatial average reverberation times for the room.

The space average sound pressure levels and the spatial average reverberation times of the receiving room were used to calculate impact transmission values. For impact sound transmission, the lower room is the receiving room.

A complete description of the test procedure is available on request.