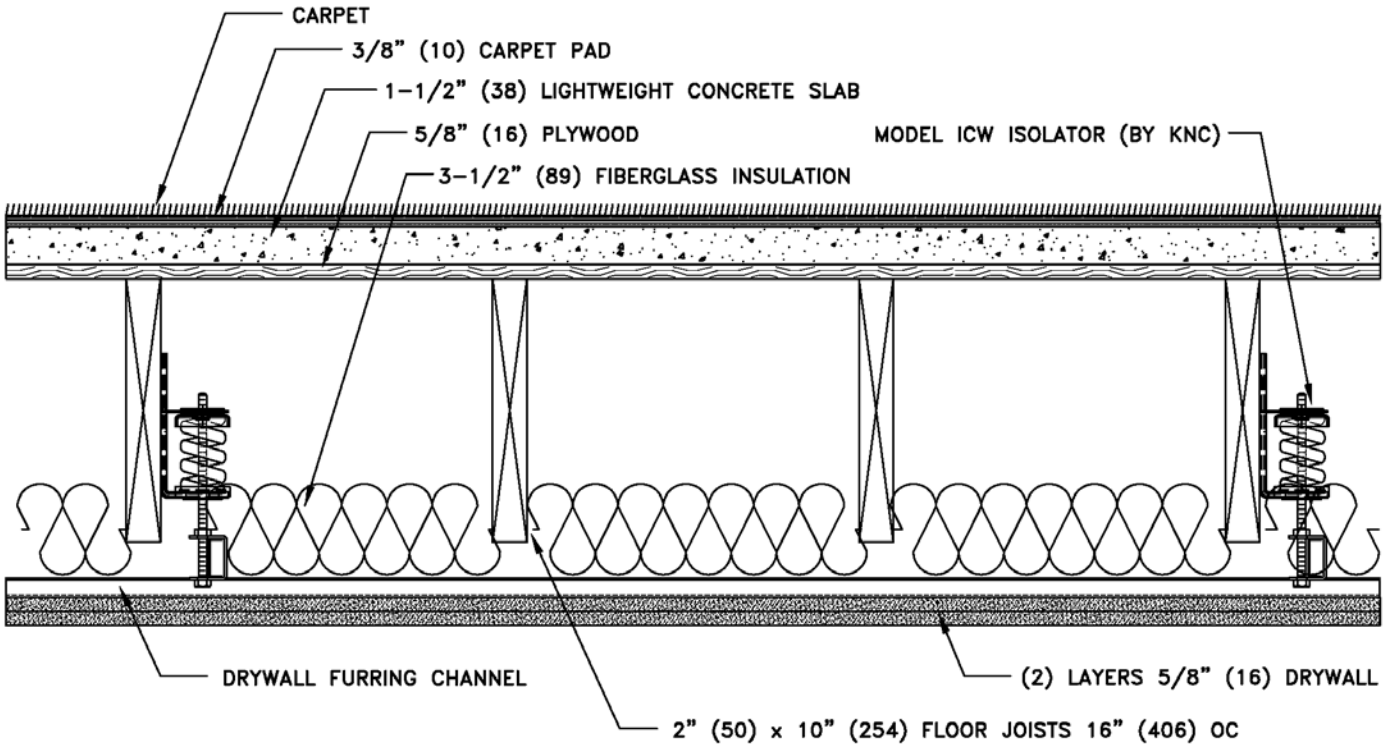
KINETICS NOISE CONTROL TEST REPORT #AT001021C

- **KINETICS NOISE CONTROL PRODUCTS:**
  - ICW

- **ACOUSTICAL RATINGS:**
  - STC 73
  - IIC 89

- **TESTING AGENCY & REPORT NUMBER:**
  - NRC-CANADA
  - B3463.14



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Client Report

B-3463.14

Final Report

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

for

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

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Canada

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

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INTRODUCTION

Airborne and impact sound transmission measurements were performed on one floor assembly.

Please note that this floor assembly was tested as one of seven specimens under contract A1041 in 1994, but an individual report for this specimen was not requested or issued as part of that contract.

For report purposes, the floor is identified as Floor “B”, as designated in the original report A-1041.1.

