MARSHALL DAY Acoustics

SOUND INSULATION ASSESSMENT

RANELAGH MULTI-DENOMINATIONAL SCHOOL, DUBLIN 6

22 October 2014

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Project: **Sound Insulation Assessment**
Ranelagh Multi-Denominational School, Dublin 6

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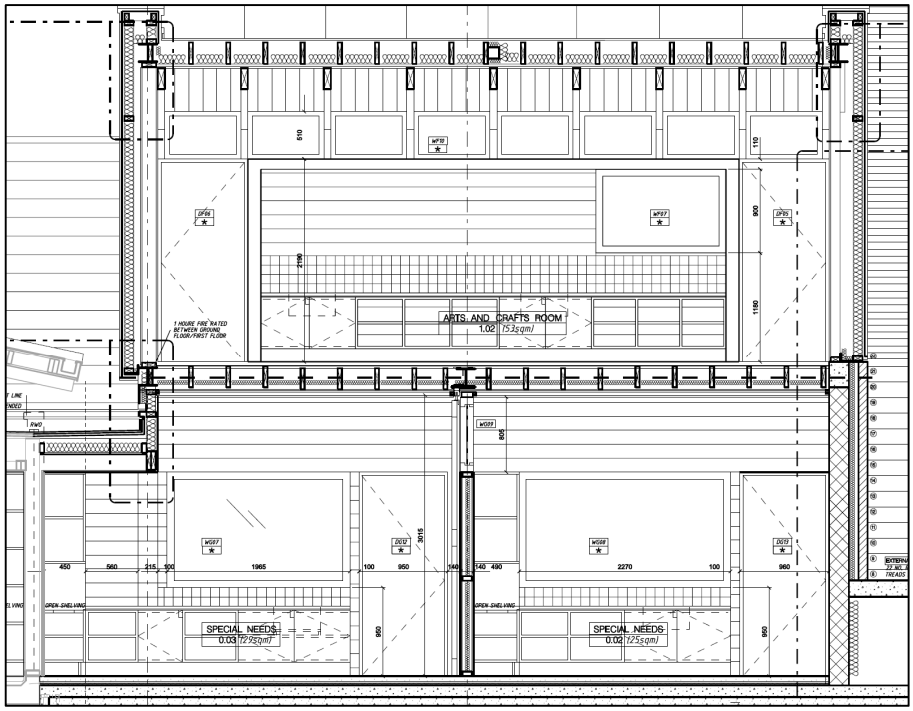
1.0 INTRODUCTION

Marshall Day Acoustics has been commissioned by Big Bear Sound Ltd to undertake a sound insulation assessment at the Ranelagh Multi-Denominational School, Dublin 6. The specific items under assessment are floors and partitions separating the ground floor Special Needs Unit and first floor Arts & Craft Room as shown in Figure 1. This report details our assessment following our site inspection and acoustic tests of the existing constructions.

Figure 1: Areas under assessment



2.0 SOUND INSULATION REQUIREMENTS

The appropriate design guidance relating to the acoustic performance of schools is detailed in the Department of Education & Skills Technical Guidance Document *TDG-021-5 'Acoustic Performance in Schools' (June 2013)*.

Table 1 details the TGD-021-5 recommended airborne and impact sound insulation ratings between teaching spaces. The sound insulation ratings are designed to ensure a high level of privacy between teaching spaces as well as mitigating the potential for noise disturbance in noise sensitive areas.

Table 1: Airborne & Impact sound insulation requirements between teaching areas

Description	Sound Insulation Performance
Airborne sound insulation (higher value = better performance)	45dB $D_{nT,w}$
Impact sound insulation (lower value = better performance)	60dB $L_{nT,w}$

We note that the airborne sound insulation ratings in TGD-021-5 do not take into account partitions separating classrooms that contain a door. The presence of a door will inherently degrade the sound insulation performance and this is discussed in Section 5.0.

3.0 SOUND INSULATION TEST RESULTS

Sound insulation tests were undertaken on 9 October 2014.

The results of the airborne sound insulation tests undertaken on the partition and floor constructions are summarised in Table 2.

Table 2: Partition & Floor Airborne sound insulation tests

Test Type	Source Room	Receive Room	Measured Performance $D_{nT,w}$ (dB)	Achieves TDG-021-5 45dB criterion
Partition	Special Needs 1	Special Needs 2	15	×
Floor	Arts & Grafts Room	Special Needs 1	39	×

A review of the measurements shows that the existing partition airborne sound insulation is 30dB less than the recommended 45dB $D_{nT,w}$ performance.

The measured floor airborne sound insulation is 6dB less than the recommended 45dB $D_{nT,w}$ performance.

