Airborne Sound Transmission Loss and Impact Sound Transmission Measurements Performed on Specimen B3414-5

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INTRODUCTION

Airborne sound transmission measurements were performed on a wall assembly with a single layer of the product identified by the client as QuietRock QR-530 Serenity on one side of a single row of 38 mm x 89 mm wood studs, spaced 610 mm on center with a layer of 16mm gypsum board on the other side and 90 mm of glass fibre batts. For report purposes, this wall assembly is identified as Specimen B3414-5. A complete description of the tests procedure is outlined in the Test Procedure Section.

SPECIMEN DESCRIPTION

Construction on the wall assembly began on 13-Jul-04. The airborne sound transmission loss test was performed on 15-Jul-04. The wall assembly comprised the following elements, listed from one side of the wall to the other.

Specimen B3414-5

Table 1: Element breakdown of Specimen B3414-5

Element	Surface weight (kg/m^2)	Mass (kg)
16 mm QuietRock QR-530 Serenity	13.45	120.0
38mm x 89mm wood studs, 610mm oc (on center) including headers		36.7
90 mm glass fibre batts, R12	0.9	8.0
16 mm Type X, Firecode C, gypsum board	11.0	98.1
TOTAL		262.8

Total thickness: 121 mm

The Specimen B3414-5 was mounted in the IRC acoustical wall test opening which measures 3.66 m x 2.44 m. The area used for the calculation of the airborne sound transmission loss was 8.92 m^2.

The wood studs were spaced at 610mm on center. The glass fibre batts with a thickness of 90 mm was installed in the single wood stud cavity. A single layer of 16mm QuietRock QR-530 Serenity drywall on one side of the wall assembly

and a single layer of 16mm gypsum board on the other side were installed vertically and attached on the wood studs with Type S drywall screws, 41mm long and spaced at 406mm oc along the edges and in the field. A product identified by the client as QuietSeal was used to seal all the joints of the QuietRock QR-530 Serenity and of the gypsum boards then covered with metal tape. The perimeter of the specimen was also caulked with QuietSeal and covered with metal tape.

Figure 1: The Specimen B3414-5 installed in the IRC acoustical wall test frame.

The measured temperature and relative humidity in the large chamber during testing were 22.7^{o}C and 66.6%, respectively. The measured temperature and relative humidity in the small chamber during testing were 22.7^{o}C and 71.5%, respectively.

RESULTS

Results of the airborne sound transmission loss measurements for Specimen B3414-5 are given in Table 2 and Figure 2.

Certain values in Table 2 and Figure 2 are marked. These indicate limitations on the precision of the results.

- 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.
- The marked values do not affect the estimate of the single number ratings.

