

DESIGN HOUSE RESIDENTIAL BUILDING

FAÇADE SOUND INSULATION ASSESSMENT

REPORT REFERENCE NO. J004303/6048/01

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Document Control Sheet

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Issue	Date	Author	Remark	Status
01	28/02/2023	Max de Salis	Initial Issue	Initial

	Name	Position
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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.

CONTENTS

1.0	SUMMARY.....	4
2.0	PLANNING CONDITIONS	4
3.0	FAÇADE SOUND INSULATION ASSESSMENT	5
3.1	Existing Cladding Type 1 – Render	5
3.2	Existing Cladding Type 2 – Timber.....	6
3.3	Proposed Wall Type 1 – Wetherby SFS-RAGRAIL-EWI-SILICONE system (cavity)	7
3.4	Proposed Wall Type 2 – Wetherby SFS-RAGRAIL-EWI-SILICONE system (no cavity)	9
3.5	Proposed Wall Type 3 –Ash & Lacey LineAL-F System	10

APPENDIX A – DEFINITION OF ACOUSTIC TERMS (ARCHITECTURAL)

APPENDIX B – INSUL® SOUND INSULATION PERFORMANCE PREDICTION SHEETS

1.0 SUMMARY

This report has been prepared by Philip Dunbavin Acoustics Ltd (PDA) on behalf of Thomasons to compare the predicted sound insulation performance of the proposed new façade cladding at Design House Manchester, Copperas Street, Manchester, M4 1HS, to the predicted façade sound insulation of the existing / former cladding system.

Section 3.0 gives the following predicted sound insulation performance values for the existing and proposed cladding systems:

Table 1: Sound insulation (SI) performance predictions for existing and proposed cladding systems

SI Performance Indicator	Existing Cladding System		Proposed Cladding System		
	Render	Timber	Render (Cavity)	Render (No Cavity)	Aluminium
R_w dB	52	49	56	56	54
R_w+C_{tr} dB	44	45	52	51	47

As shown the existing cladding sound insulation performance is met or exceeded by the proposed systems in all cases.

As such Planning Condition 4 for the development is adjudged to have been met.

2.0 PLANNING CONDITIONS

Manchester City Council Environmental Health have imposed the following planning conditions on the re-cladding project at the Design House Residential Building:

4) Before development commences details shall be submitted to demonstrate that the performance of the new cladding system installed has at least the same acoustic performance as the existing. In the event that the cladding system does not have the same acoustic performance, a mitigation scheme shall be submitted for approval in writing prior to the installation of the cladding. The approved details shall be implemented as part of the development.

Reason - To ensure the existing internal noise levels (for the residential) and potential noise break-out from the commercial are not compromised pursuant to policies SP1, H1 and DM1 of the Core Strategy.

3.0 FAÇADE SOUND INSULATION ASSESSMENT

3.1 Existing Cladding Type 1 – Render

The MBLC Architects drawing no. 4.21REV-G-4.21G “Smithfield Block 5 – External Wall details” dated December 02 gives the following detail for the existing rendered cladding:

