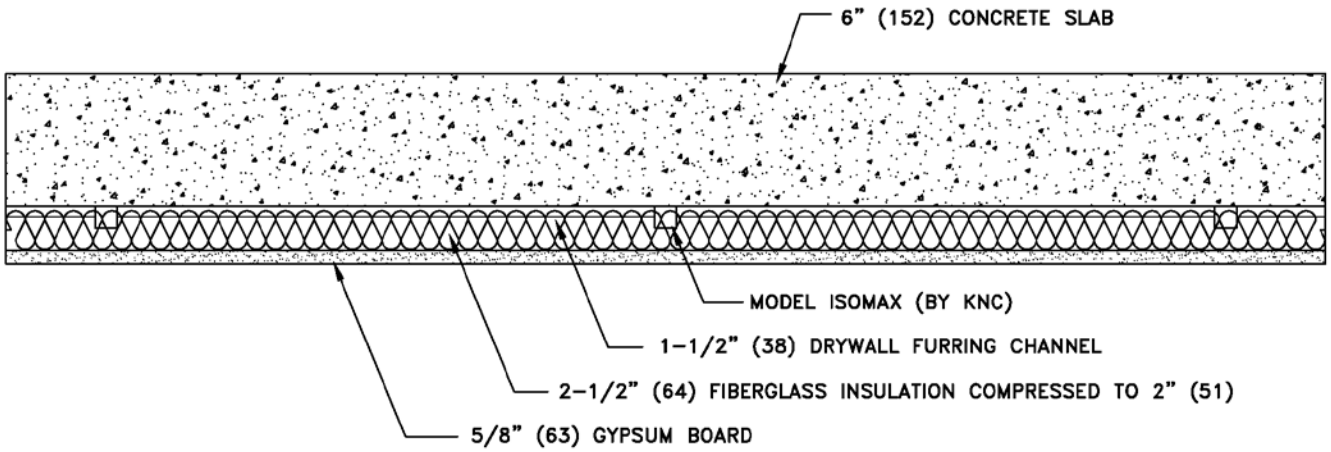
KINETICS NOISE CONTROL TEST REPORT #AT001052

- **KINETICS NOISE CONTROL PRODUCTS:**
  - ISOMAX CLIPS

- **ACOUSTICAL RATINGS:**
  - STC 66
  - IIC 44

- **TESTING AGENCY & REPORT NUMBER:**
  - NATIONAL RESEARCH COUNCIL OF CANADA
  - B-3448.5



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Client Report

B-3448.5

Airborne Sound Transmission Loss and Impact Sound Transmission Measurements Performed on One (1) Floor Assembly with IsoMax Clips

for

Kinetics Noise Control
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Dublin, OH, USA
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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 IsoMax Clips for Kinetics Noise Control

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INTRODUCTION

Airborne and impact sound transmission measurements were performed on one floor assembly. For report purposes, the specimen is identified as Specimen B3192-4. 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

The 150 mm reference concrete slab, provided by NRC, was installed in the floor test frame on September 1, 2004. The perimeter of the reference concrete slab wad sealed at the top with insulation and covered with metal tape and at the bottom with mortite then covered with metal tape. The density of the concrete slab was 2446 kg/m^3.

Figure 1: The NRC reference concrete slab installed in the floor test frame.

Specimen B3192-4

Construction on the floor assembly began on September 22, 2004. The airborne and impact sound transmission loss tests were performed on September 29, 2004. The following table gives the elements of the specimen, listed from top to bottom.

Table 1: Element breakdown of Specimen B3192-4.

Element	Surface weight (kg/m^2)	Mass (kg)
150 mm NRC reference concrete slab	356	7030
25 mm IsoMax clips (thirty-two clips)		4.2
38 mm furring channels, 610 mm on center (oc)		14.4
64 mm glass fibre batts	2.8	16.6
16 mm gypsum board	10.70	190
TOTAL		**7253.1**

Total thickness: 229 mm

Thirty-two IsoMax clips supplied by the client were installed on the underside of the NRC reference concrete slab using tapcon screws measuring 57 mm long. The IsoMax clipped were spaced 610 x 1219 mm. The furring channels were inserted in the slots of the IsoMax clips and installed at 610 mm on center. The furring channels measured 38 mm deep.

Figure 2: A close view of the IsoMax clip and the furring channel installed on the underside of the NRC reference concrete slab.

Figure 3: The full view of the IsoMax clips and furring channels installed on the floor assembly.

One layer of glass fiber insulation batts (Owens Corning) having nominal dimensions of 64 x 610 x 1219 mm were installed between the furring channels on the underside of the concrete slab. The density of the insulation was 44.68 kg/m^3.

Figure 4: The measured cavity of 76 mm with the insulation and gypsum boards installed on the floor assembly.