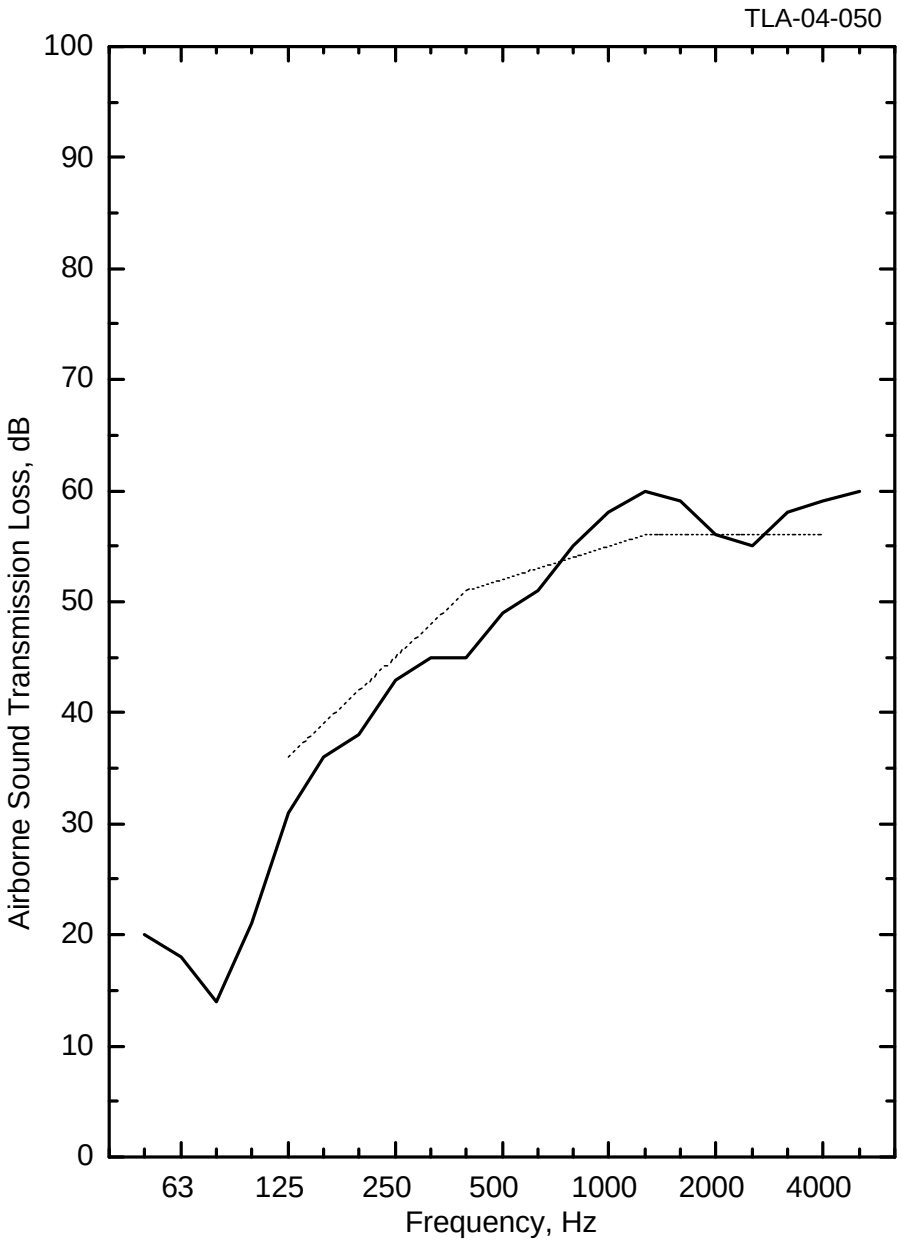
Table 2: Airborne sound transmission loss measurements of Specimen B3414-5, TLA-04-050.

Frequency (Hz)	Airborne Sound Transmission Loss (dB)	95% Confidence Limit[1]	Deviation Below the STC Contour
50	20c		
63	18		
80	14		
100	21		
125	31	±2.2	5
160	36	±1.4	3
200	38	±1.0	4
250	43	±0.9	2
315	45	±0.8	3
400	45	±0.6	6
500	49	±0.5	3
630	51	±0.5	2
800	55	±0.3	
1000	58	±0.4	
1250	60	±0.3	
1600	59	±0.4	
2000	56	±0.4	
2500	55	±0.5	1
3150	58	±0.5	
4000	59	±0.6	
5000	60		
Sound Transmission Class (STC)[2] =52			
Weighted Sound Reduction (R_W)[3] =51			

[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 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)
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80	14
100	21
125	31
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200	38
250	43
315	45
400	45
500	49
630	51
800	55
1000	58
1250	60
1600	59
2000	56
2500	55
3150	58
4000	59
5000	60

STC52

Figure 2: Airborne sound transmission loss results for Specimen B3414-5. The solid line is the experimental data and the dotted line is the STC 52 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 wall 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.

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). 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 wall test facility comprises two reverberation rooms with a moveable test frame between the two rooms. One room has a volume of 138 m^3. The volume of the other room is 250 m^3. In this report they are referred to as the small and large chambers, respectively.

Measurements are controlled by a desktop PC-type computer interfaced to a Bruel & Kjaer 2144 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 nine microphone positions 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 large room) and reverse (receiving room is the small 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.