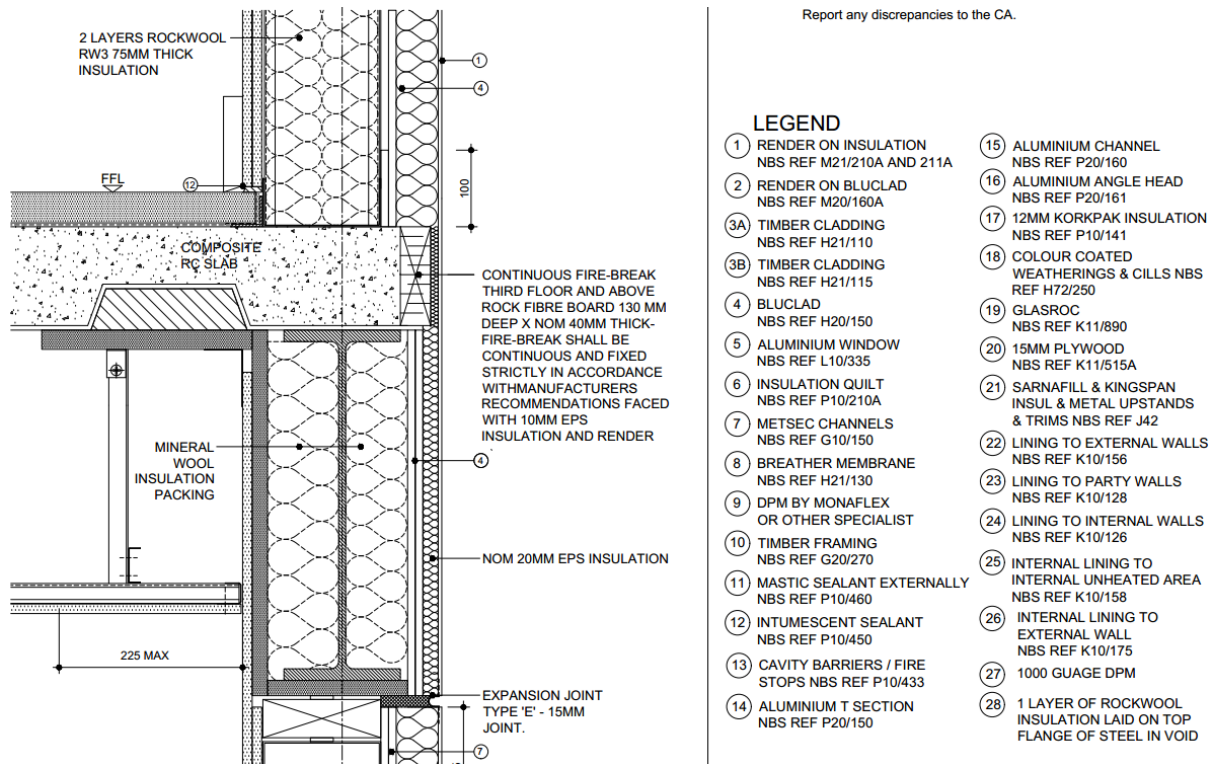


Figure 2: Existing Render on Insulation Cladding

The MBLC Architects drawing no. 4.703-4.703 “Smithfield Block 5 – Exterior Wall details” dated August 2003 also indicates that the internal plasterboard layer is of 12.5mm Duplex Plasterboard (NBS [National Building Specification] shows 7.7 kg/m²) and 12.5mm Fireline plasterboard (NBS shows 9.5 kg/m²).

Insul® proprietary sound insulation prediction software has been utilised to assess the sound insulation of the said system. The system as modelled in Insul® would be equivalent to the following:

- One layer 12.5mm thick plasterboard standard wall board and 1 layer 12.5mm Fire rated plasterboard.
- 150mm structural steel stud (circa 1 to 1.2mm gauge)
- Cavity containing 150mm thick mineral wool at nominal density 10kg/m³
- 10mm Cement Particle board nominal density 1154 kg/m³ as per NBS Siniat Bluclad Specification.
- Point connections at nominal 600mm centres forming 80mm cavity.
- 60mm phenolic foam insulation in cavity nominal density circa 40 kg/m³
- 2mm Sand / Cement Render with polypropylene mesh (assumed nominal density 1600 kg/m³).

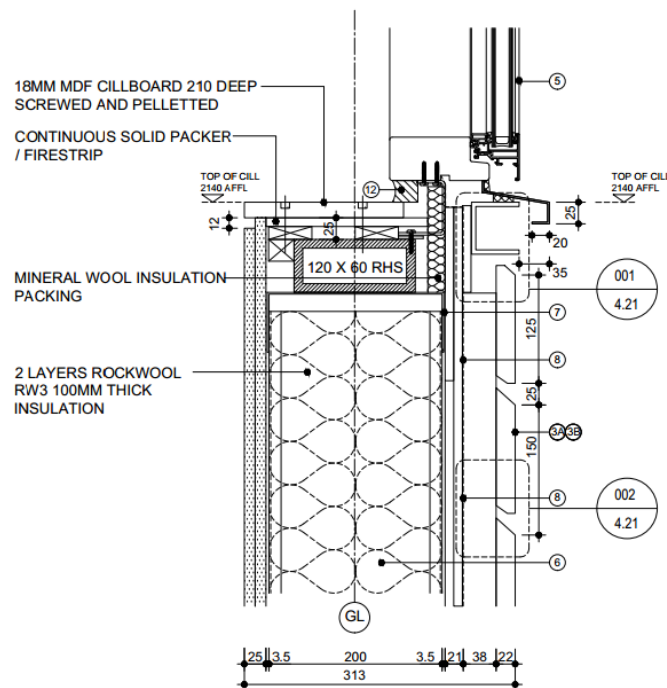
The performance prediction sheet is given in Appendix B1 and the overall predicted sound insulation performance given is as follows:

$$R_w = 52 \text{ dB}$$

$$R_w + C_{tr} = 44 \text{ dB}$$

3.2 Existing Cladding Type 2 – Timber

The MBLC Architects drawing no. 4.703-4.703 “Smithfield Block 5 – Exterior Wall details” dated August 2003 gives the following detail for the existing timber cladding:



The Thomason's report on External Walls – “Design House Manchester, Copperas Street, Manchester, M4 1HS” dated 6th January 2020 indicates that the outer layers are as follows:

- 25mm thick timber boarding – probably hardwood (horizontal),
- 40mm square timber battens (vertically installed),
- Breather Membrane
- 2no 8mm thick Fibre Board,

Insul ® proprietary sound insulation prediction software has been utilised to assess the sound insulation of the said system. The system as modelled in Insul ® would be equivalent to the following:

- One layer 12.5mm thick plasterboard standard wall board and 1 layer 12.5mm Fire rated plasterboard.
- 200mm structural steel stud (circa 1 to 1.2mm gauge)
- Cavity containing 200mm thick RW3 mineral wool at minimum nominal density 10kg/m³.

- 2 no. 8 mm Cement Particle board nominal density 1154 kg/m³ as per NBS Siniat Bluclad Specification.
- Line connections of 40mm timber battens at nominal 600mm centres forming 80mm cavity.
- 40mm cavity
- 25mm thick timber nominal density 600 kg/m³

The performance prediction sheet is given in Appendix B1 and the overall predicted sound insulation performance given is as follows:

R_w = 49 dB

R_w+C_{tr} = 45 dB

3.3 Proposed Wall Type 1 – Wetherby SFS-RAGRAIL-EWI-SILICONE system (cavity)

The following is an excerpt from DWMR Architects drawing 3685-DR-200 Rev B of 29.10.20 “Proposed Slab Edge Party Floor” which shows the SFS-RAGRAIL-EWI-SILICONE system (cavity):