The results of the impact sound insulation tests undertaken on the floor construction is summarised in Table 3.

Table 3: Floor Impact sound insulation tests

Test Type	Source Room	Receive Room	Measured Performance $L_{nT,w}$ (dB)	Achieves TDG-021-5 60dB criterion
Floor	Arts & Grafts Room	Special Needs 1	77	×

A review of the measurements shows that the existing floor impact sound insulation is 17dB greater than the recommended 60dB $L_{nT,w}$ performance.

4.0 RECOMMENDATIONS

4.1 Floor Upgrades

The existing floor construction is shown in Figure 2.

Figure 2: Existing floor Construction

The floor construction comprises the following:

- Marmoleum floor finish
- 2 x 18mm T&G plywood
- 225mm timber joists
- 2 x 15mm Fireboard
- 25 x 50mm timber battens
- 18mm T&G softwood ceiling finish

Analysis of the test results indicates that the airborne and impact sound insulation performance is relatively poor. We recommend that the following remedial works:

- Increase the floor stiffness to improve the low-frequency sound insulation performance.
- Install independent ceiling to improve the airborne and impact sound insulation performance.

We recommend upgrading the floor stiffness using the 'stepped blocking' technique described in *Architectural Acoustics*, (M. Long, 2006). The relevant extract is shown below:

> ***Structural Isolation of Floors***
>
> *Three mechanisms are available to improve low-frequency transmission: 1) increase the stiffness of the floor support system, 2) increase the structural damping, and 3) increase the vibrational decoupling between floor and ceiling.*
>
> *In wood floor structures both stiffness and damping can be increased by using stepped blocking as shown in Figure 12.24. Blocking, using 2 x lumber one size smaller than the joist material, is installed in a series of inverted U shapes, glued and end nailed into place. The next set of blocks is stepped (i.e. installed in a position that is offset relative to the first set) so that it can also be end-nailed. Both careful trimming and liberal application of glue are important to the installation. Blocks must be trimmed so that no more than a 1/8" gap is left between the block and the joist. The object of the blocking is to build an additional beam at right angles to the joists near the midpoint of the span and to provide additional damping.*

FIGURE 12.24 Stepped Blocking in 2 x Wood Framing

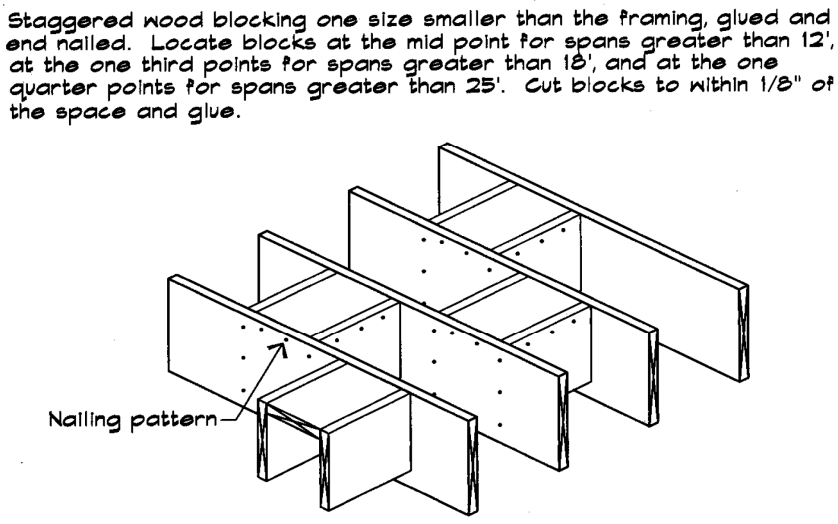


Figure 3 shows the proposed upgraded floor construction.

Figure 3: Upgraded floor construction

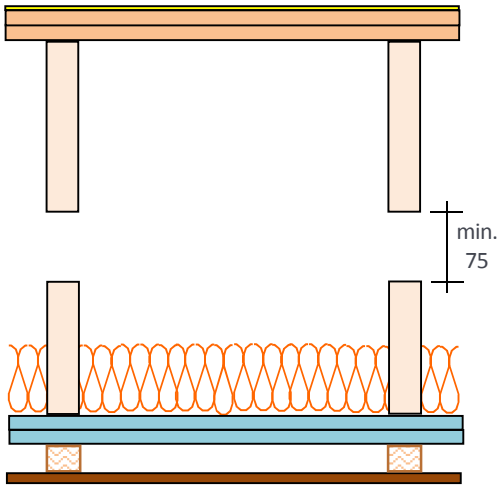
Upgraded Floor Construction	Sketch
– Marmoleum floor finish – 2 x 18mm T&G plywood – 225mm timber floor joists – Stepped Blocking* between joists installed at mid-span (staggered) as shown in Figure 4 – 175mm timber joist (min. 75mm below existing joists) – 100mm mineral wool insulation, min. density 10kg/m^3 – 2 x 15mm Gyproc Soundbloc (staggered joints) – 25 x 50mm timber battens – 18mm T&G softwood ceiling * Stepped Blocking to be constructed from 36mm thick timber to form inverted U-shapes with 1no. 250mm wide top and 2no. 250mm sides, cut Stepped Blocking elements to within 3mm of joist cavity spacing, glued and end screwed into place with min. 3no. 90mm screws in vertical piece and 2no. 90mm screws in horizontal piece joists	