One layer of CGC Sheetrock ®, Firecode “C”, Type X, gypsum boards with nominal dimensions 1.22 m wide and 16 mm thick were installed perpendicular to the furring channels. The gypsum boards were attached with Type S drywall screws, 41 mm long and spaced 305 mm on center along the edges and in the field. The joints of the gypsum boards were caulked and then covered with metal tape.

The test specimen was mounted in the IRC acoustical floor test opening which measures 4.70 m 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^{o}C and 38.8%, respectively. The measured temperature and relative humidity in the lower chamber during testing were 20.5^{o}C and 46.0%, respectively.

RESULTS

Results of the airborne sound transmission loss measurements of Specimen B3492-4 are given in Table 2 and Figure 5. Results of the impact sound transmission measurements of this floor construction are given in Table 3 and Figure 6.

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 B3192-4, TLF-04-039/040.

Frequency (Hz)	Airborne Sound Transmission Loss (dB)	95% Confidence Limit	Deviation Below the STC Contour
50	34		
63	31		
80	34		
100	40		
125	46	± 1.3	4
160	49	± 1.0	4
200	49	± 0.8	7
250	53	± 0.7	6
315	57	± 0.5	5
400	61	± 0.5	4
500	64	± 0.3	2
630	67	± 0.4	
800	69	± 0.3	
1000	72	± 0.3	
1250	74	± 0.3	
1600	78	± 0.3	
2000	81	± 0.3	
2500	83	± 0.3	
3150	87	± 0.3	
4000	90	± 0.4	
5000	94		
Sound Transmission Class (STC)[1] = 66			
Weighted Sound Reduction (R_W)[2] = 65			

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

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

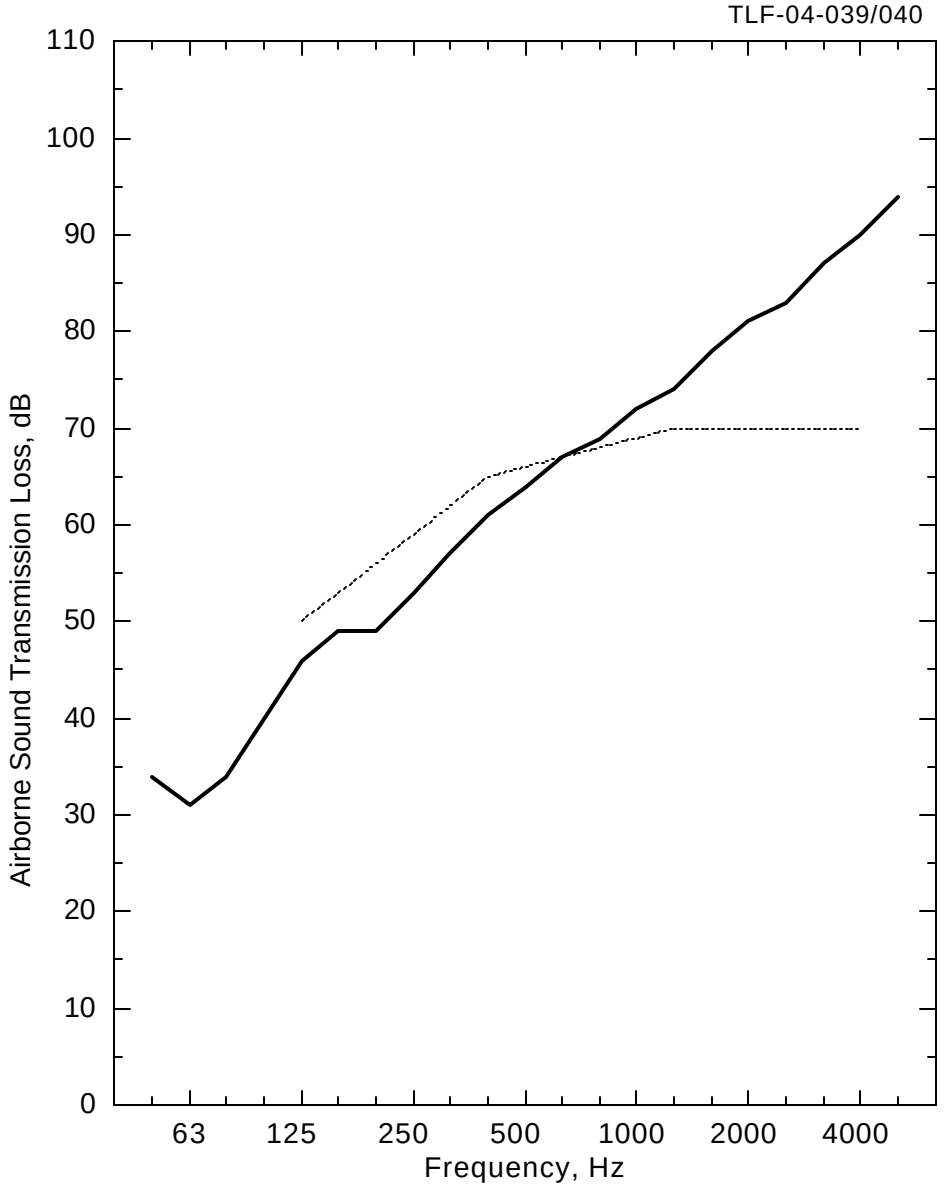

Figure 5: Airborne sound transmission loss measurements of Specimen B3192-4. The solid line is the experimental data and the dotted line is the STC 66 contour.