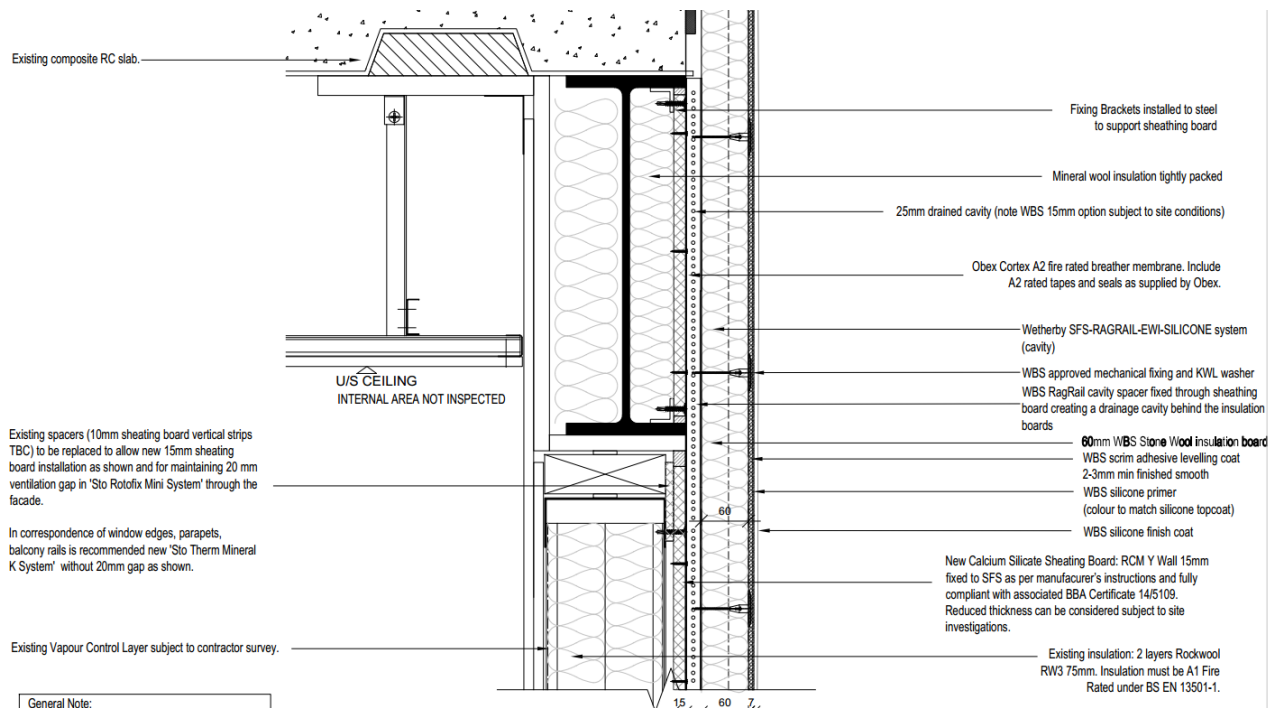


Figure 3: Proposed Wetherby SFS-RAGRAIL-EWI-SILICONE system (cavity) (DWMR Architect Drawing 3685-DR-200 Rev B)

It is noted that whilst Figure 3 shows a 2-3mm WBS scrim only, the Wetherby Building Systems specification document “External Wall Insulation Detail Drawings Insulation & Silicone Render Finish” shows for the SFS-RAGRAIL-EWI-SILICONE-01 system that in addition to this there is a 4-6mm scrim adhesive coat below this with a WBS alkali resistant glass fibre reinforcing mesh between the two as shown in Figure 4 below:

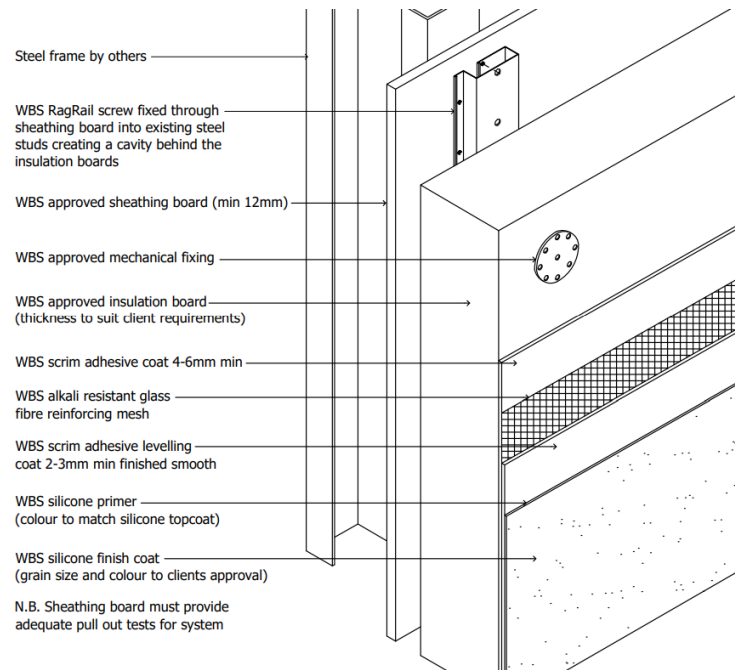


Figure 4: Wetherby Building Systems specification document “External Wall Insulation Detail Drawings Insulation & Silicone Render Finish” shows for the SFS-RAGRAIL-EWI-SILICONE-01

Based on the above there will be an effective 6-9mm render / scrim type finish and taking a mid-point this would be 7.5mm thick on average. This ties in with the 7mm thickness shown in the DWMR drawing in Figure 3.