Figure 4: Stepped Blocking installation configuration

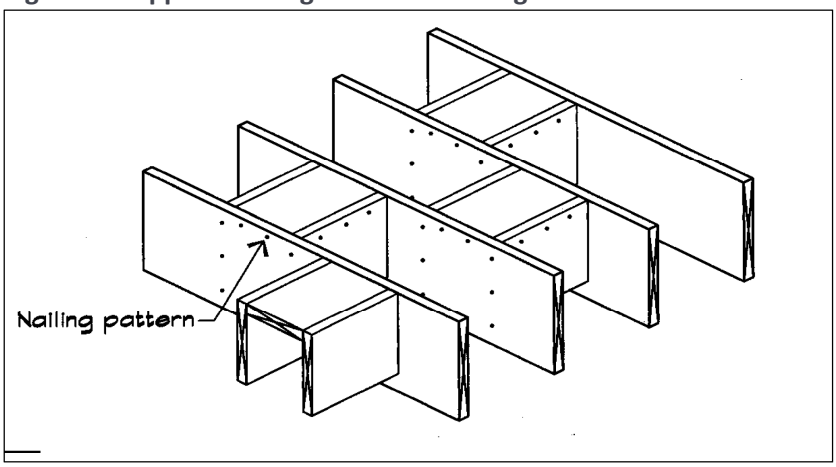
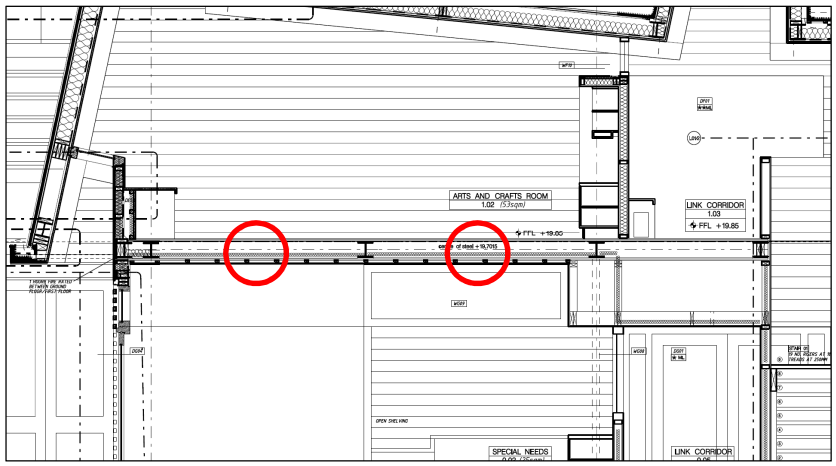


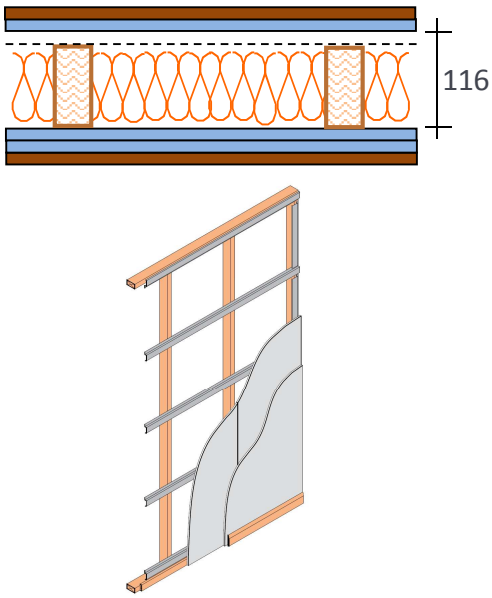
Figure 5: Stepped Blocking installation locations



4.2 Partition Upgrades

We recommend increasing the partition mass layers and the resilient connections between the layers as detailed in Figure 6.