SPECIMEN DESCRIPTION

Construction on the series of floor assemblies for contract A1041 started 4 April 1994 and concluded 22 May 1994. The airborne and impact sound transmission loss tests for this floor assembly were performed on 14 April 1994.

Floor “B”

Each floor had a wood joist frame, with the gypsum board ceiling hung on an ICW hanger system.

The hanger system, provided by the client, comprised fourteen ICW-50 hanger brackets, six ICW-100 hanger brackets (1 kg each), 16 gauge steel rails (0.7 kg/m) which ran parallel to the joists and 22 gauge steel furring channels (0.4 kg/m). The ICW hanger brackets were on 1.2 m centers.

Details of the floor topping, and other elements of the construction are given in Table 1.

The area of the specimen was 20.0 m^2; however the exposed specimen area was 17.85 m^2. The weights of the materials are given for the entire floor area. The exposed specimen area was used for the calculations of transmission loss.

Table 1: Floor "B" comprised the following elements, listed from top to bottom:

	Surface weight (kg/m^2)	Weight (kg)
7 mm carpet	1.7	34.0
10 mm underpad	0.5	10.0
40 mm (nominal) concrete	63.4	1268.0
1 mm asphalt paper	0.6	12.0
16 mm plywood	7.1	142.0
240 mm wood joists, 400 mm o.c. (3.7 kg/m)		281.7
90 mm R12 glass fibre batts	1.0	19.6
27 mm ICW hangers		74.3
16 mm fire rated gypsum board	10.2	203.5
16 mm fire rated gypsum board	10.1	201.0
TOTAL	**94.5**	**2246.1**

Total thickness: 373 mm

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.

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 were controlled by a desktop PC-type computer interfaced to a Norwegian Electronics type 830 real time analyser. Each room had a calibrated Bruel & Kjaer condenser microphone with a type 4166 cartridge that was moved under computer control to nine positions used for the acoustical measurements. Each room had four loudspeakers driven by separate amplifiers and independent noise sources. To increase the randomness of the sound field, there were 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 E90-90, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions", and of ISO 140-3 1978, "Laboratory Measurement of Airborne Sound Insulation of Building Elements".

The Sound Transmission Class (STC) was determined in accordance with ASTM E413-87, "Classification for Rating Sound Insulation". The Weighted Sound Reduction Index (R_w) was determined in accordance with the current version of 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 E492-90, "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 E989-89, “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.

RESULTS

Results of the airborne sound transmission loss measurements of Floor “B” are given in Table 2 and Figure 1.

Results of the impact sound transmission measurements of this floor construction are given in Table 3 and Figure 2.

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 Floor “B”, TLF-94-028/029.

Frequency (Hz)	Airborne Sound Transmission Loss (dB)	95% Confidence Limits	Deviation Below the STC Contour
80	45	±2.7	
100	47	±1.8	
125	50	±1.1	-7
160	56	±0.9	-4
200	58	±0.8	-5
250	59	±0.6	-7
315	62	±0.6	-7
400	70	±0.6	-2
500	74	±0.5	
630	79	±0.5	
800	84	±0.2	
1000	86	±0.3	
1250	90	±0.4	
1600	94	±0.5	
2000	97	±0.4	
2500	100*	±0.4	
3150	100*	±0.4	
4000	95*	±0.5	
5000	96*	±0.5	
6300	96*	±0.5	