Insul ® proprietary sound insulation prediction software has therefore been utilised to assess the sound insulation of the said system. The system as modelled in Insul ® would be equivalent to the following:

- One layer 12.5mm thick plasterboard standard wall board and 1 layer 12.5mm Fire rated plasterboard.
- 150mm structural steel stud (circa 1 to 1.2mm gauge)
- Cavity containing 150mm thick RW3 mineral wool at minimum nominal density 10kg/m³.
- 15mm New Calcium Silicate Sheathing Board nominal density 1200 kg/m³.
- 25mm Drained Cavity
- Point connections at nominal 600mm centres forming 60 mm cavity.
- Cavity containing 60mm thick Stone Wool insulation at nominal density 10kg/m³.
- 7mm adhesive scrim at bulk density 2000 kg/m³ (Wetherby Safety Data sheet “WBS Scrim Adhesive”).

The performance prediction sheet is given in Appendix A2 and the overall predicted sound insulation performance given is as follows:

$$R_w = 56 \text{ dB}$$

$$R_w + C_{tr} = 52 \text{ dB}$$

3.4 Proposed Wall Type 2 – Wetherby SFS-RAGRAIL-EWI-SILICONE system (no cavity)

The SFS-RAGRAIL-EWI-SILICONE system (no cavity) is shown in the DWMR Architects drawing 3685-DR-201 Rev B of 29.10.20 “Proposed Slab Edge – Window Cill and Head” as being effectively the same as the SFS-RAGRAIL-EWI-SILICONE system (cavity) except without the 25mm drainage cavity.

Insul ® proprietary sound insulation prediction software has therefore been utilised to assess the sound insulation of the said system. The system as modelled in Insul ® would be equivalent to the following:

- One layer 12.5mm thick plasterboard standard wall board and 1 layer 12.5mm Fire rated plasterboard.
- 150mm structural steel stud (circa 1 to 1.2mm gauge)
- Cavity containing 150mm thick RW3 mineral wool at minimum nominal density 10kg/m³.
- 15mm New Calcium Silicate Sheathing Board nominal density 1200 kg/m³.
- Point connections at nominal 600mm centres forming 60 mm cavity.
- Cavity containing 60mm thick Stone Wool insulation at nominal density 10kg/m³.
- 7mm adhesive scrim at bulk density 2000 kg/m³ (Wetherby Safety Data sheet “WBS Scrim Adhesive”).

The performance prediction sheet is given in Appendix A2 and the overall predicted sound insulation performance given is as follows:

$$R_w = 56 \text{ dB}$$

$$R_w + C_{tr} = 51 \text{ dB}$$

3.5 Proposed Wall Type 3 –Ash & Lacey LineAL-F System

The following is an excerpt from DWMR Architects drawing 3685-DR-201 Rev B of 29.10.20 “Proposed Render Window Jamb” which shows the proposed LINEAL F Ash & Lacy System to replace existing timber slats:

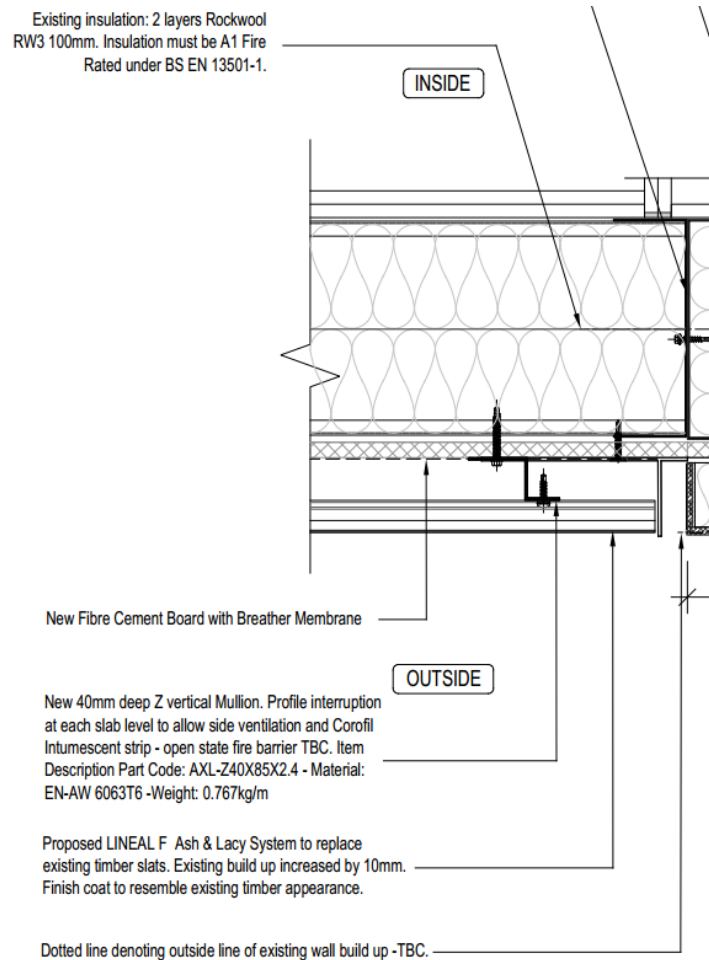


Figure 5: Proposed LINEAL F Ash and Lacy system (DWMR Architects Drawing 3685-DR-201 Rev B)

The DWMR Architects specification document for the project “Design House, Manchester Cladding Remediation 13-05-2022” notes that the Rainscreen panel is to be solid 2.0mm thick aluminium.

