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THE USE OF LIMP MASS LOADED BARRIERS IN STANDARD WALL CONSTRUCTION

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ABSTRACT
The transmission loss effect of using a limp high-mass natural rubber barrier was investigated in dry-wall constructions. A standard dry-wall was constructed and tested using the sound intensity method, which allowed for smaller sample sizes and reduced testing time. This showed close correlation with standard testing methods. The effect of various framing materials, fixing methods and cavity absorbers combined with a limp high-mass barrier was investigated. Using the barrier achieved a significant reduction in the coincidence dip of the wall's performance. Changing the fixing spacing also gave a significant increase in transmission loss.

1 - INTRODUCTION
The additional transmission loss obtained using a limp high-mass natural rubber barrier was investigated in dry-wall constructions. The purpose of the testing was to quantify what improvements could be made in ensuring quietness and privacy between rooms in multi-storey dwellings, residential and commercial buildings.

The effect of various framing materials, fixing methods and cavity absorbers combined with a limp high-mass barrier on the transmission loss of a standard dry wall was investigated. The transmission loss was determined using the sound intensity method. Using the barrier achieved a significant reduction in the coincidence dip of the wall's performance.

2 - MEASUREMENT PROCEDURE
The transmission loss suite at the University of Canterbury (in the Department of Mechanical Engineering) is a general-purpose facility, used to measure the transmission loss of walls, doors or panels.

The transmission loss suite comprises of a diffuse reverberation room and a small adjacent highly absorbent room with a common opening. The transmission loss of different wall constructions can be determined by measuring the sound intensity transmitted through the construction, which is placed in the common opening.

The sound intensity method used determines the contribution of each element of a segmented panel to the overall sound reduction of the panel. Possible flanking transmissions are excluded.

The sound source is a loud speaker placed at a number of positions in the reverberation room. The test signals are random pink noise generated by a Bruel and Kjaer 2260 Investigator. Measurements were made using a Bruel and Kjaer 2260 Investigator and a Bruel and Kjaer type 3595 Sound intensity probe kit.

Measurements were made over only the central area of the test sample (1.2 $\times$ 2 m) to limit edge effects. The area is marked out in to a 50 mm grid, 600 mm square. The transmitted intensity is measured by sweeping the two phase matched microphones 50 mm from the specimen's surface.

3 - WALL CONSTRUCTIONS
Two types of wall construction were used; 100 mm $\times$ 50 mm timber frame and 92 mm $\times$ 50 mm steel stud each with three facing/in fill configurations giving six separate tests.

	Wall facing (reverb room side)	**Framing**	**Infill**	**Wall facing**
Test 1	9.5 mm plasterboard	Steel stud	None	9.5 mm plasterboard
Test 2	9.5 mm plasterboard	Steel stud	None	AFB/4, 9.5 mm plasterboard
Test 3	9.5 mm plasterboard	Steel stud	Fibreglass infill	9.5 mm plasterboard
Test 4	9.5 mm plasterboard	Timber stud	None	9.5 mm plasterboard
Test 5	9.5 mm plasterboard	Timber stud	None	AFB/4, 9.5 mm plasterboard
Test 6	9.5 mm plasterboard	Timber stud	None	9.5 mm plasterboard, AFB/4, 9.5 mm plasterboard

Table 1: Wall constructions used in testing.

4 - SAMPLE PREPARATION

For the timber-framed walls each sample was constructed separately, depending on the type of wall covering under test. For the steel stud wall only one wall was used, with one side of the wall being replaced depending on the type of covering.

5 - WALL LININGS/INFILL

Lining: The wall covering used was 9.5 mm plasterboard with a surface density of 6.6 kg/m^2.
Infill: The absorbent infill (where used) was a thermal grade 75 mm thick 9 kg/m^3 fibreglass.
Transmission loss barrier: The high-mass natural rubber barrier used was Acoustop® FlexiBarrier® manufactured by D. G. Latimer & Associates Ltd New Zealand. This product consists of foil-faced barium loaded natural rubber having a surface density of 4.5 kg/m^2 (code AFB/4). By using rubber as the carrying medium for the filler, FlexiBarrier® remains highly flexible and limp.
Fixing: For all tests using FlexiBarrier® the product was bonded to the plasterboard using a contact adhesive. The plasterboard was fixed using screws at 600 mm × 300 mm centres.

6 - RESULTS

The addition of FlexiBarrier® increases low frequency performance, as would be expected due to the mass law. The increase at mid-to-high frequencies is very similar to the use of a resilient channel (refer graph 1) suggesting that the FlexiBarrier® is de-coupling the plasterboard. This de-coupling effect only accounts for some of the increased performance. Further tests showed that the damping properties of FlexiBarrier® on the plasterboard increased the mid-to-high frequency performance (coincidence dip).
The absorptive infill gave the same type of result as the inclusion of FlexiBarrier® although not performing as well in the coincidence dip region (refer to graph 1).
The inclusion of FlexiBarrier® in the timber stud wall gave the same type of improvement in the low and high (coincidence dip) frequency range (refer to graph 2). A sandwich construction was also tested using FlexiBarrier® laminated between two layers of 9.5 mm plasterboard. This gave an improvement only in the low frequencies as expected due to the mass law.

