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Client Report

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Airborne Sound Transmission Loss and Impact Sound Transmission Measurement Performed on One (1) Floor Assembly with 25 mm Thick SEP, Resilient Channels and More Insulation

for

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Airborne Sound Transmission Loss and Impact Sound Transmission Measurements Performed on One Floor Assembly with 25 mm thick SEP, Resilient Channels and More Insulation for Supress Products, LLC

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INTRODUCTION

Airborne and impact sound transmission measurements were performed on one floor assembly. For report purposes, this specimen is identified as Specimen B3453-21F. A complete description of the tests procedure is outlined in the Test Procedure Section.

SPECIMEN DESCRIPTION

The base floor assembly was constructed under specimen B3453-18F. The insulation and channels of the ceiling assembly was modified for this assembly on 08-Feb-07. The airborne and impact sound transmission loss tests were performed 08-Feb-07. The floor assembly comprised the following elements, listed from top to bottom.

Table 1: Element breakdown of Specimen B3453-21F.

Element	Surface weight (kg/m²)	Mass (kg)
25 mm Supress Engineered Plywood - SEP	13.11	262.3
457 mm wood trusses (610 mm on center) including strongback and rim board		340.1
270 mm glass fibre insulation	0.7	44.5
13 mm resilient channels (610 mm on center)		9.8
16 mm Supress Engineered Drywall - SED5848	12.33	218.9
TOTAL		**818.7**

Total thickness: 505 mm

BASE ASSEMBLY

Subfloor: Single layer of 25 mm thick tongue and groove Supress Engineered Plywood –SEP sheets were fastened to the wood trusses using collated screws #8, 41 mm long. The screw spacing was 305 mm in the field and 203 mm around the perimeter of the specimen. The Supress Engineered Plywood sheets were oriented with the long axis perpendicular to the wood trusses with staggered butt joints. The joints of the Supress sheets were caulked with Supress acoustical sound sealant and then covered with an aluminum foil tape.

Trusses: Wood trusses were installed in the floor test frame, spaced 610 mm on center. The average measured dimensions were 89 x 457 x 3940 mm.

Header: Rim board having measured dimensions of 32 x 457 x 4880 mm formed the headers at each end of the floor. The wood trusses were secured at the top and bottom to the rim board using glue nails, 83 mm long.

Bridging: Strongback with nominal measurements of 38 x 89 x 4,877 mm was attached to the top of the bottom chords of each wood truss and located at the mid-point of the wood truss span. Two common nails, 76 mm long were used at each wood truss position to secure the strongback.

CEILING ASSEMBLY

Cavity insulation: Three layers of glass fiber batt insulation (Owens Coming R12) having nominal dimensions of 89 x 587 x 1194 mm were installed between the wood trusses.

Resilient Channels: Resilient channels with a « Z profile » were installed perpendicular to the wood trusses. The resilient channels were spaced 610 mm on center and secured to each wood truss using 41 mm long drywall screws spaced at 610 mm on center. An extra piece of 38 x 89 mm wood lumber was added at one end of the floor to support the resilient channels.

Ceiling board: The ceiling consisted of a single layer of 1.22 m wide, 16 mm thick Supress panels SED 5848 supplied by the client. Panels were oriented with the long axis perpendicular to the resilient channels with staggered butt joints. The Supress panels were fastened to the resilient channels using Type S drywall screws 41 mm long and spaced 610 mm on center at the perimeter and 305 mm on center in the field of the panels. Joints between the Supress panels were caulked with Supress acoustical sound sealant and covered with an aluminum foil tape.

The test specimen was mounted in the IRC acoustical floor test opening which measures 4.71 m x 3.79 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 23.7°C and 12.3%, respectively. The measured temperature and relative humidity in the lower chamber during testing were 17.6°C and 22.9%, respectively.

RESULTS

Results of the airborne sound transmission loss measurements of Specimen B3453-21F are given in Table 2 and Figure 1. Impact sound transmission measured data are given in Table 3 and Figure 2. Certain values in the tables are marked.