Insul ® proprietary sound insulation prediction software has therefore been utilised to assess the sound insulation of the said system. The system as modelled in Insul ® would be equivalent to the following:

- One layer 12.5mm thick plasterboard standard wall board and 1 layer 12.5mm Fire rated plasterboard.
- 150mm structural steel stud (circa 1 to 1.2mm gauge)
- Cavity containing 150mm thick RW3 mineral wool at minimum nominal density 10kg/m³.
- 15mm New Calcium Silicate Sheathing Board nominal density 1200 kg/m³.
- Line connections at nominal 600mm centres forming 60 mm cavity.

- 60mm clear cavity.
- 2mm aluminium at nominal density 2700 kg/m³

The performance prediction sheet is given in Appendix A2 and the overall predicted sound insulation performance given is as follows:

$R_w = 54 \text{ dB}$

$R_w + C_{tr} = 47 \text{ dB}$

APPENDIX A – DEFINITION OF ACOUSTIC TERMS (ARCHITECTURAL)

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq}(s)$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} , or for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see later). $L_{eq}(s)$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n , or for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Reverberation Time

This is the most common way of expressing a room's basic acoustic character. It is defined as the duration required for the space-averaged sound energy density in an enclosure to decrease by 60 dB after the source emission has stopped, denoted as RT_{60} . It is usually impractical to measure a full 60 dB dynamic range in the field; a smaller dynamic range may be used extrapolated to a decay time of 60 dB. Common derivations include a range between 5 dB and 25 dB below the initial level, which is labelled T_{20} , or the range between 5 dB and 35 dB below the initial level, labelled as T_{30} .

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.

Sound reduction index (R)

This is a measure in decibels (dB) of the sound insulation of a particular construction. It is a laboratory measured parameter independent of area, and of receiving room conditions. The sound reduction index is the value produced from laboratory tests on a construction. When tested in a laboratory, results of R are obtained over a range frequencies in 1/3rd and/or full octave bands. These may then be weighted in accordance with BS EN ISO 717: 1997: Part 1 to give the overall *Weighted Sound Reduction Index* R_w . Where sound reduction with respect to road traffic noise is required the frequency weighting may be adapted using the C_{tr} spectrum adaptation term. In this case the single figure value is given in terms of $R_w + C_{tr}$.

Standardised level difference (D_{nT})

This is the level difference adjusted to assume a standard reverberation time of 0.5 seconds in the receiving room so that partitions can be compared independent of the furnishing and surface finishes of the rooms. The measure is generally used in residential testing as 0.5 seconds is taken as the approximate reverberation time of a furnished living room or bedroom. The D_{nT} is usually quoted for 1/3rd octave bands between 100 Hz and 3150 Hz.

Weighted standardised level difference ($D_{nT,w}$)

The $D_{nT,w}$ is a single figure expression used to describe the sound insulation of a partition. The weighting system used to obtain the single figure $D_{nT,w}$ from the 1/3rd octave D_{nT} values is given in BS EN ISO 717: Part 1. The $D_{nT,w}$ is used for expressing sound insulation measured “in the field”, and is part of the term used in Approved Document E 2003, guidance to the Building Regulations for the assessment of performance of separating elements between residences.

Spectrum adaptation terms (C, C_{tr})

These terms are single figure values which are added to a single figure R_w or D_w term to adapt the frequency weighting for different source noise spectra. Adding the C_{tr} term to a weighted parameter approximates to the human perceived sound insulation of an element when subjected to road traffic noise. The C_{tr} term may be used to determine a single figure approximation of sound insulation against road traffic noise. The C_{tr} term is part of the term used in Approved Document E: 2003 of the Building Regulations for the assessment of performance of separating elements between residences.

Flanking

Flanking is the term used to describe how sound gets from one room to another by routes other than via the wall or floor directly separating them. Such flanking paths around a party wall would be the internal leaf of the external wall or the roof void, plus any air gaps at junctions. The sound insulation of flanking paths is very important. If the insulation is poor it can result in a poor built performance in terms of sound insulation, even if the party walls or floors themselves are adequate. When a measurement of sound insulation is made in a building as opposed to an acoustic laboratory, it will include flanking sound transmission. Standards for sound insulation in residential properties now require testing of $D_{nT,w} + C_{tr}$ values which include sound transmission via flanking paths.

APPENDIX B – INSUL[®] SOUND INSULATION PERFORMANCE PREDICTIONS

B1

INSUL ® MODEL OF EXISTING RENDER CLADDING SYSTEM

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within $R_w \pm 3$ dB

- Key No. 5527

Job Name:

Job No.:

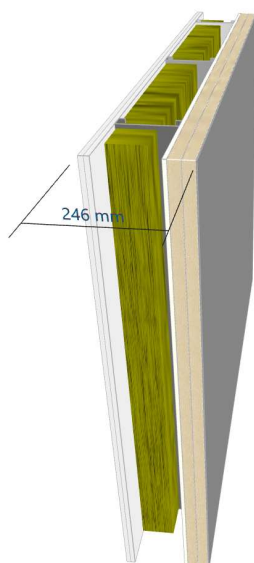
Initials:Naomi Bolton

Date:28/02/2023

File Name:Render Existing.ixl



Notes:



R_w 52 dB

C -2 dB

Ctr -7 dB

Mass-air-mass resonant frequency = 45 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 36.4 kg/m²

System description

Panel 1 : 1 x 12.1 mm Gyproc Wallboard 12.5mm

+ 1 x 12.1 mm Gyproc Fireline 12.5mm

Frame: Steel Stud (1.0-1.6mm) (1.5E2 mm x 38 mm), Stud spacing 600 mm ; Cavity Width 150 mm , 1 x Fibreglass (10kg/m³) 60mm Thickness 100 mm