Table 3: Impact sound transmission measurements of Specimen B3192-4, IIF-04-021.

Frequency (Hz)	Normalized Impact Sound Pressure Level (dB)	95% Confidence Limit[1]	Deviation Above the IIC Contour
50	65		
63	69		
80	69		
100	62	± 0.9	
125	57	± 0.7	
160	58	± 0.4	
200	61	± 0.5	
250	58	± 0.4	
315	59	± 0.3	
400	57	± 0.2	
500	57	± 0.2	
630	57	± 0.2	
800	59	± 0.1	
1000	59	± 0.1	
1250	59	± 0.1	
1600	59	± 0.2	2
2000	59	± 0.1	5
2500	59	± 0.1	8
3150	56	± 0.1	8
4000	55	± 0.2	
5000	49		
Impact Insulation Class (IIC)[3] = 44			
Weighted Normalized Impact Sound Pressure Level ($L_{n,W}$)[4] = 64			

[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.

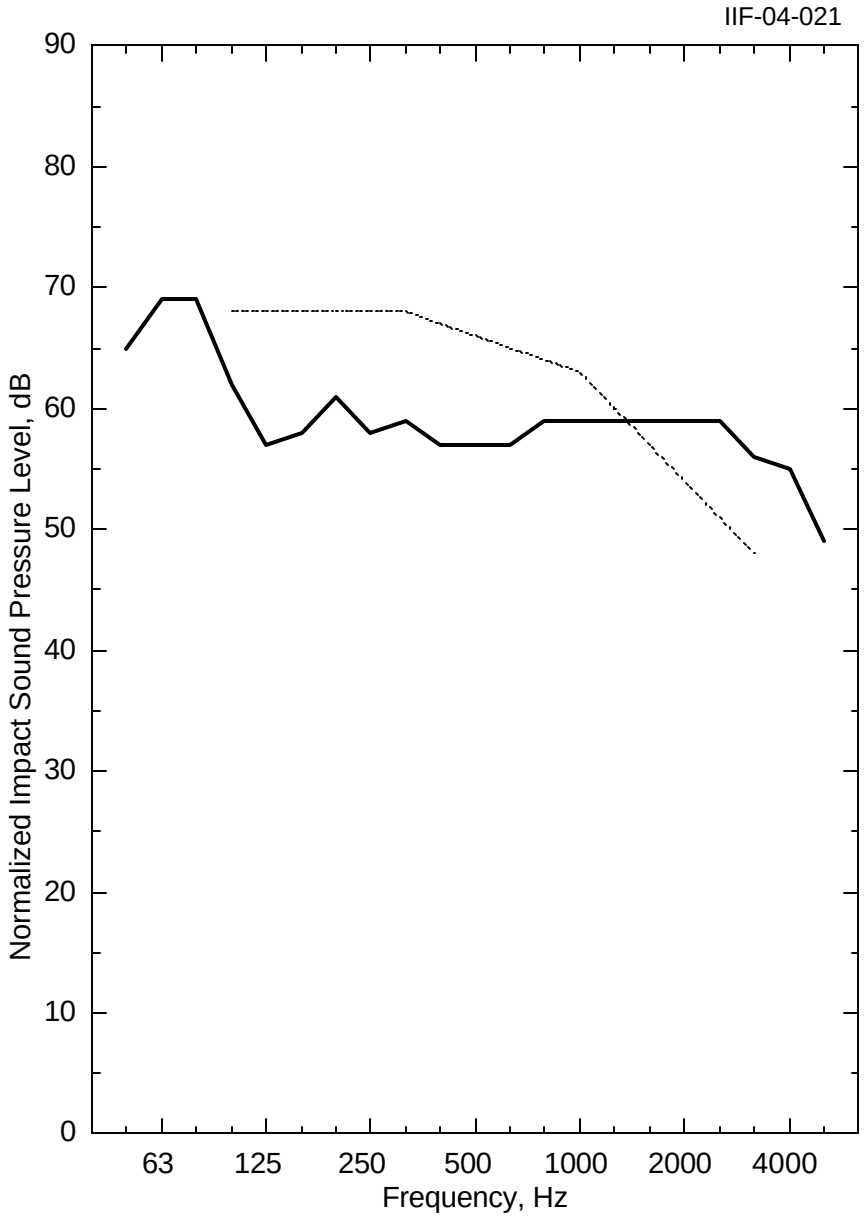

Figure 6: Impact sound transmission measurements of Specimen B3192-4. The solid line is the experimental data and the dotted line is the IIC 44 contour.

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 32 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 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 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.