- 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.

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).

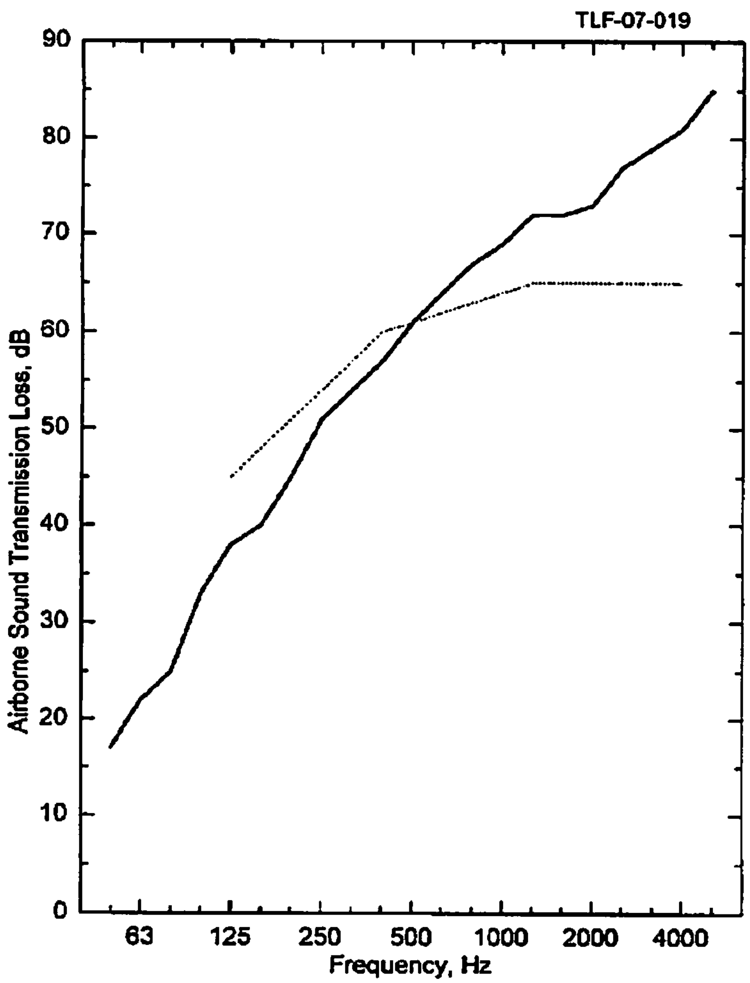
Table 2: Airborne sound transmission loss measurements of Specimen B3453-21F TLF-07-019.

Frequency (Hz)	TL (dB)	95% confidence limits[1]	Deviation Below the STC Contour
50	17		
63	22		
80	25		
100	33		
125	38	± 0.9	7
160	40	± 0.9	8
200	45	± 0.7	6
250	51	± 0.5	3
315	54	± 0.5	3
400	57	± 0.3	3
500	61	± 0.4	
630	64	± 0.4	
800	67	± 0.3	
1000	69	± 0.3	
1250	72	± 0.4	
1600	72	± 0.3	
2000	73	± 0.4	
2500	77	± 0.4	
3150	79	± 0.3	
4000	81	± 0.4	
5000	85		
Sound Transmission Class (STC)[2] = 61			
Weighted Sound Reduction (R_W)[3] = 59			

[1] 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).

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

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



Frequency (Hz)	Airborne Sound Transmission Loss (dB)
50	17
63	22
80	25
100	33
125	38
160	40
200	45
250	51
315	54
400	57
500	61
630	64
800	67
1000	69
1250	72
1600	72
2000	73
2500	77
3150	79
4000	81
5000	85