Figure 6: Stud wall upgrade

Description	Sketch
– 18mm T&G softwood lining – 1no. layer 15mm SoundBloc – Gypframe RB1 resilient bars* fixed horizontally to studs at 600mm centres, SoundBloc and softwood layers screw fixed into RB1 resilient bars using drywall screws selected to ensure no contact with timber studs (otherwise acoustic performance will be significantly reduced). – 100mm timber studs at 600mm centres – 1no. layer 100mm glass mineral wool in cavity, min. density 12kg/m^3 – 2no. layers 15mm SoundBloc, staggered joints – 18mm T&G softwood lining * Refer to Appendix A for manufacturer's installation instructions	

4.2.1 Glazed panel

A viewing panel is proposed in the partition to allow a visual connection between the two spaces. We recommend that this is kept to a maximum area of 4sq.m.

To provide levels of sound insulation consistent with the main stud partition, a double glazed unit is recommended with the following glazing configuration:

- 10mm toughened glass / 100mm cavity / 12.76mm laminated glass

4.2.2 Door

We understand that a door is required linking the two rooms to allow supervision by staff. The presence of a door in the partition will limit the overall level of sound insulation.

We understand that this door will not be heavily trafficked. The most cost effective method to achieve high sound insulation in this instance is to install two doors in a single frame to act in 'series'. The doors leaves should be spaced a minimum 75mm apart. Each door should be constructed as detailed in Figure 7.

Figure 7: Door Construction

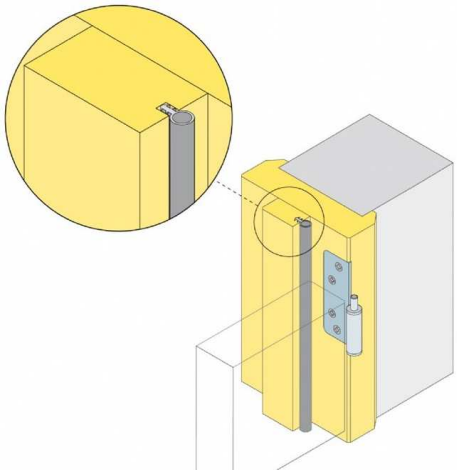
Door Leaf:
54mm thick, 60min solid-core fire door, min. surface weight 30kg/m^2

Door Frame:
Solid hardwood

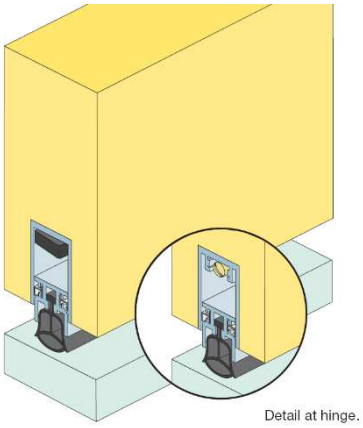
Head & Jamb Seal:
Lorient type IS1007 or IS7020 or equivalent approved

Threshold Seal:
Lorient type IS8040 or equivalent approved

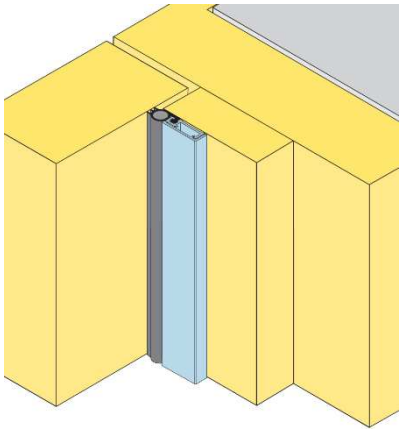
Lorient IS1007 head & jamb seal



Lorient IS8040 threshold seal



Lorient IS7020 head & jamb seal



5.0 PREDICTED PARTITION PERFORMANCE

Our predicted partition performance is shown overleaf.

A nominal 5dB correction should be applied to convert from the predicted 47dB R_w performance to the anticipated 'on-site' performance. On this basis, we predict a nominal **42dB $D_{nT,w}$** 'on-site' performance.

Our predictions show that the door is the limiting factor in the overall sound insulation. Whilst the anticipated on-site performance of 42dB $D_{nT,w}$ is 3dB less than the TGD-021-5 recommended 45dB $D_{nT,w}$ sound insulation rating, it is 27dB higher than the existing 15dB $D_{nT,w}$ performance.

To achieve the TGD-021-5 recommended 45dB $D_{nT,w}$ sound insulation rating, the door would need to be either omitted from the design or proprietary doors would be required.