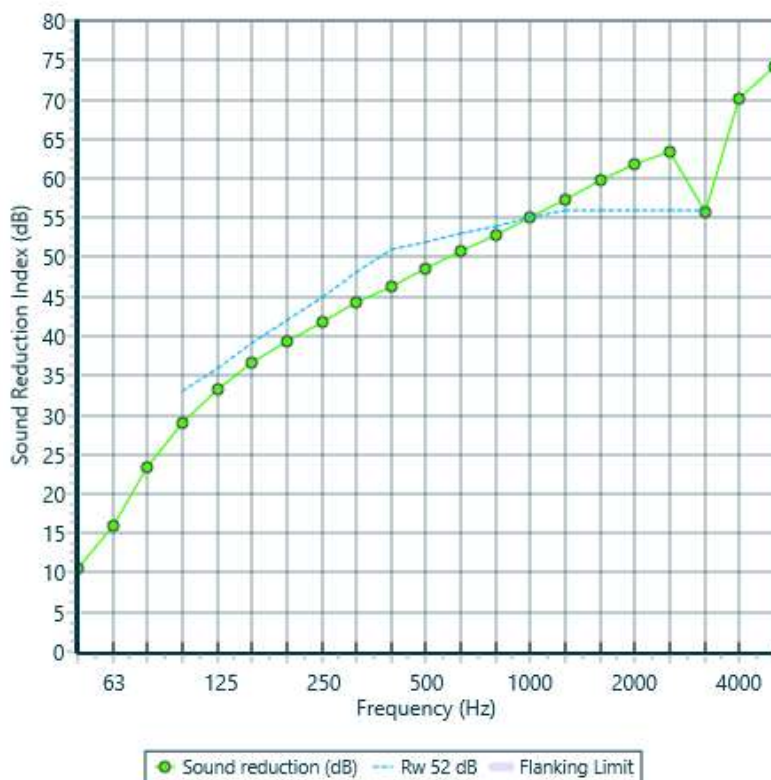
Panel 2 : 1 x 9.6 mm NuClad

+ 2 x 29.9 mm Kool Duct

...

+ 1 x 2 mm Sand/Cement render (plaster)

freq.(Hz)	R(dB)	R(dB)
50	11	
63	16	14
80	23	
100	29	
125	33	32
160	37	
200	39	
250	42	41
315	44	
400	46	
500	49	48
630	51	
800	53	
1000	55	55
1250	57	
1600	60	
2000	62	61
2500	63	
3150	56	
4000	70	60
5000	74	



B2

INSUL ® MODEL OF EXISTING TIMBER SYSTEM

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within $R_w \pm 3$ dB

- Key No. 5527

Job Name:

Job No.:

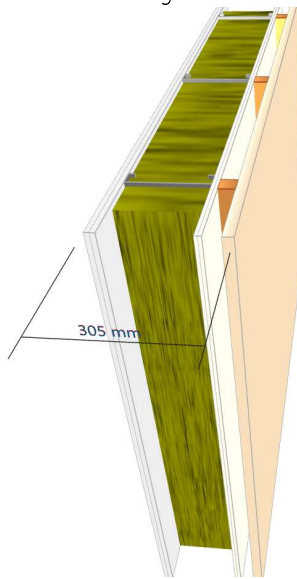
Initials:Naomi Bolton

Date:28/02/2023

File Name:Timber Existing.ixl



Notes:



R_w 47 dB

C -1 dB

Ctr -4 dB

Mass-air-mass resonant frequency = 40 Hz, 141 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 48.1 kg/m²

System description

Panel 1 : 1 x 12.1 mm Gyproc Wallboard 12.5mm

+ 1 x 12.1 mm Gyproc Fireline 12.5mm

Frame: Steel Stud (1.0-1.6mm) (2E2 mm x 38 mm), Stud spacing 600 mm ; Cavity Width 200 mm , 1 x Fibreglass (10kg/m³) 60mm Thickness 200 mm

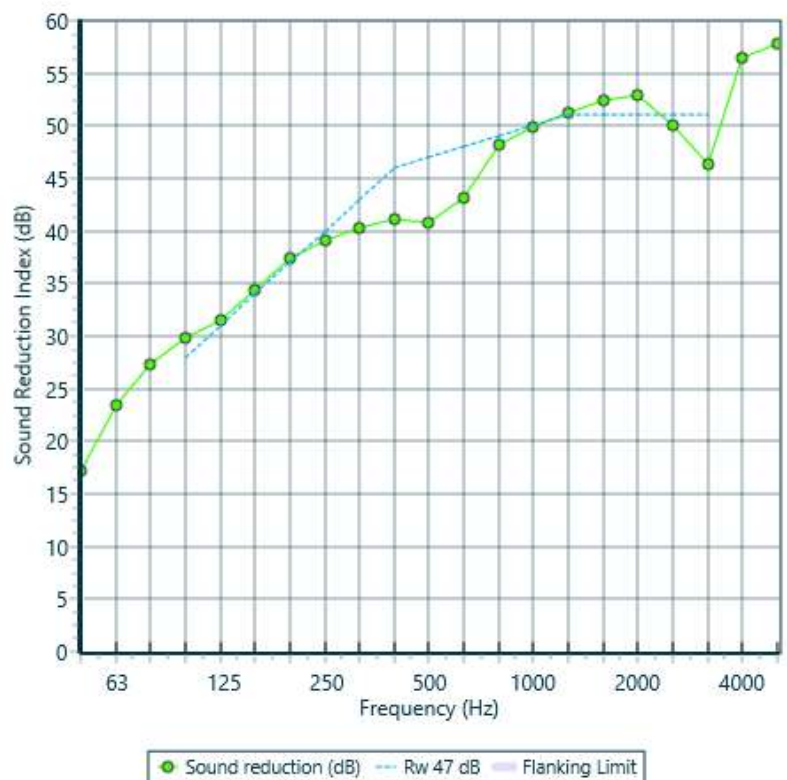
Panel 2 : 2 x 8 mm NuClad

...