Sound Transmission Class (STC) = 73

Weighted Sound Reduction (R_w) = 72

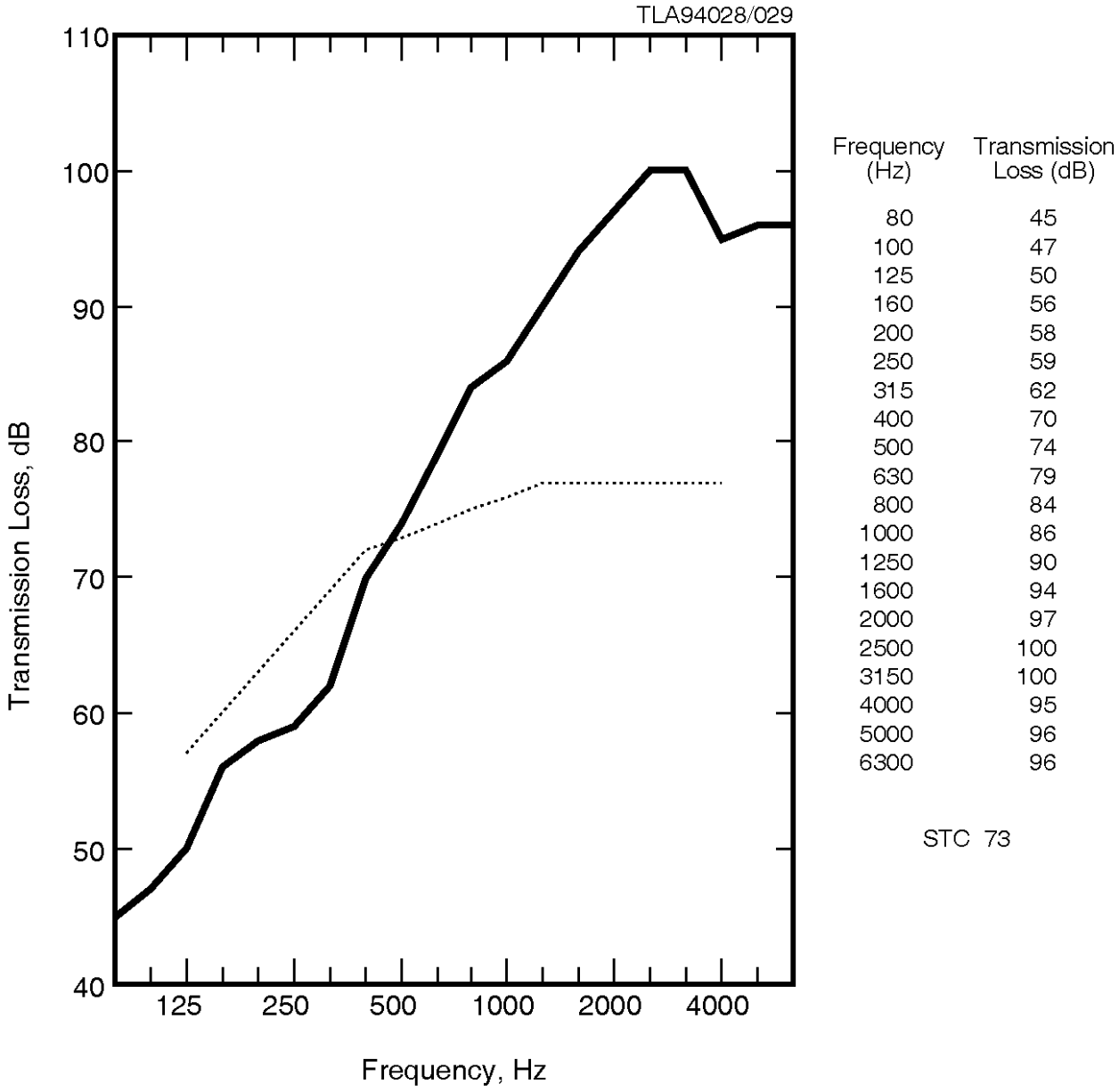

Figure 1: Airborne sound transmission loss measurements of Floor “B”. The solid line is the experimental data, the dotted line is the STC 73 contour.

Table 3: Impact sound transmission measurements of Floor "B", IIF-94-008

Frequency (Hz)	Normalized Impact Sound Level (dB)	95% Confidence Limits	Deviation Above the IIC Contour
50	52		
63	48		
80	38	±1.1	
100	31	±1.0	8
125	29	±0.7	6
160	27	±0.8	4
200	22	±0.5	
250	19	±0.4	
315	16*	±0.3	
400	14*	±0.5	
500	10*	±0.5	
630	10*	±0.7	
800	6*	±1.1	
1000	6*	±1.2	
1250	6*	±0.9	
1600	5*	±0.6	
2000	6*	±0.5	
2500	7*	±0.5	1
3150	7*	±0.3	4
4000	9*	±0.3	
5000	11*	±0.3	
6300	12*	±0.2	