Sound Insulation Prediction (v8.0.1)

Microsoft - Key No. 0089

Margin of error is generally within Rw +/- 3 dB

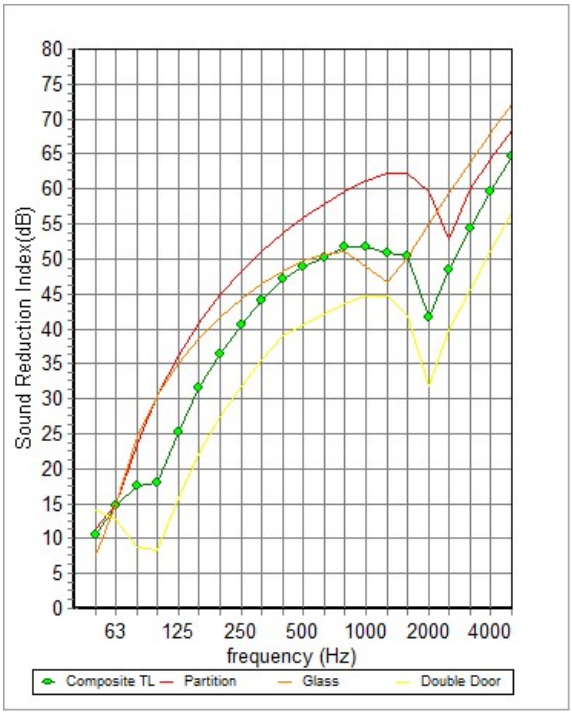
Job Name:

Job No.: Page No.: Notes:

Date: 22 Oct 14 Initials:Andy Irwin

File Name: insul

Composite Transmission Loss Calculation



Rw	47 dB
C	-4 dB
C_{tr}	-10 dB

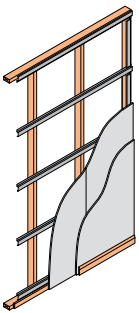
Composite TL per Frequency(Hz))						
63	125	250	500	1k	2k	4k
13	22	39	49	51	45	58

Element	Area	Third Octave Band Centre Frequency (Hz)																						
		50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1k25	1k6	2k	2k5	3k15	4k	5k	Rw	C;Ctr
Partition	13.5	11	15	24	30	36	41	45	48	51	54	56	58	60	61	62	62	60	53	60	64	68	56	-2;-8
Glass	4.0	8	15	25	31	35	39	42	44	46	48	50	51	51	49	47	50	55	59	64	68	72	51	-2;-5
Double Door	2.0	14	13	9	8	16	22	27	32	36	39	40	42	44	45	45	42	32	40	45	51	56	37	-3;-10
	19.5	11	15	18	18	25	31	36	41	44	47	49	50	52	52	51	50	42	48	54	60	65	47	-4;-10

APPENDIX A GYPFRAME RB1 RESILIENT BAR INSTALLATION GUIDE

Installation - Gypframe RB1 Resilient Bar fixing

1



2 Resilient Bar fixed to one side

- If supports are at closer centres trim the board as appropriate.
- Noggings are required to support horizontal joints. Provide support for board ends and edges at the perimeter. Stagger horizontal joints and tape all joints when the board is plastered.
- Fixing - follow the instructions in 'Board fixing - single layer' or double layer as appropriate.

Installation - Gypframe RB1 Resilient Bar fixing

- Where Gypframe RB1 Resilient Bars are required, these are fixed horizontally to the timber studs to one or both sides as specified, at 600mm centres with 36mm Gyproc Drywall Screws.
- The bars are normally fixed with the base flange on the top side, with the exception of the uppermost bar which is fixed base flange down to provide board fixing at the partition head.
- Timber packers (16mm thick) should be used at the base to facilitate skirting fixing.

- Install Gypframe RB1 Resilient Bar noggings where required to support the lining at corners, openings and abutments.

- Install boards vertically, fixing at 300mm centres along each Gypframe RB1 Resilient Bar using Gyproc Drywall Screws. Select the fixing to give a minimum 10mm penetration into the metal.
- Lightly butt boards, inserting fixings not closer than 10mm from bound edges and 13mm from cut edges. Stagger board joints relative to the opposite side.
- At abutments and openings, insert screw fixings into Gypframe RB1 Resilient Bar noggings at 300mm centres. At external corners, fixing centres are reduced to 200mm centres.

- For double layer linings mark the position of bars prior to installing first layer board. After first layer boards have been installed, transfer these dimensions to the lining and mark lines to indicate the position of bars.
- Fix second layer board to Gypframe RB1 Resilient Bar as for first layer. Stagger board joints.

NB Ensure that board fixings into Gypframe RB1 Resilient Bar clear the timber stud position otherwise acoustic isolation will be impaired.