Frame: Timber stud (40 mm x 40 mm), Stud spacing 600 mm ; Cavity Width 40 mm

Panel 3 : 1 x 25 mm Cedar (Western Red)

freq.(Hz)	R(dB)	R(dB)
50	17	
63	23	21
80	27	
100	30	
125	32	32
160	34	
200	37	
250	39	39
315	40	
400	41	
500	41	42
630	43	
800	48	
1000	50	50
1250	51	
1600	52	
2000	53	52
2500	50	
3150	46	
4000	56	50
5000	58	



B3

INSUL ® MODEL OF PROPOSED RENDER CLADDING SYSTEM (CAVITY)

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within $R_w \pm 3$ dB

- Key No. 5527

Job Name:

Job No.:

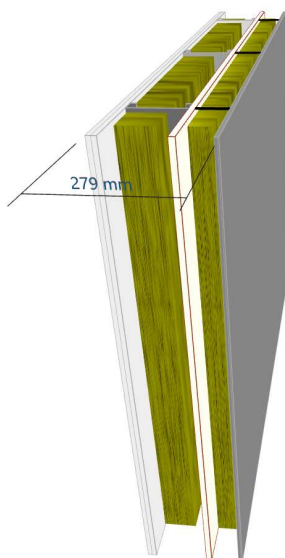
Initials:Naomi Bolton

Date:28/02/2023

File Name:Wetherby SFS-RAGRAIL-EWI-SILICONE system (cavity).ixl



Notes:



R_w 56 dB

C -1 dB

Ctr -4 dB

Mass-air-mass resonant frequency = 42 Hz, 79 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 52.2 kg/m²

System description

Panel 1 : 1 x 12.1 mm Gyproc Wallboard 12.5mm

+ 1 x 12.1 mm Gyproc Fireline 12.5mm

Frame: Steel Stud (1.0-1.6mm) (1.5E2 mm x 38 mm), Stud spacing 600 mm ; Cavity Width 150 mm , 1 x Fibreglass (10kg/m³) 60mm Thickness 100 mm

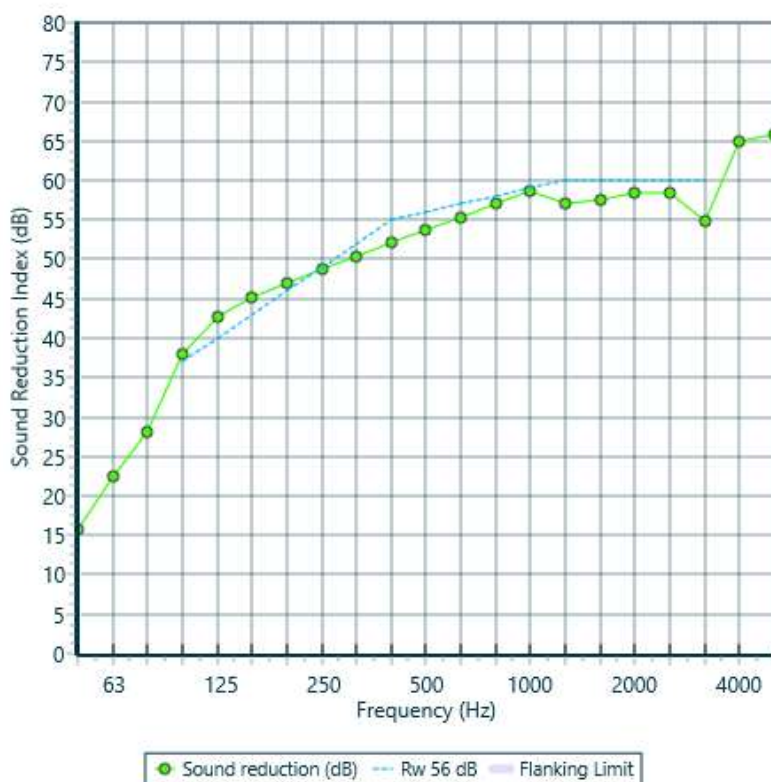
Panel 2 : 1 x 15 mm NuClad

Frame: Point Connection (80 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 80 mm , 1 x **Not known** Thickness 60 mm

Panel 3 : 1 x 7 mm Sand/Cement render (plaster)

+ 1 x 3 mm Sand/Cement render (plaster)

freq.(Hz)	R(dB)	R(dB)
50	16	
63	22	20
80	28	
100	38	
125	43	41
160	45	
200	47	
250	49	49
315	50	
400	52	
500	54	53
630	55	
800	57	
1000	59	57
1250	57	
1600	58	
2000	58	58
2500	58	
3150	55	
4000	65	59
5000	66	



B4

INSUL ® MODEL OF PROPOSED RENDER CLADDING SYSTEM (NO CAVITY)

Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within $R_w \pm 3$ dB

- Key No. 5527

Job Name:

Job No.:

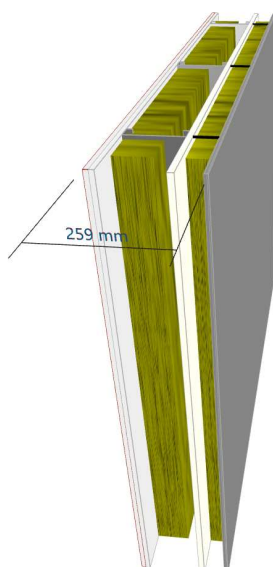
Initials:Naomi Bolton

Date:28/02/2023

File Name:Wetherby SFS-RAGRAIL-EWI-SILICONE system (no cavity).ixl



Notes:



R_w 56 dB

C -1 dB

Ctr -5 dB

Mass-air-mass resonant frequency = 43 Hz , 89 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 52.2 kg/m²

System description

Panel 1 : 1 x 12.1 mm Gyproc Wallboard 12.5mm

+ 1 x 12.1 mm Gyproc Fireline 12.5mm

Frame: Steel Stud (1.0-1.6mm) (1.5E2 mm x 38 mm), Stud spacing 600 mm ; Cavity Width 150 mm , 1 x Fibreglass (10kg/m³) 60mm Thickness 100 mm

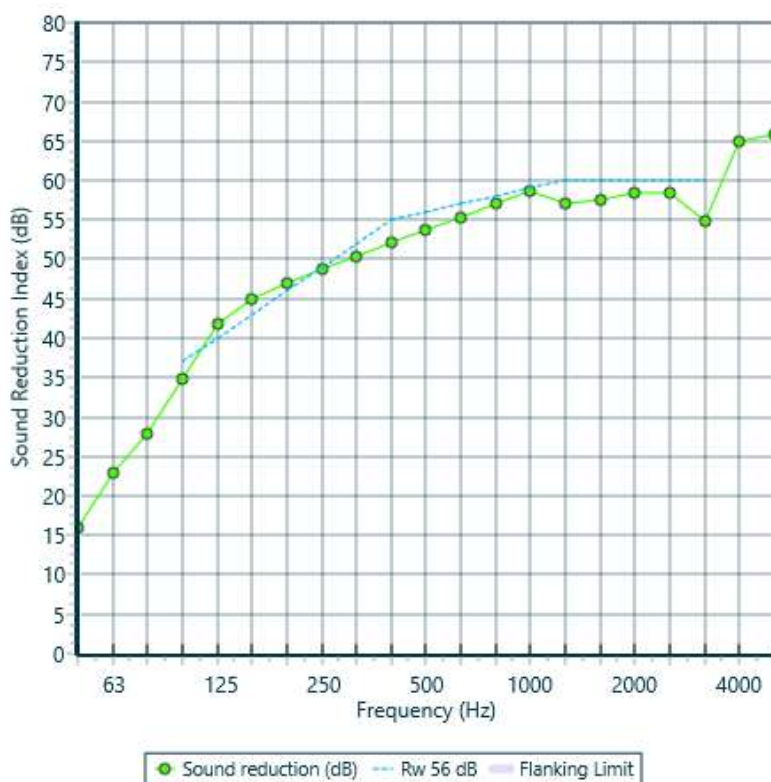
Panel 2 : 1 x 15 mm NuClad

Frame: Point Connection (60 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 60 mm , 1 x **Not known** Thickness 60 mm

Panel 3 : 1 x 7 mm Sand/Cement render (plaster)

+ 1 x 3 mm Sand/Cement render (plaster)

freq.(Hz)	R(dB)	R(dB)
50	16	
63	23	20
80	28	
100	35	
125	42	38
160	45	
200	47	
250	49	48
315	50	
400	52	
500	54	53
630	55	
800	57	
1000	59	57
1250	57	
1600	58	
2000	58	58
2500	58	
3150	55	
4000	65	59
5000	66	



B5

INSUL ® MODEL OF PROPOSED METAL CLADDING SYSTEM

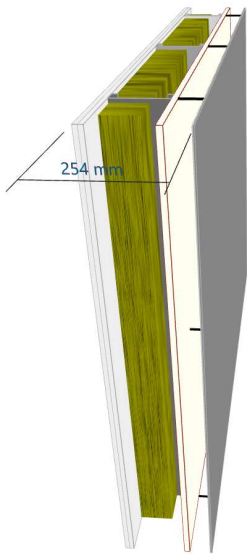
Sound Insulation Prediction (v9.0.24)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within $R_w \pm 3$ dB
- Key No. 5527
Job Name:
Job No.:
Date:28/02/2023
File Name:Ash Lineal.ixl

Initials:Naomi Bolton



Notes:



Rw 54 dB
C -2 dB
Ctr -7 dB

Mass-air-mass resonant frequency = 46 Hz , 115 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 46.8 kg/m²

System description

Panel 1 : 1 x 12.1 mm Gyproc Wallboard 12.5mm
+ 1 x 12.1 mm Gyproc Fireline 12.5mm
Frame: Steel Stud (1.0-1.6mm) (1.5E2 mm x 38 mm), Stud spacing 600 mm ; Cavity Width 150 mm , 1 x Fibreglass (10kg/m3) 60mm Thickness 100 mm
Panel 2 : 1 x 15 mm NuClad
Frame: Point Connection (60 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 60 mm
Panel 3 : 1 x 2 mm Aluminium
+ 1 x 3 mm Sand/Cement render (plaster)

freq.(Hz)	R(dB)	R(dB)
50	15	
63	22	19
80	27	
100	30	
125	34	33
160	40	
200	44	
250	47	46
315	49	
400	51	
500	53	53
630	55	
800	56	
1000	58	57
1250	56	
1600	57	
2000	57	57
2500	57	
3150	54	
4000	64	58
5000	65	