7 - DISCUSSION

Steel stud test results suggest that it would be useful to investigate the performance of a wall with both FlexiBarrier® and an absorptive infill. Prediction software has been successfully used to evaluate this option before further testing is carried out. Further testing will also trial different sized studs to evaluate the performance difference between the 92 mm stud that was tested and the commonly used 62 mm stud. It is evident that FlexiBarrier® can replace resilient channeling, which has the advantage of saving around 13 mm of wall thickness, a useful saving in multi story buildings.
The inclusion of a FlexiBarrier®/plasterboard sheet can be useful for increasing the performance of both steel or timber stud existing walls by simply fixing the sheet to the existing lining with a minimum of additional work to other architectural features such as architraves and electrical fixtures.
The work reported here is part of the research and development programme into wall construction using different combinations of framing material, lining type and thickness, combined with the acoustic insulating materials of D G Latimer and Associates Ltd.

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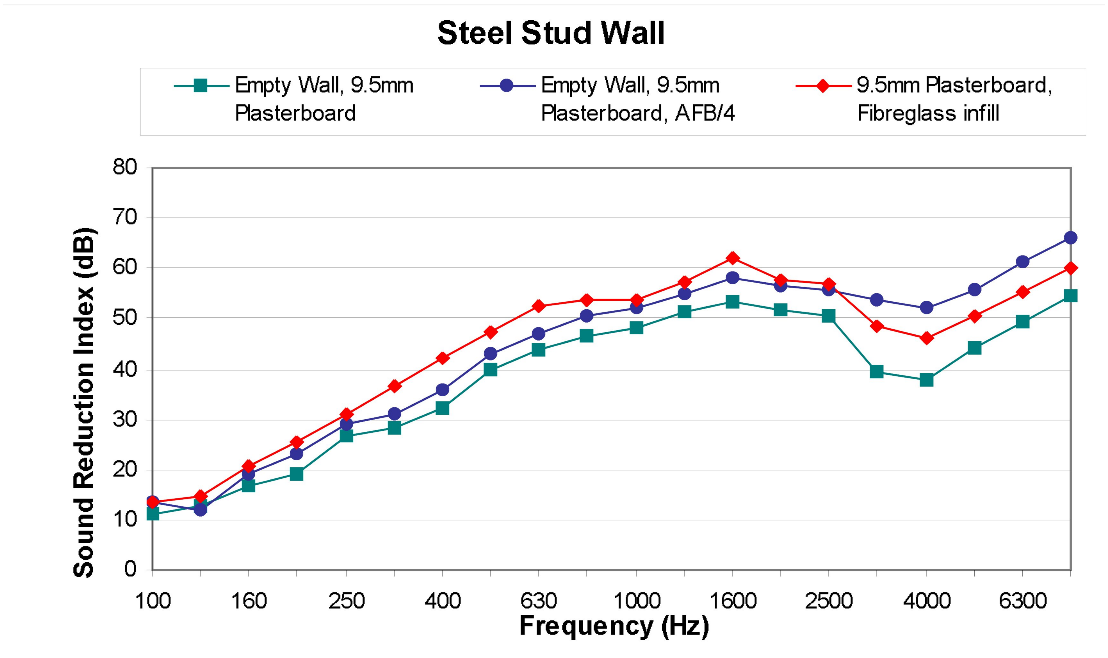

Figure 1: Test results for steel stud wall.

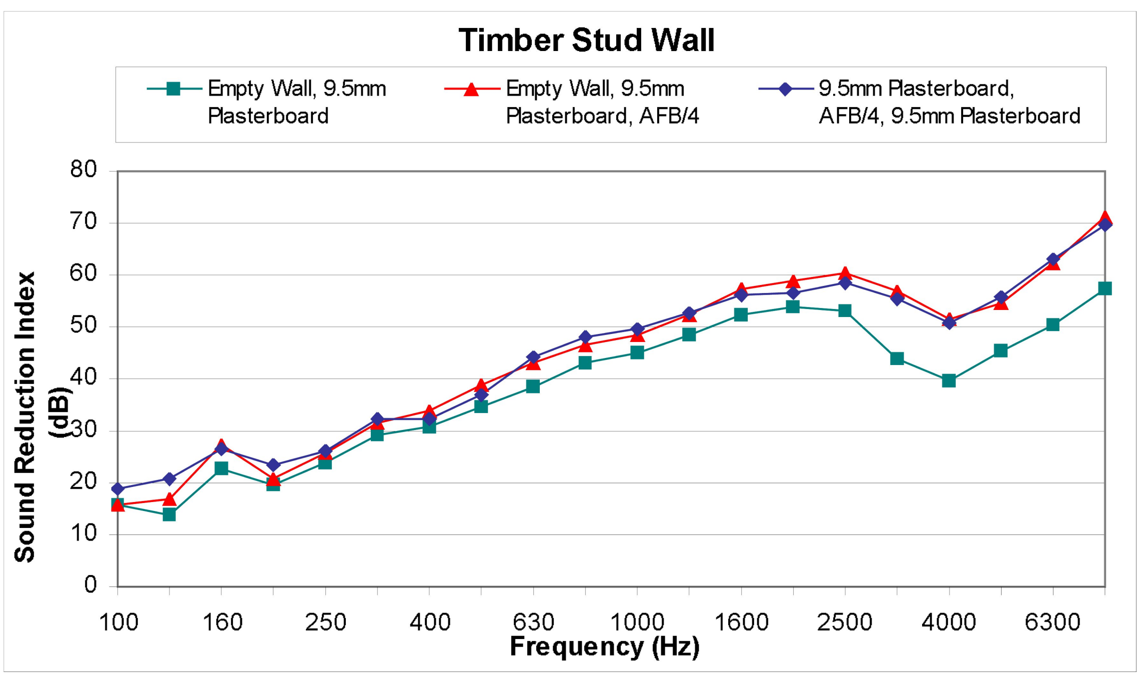

Figure 2: Test results for timber stud wall.