STC 61

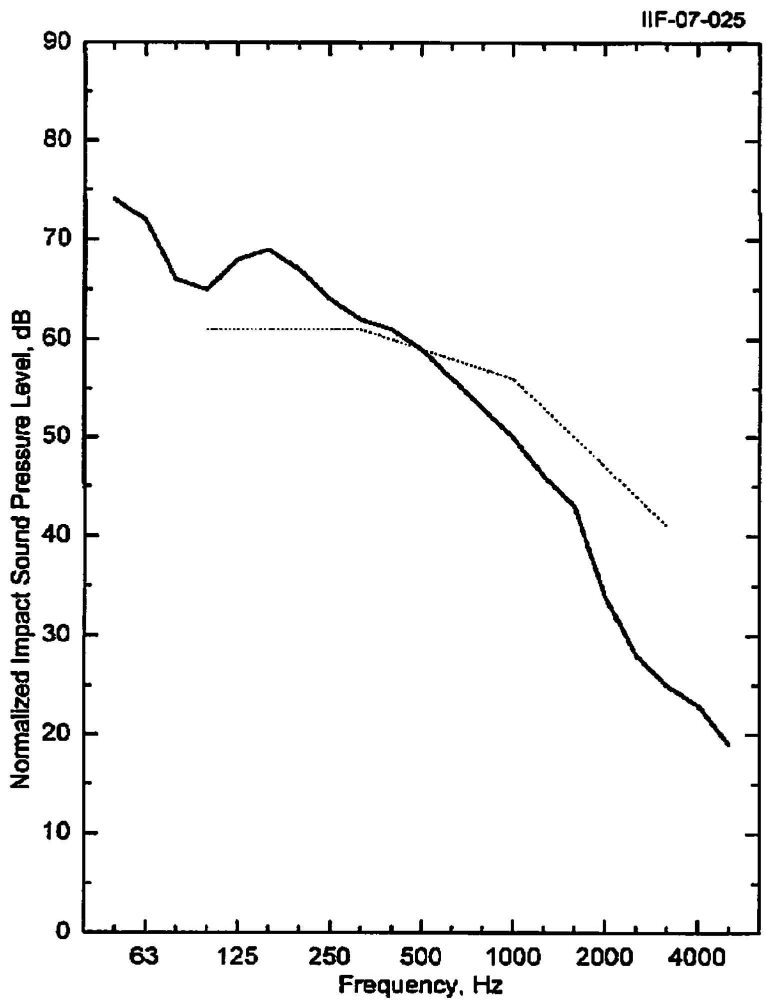
Figure 1: Airborne sound transmission loss measurements of Specimen B3453-21F, TLF-07-019. The solid line is the experimental data and the dotted line is the STC 61 contour.

Table 3: Impact sound transmission measurements of Specimen B3453-21F, IIF-07-025.

Frequency (Hz)	Normalized impact sound pressure level (dB)	95% confidence limits	Deviation above the IIC contour
50	74		
63	72		
80	66		
100	65	± 1.3	4
125	68	± 1.2	7
160	69	± 1.0	8
200	67	± 0.8	6
250	64	± 0.5	3
315	62	± 0.3	1
400	61	± 0.4	1
500	59	± 0.4	
630	56	± 0.3	
800	53	± 0.3	
1000	50	± 0.3	
1250	46	± 0.3	
1600	43	± 0.3	
2000	34	± 0.5	
2500	28	± 0.5	
3150	25	± 0.3	
4000	23 *		
5000	19 *		

Impact Insulation Class (IIC)[4] = 51
Weighted Normalized Impact Sound Pressure Level (Ln,w)[5] = 59

[4] Impact Insulation Class (IIC) calculated according to ASTM E989.
[5] Weighted Normalized Impact Sound Pressure Level ($L_{n,w}$) calculated according to ISO 717.



Frequency (Hz)	Normalized Impact Sound Pressure Level (dB)
50	74
63	72
80	66
100	65
125	68
160	69
200	67
250	64
315	62
400	61
500	59
630	56
800	53
1000	50
1250	46
1600	43
2000	34
2500	28
3150	25
4000	23 *
5000	19 *

IIC 51

Figure 2: Impact sound transmission measurements of Specimen B3453-21F, IIF-07-025. The solid line is the experimental data and the dotted line is the IIC 51 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.