Impact Insulation Class (IIC) = 89

Weighted Normalized Impact Sound Pressure Level ($L_{n,w}$) = 20

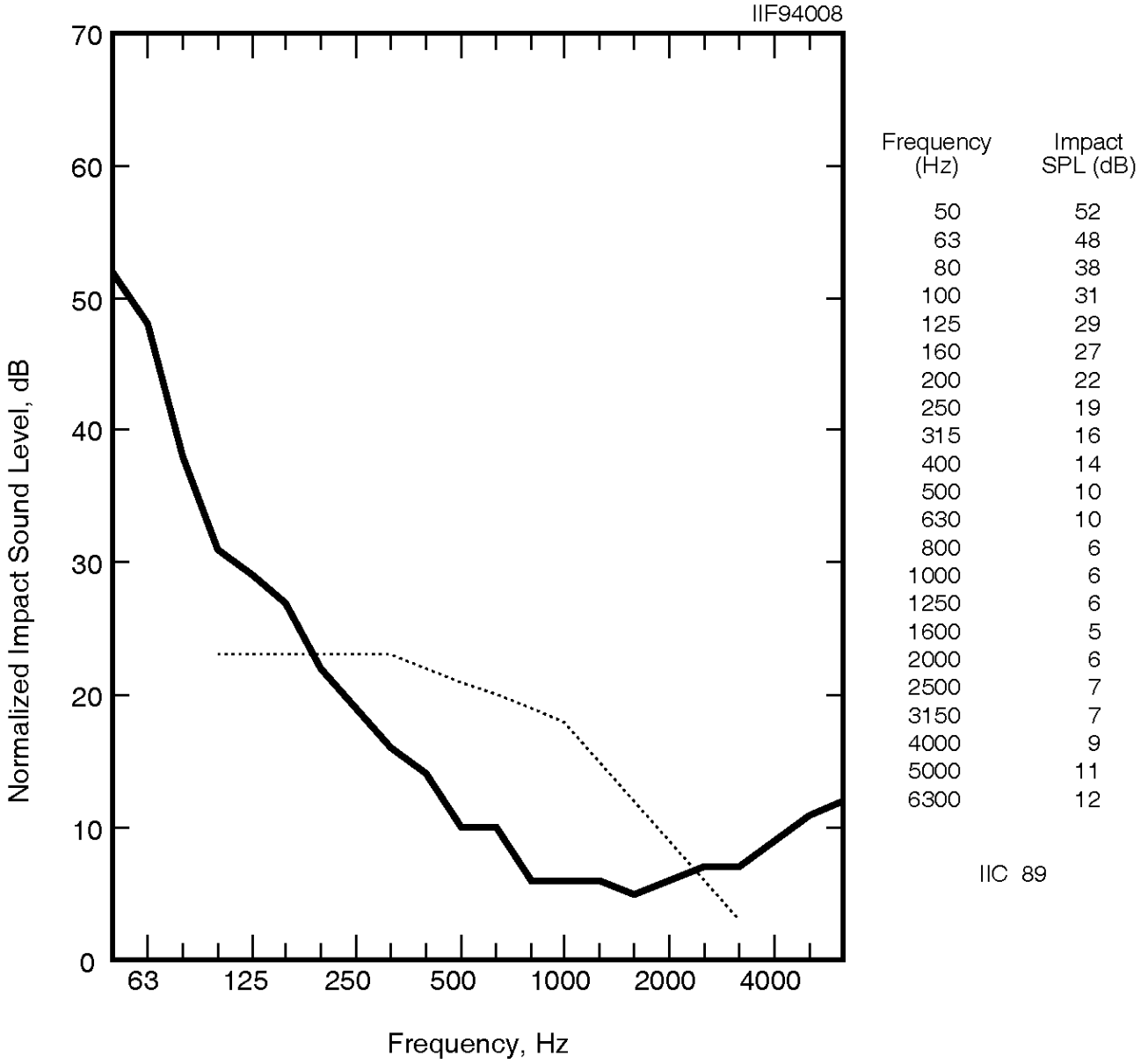

Figure 2: Impact sound transmission measurements of Floor “B”. The solid line is the experimental data and the dotted line is the IIC 89 contour.

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.