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Acoustic Report

33no. Social Housing Units in Kill, Co Kildare

Report for: Kildare County Council

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Issue Date	Revision	Status
30th August 2021	DRAFT	Suitable for review and comment

DRAFT

Contents

1 Introduction

Kilde County Council has engaged iAcoustics to provide guidance on the acoustic design of 33no. social housing units at the former Ambassador sit in Kill, Co Kildare. This report has assessed the airborne & impact sound insulation performance of separating walls and floor to ensure that separating elements are designed to comply with Part-E of the Building Regulations 2014. Furthermore, this report provides guidance on the control of flanking sound, external noise and building services noise.

Future iteration of this report will include a design assessment of external noise due to road traffic.

1.1 Development Proposal & Site Description

The project's scope includes a mix of 3-storey apartment blocks and 2-storey houses comprising 6no. 1-bed apartments, 6no. 2-bed apartments, 13no. 2-bed houses, 8no. 3-bed houses. The subject site is situated at the western edge of Kill and will be accessible off the L2014 St Brigid's Terrace Rd. The site is bound to the south-east and east by Kill GAA Club. To the south-west and west is private residental development. The N7 runs along the northern boundary of the site; the proximity to the N7 road means there is an appreciable road traffic nosie impact on the site.

Figure 1-1 – Proposed site layout

2 Acoustic Design Criteria Overview

This section presents an overview of the acoustic design criteria applicable to the project.

2.1 Building Regulations Part-E (2014)

Part E of the Second Schedule to the Building Regulations 1997 to 2014, provides as follows:

Sound	*E1*	Each wall and floor separating a dwelling from - (a) another dwelling or dwellings, (b) other parts of the same building, (c) adjoining buildings, shall be designed and constructed in such a way so as to provide reasonable resistance to sound.
Reverberation	*E2*	The common internal part of a building which provides direct access to a dwelling shall be designed and constructed so as to limit reverberation in the common part to a reasonable level.

Table 2-1 – Regulation E-1 & E-2 of Part-E

Regulation *E1* should be satisfied by achieving the sound insulation performance levels specified in Table 2-2 below; it is applicable to separating walls and floors.

Regulation E1 - Sound Insulation Performance Levels		
Separating Construction	Airborne Sound Insulation, $D_{nT,w}$ dB	Impact Sound Insulation, $L_{nT,w}$ dB
Walls	53 (min)	-
Floors	53 (min)	58 (max)

Table 2-2 – Minimum performance requirements to comply with Regulation E-1

Note, this scheme proposes that all apartments are accessed through their own door. There are no common internal areas which may contain an access door into one or more apartments. For this reason, Regulation E-2 is not applicable to this project.

2.2 Internal Noise Level Requirements

Part-E of the *2014 Regulations* does not address inward noise from external sources such as road, rail and air transport; this aspect of acoustic performance is handled by designing to recognised internal guidance which set out recommended thresholds for internal ambient noise due to transportation sources. In line with ProPG[1] BS 8233[2] & WHO guidelines[3], the following internal noise level criteria shall be applied for the project.

Internal Ambient Noise Level Criteria		
Location:	L_{Day} 07:00 to 23:00	L_{night} 23:00 to 07:00
Living room	L_{Aeq} 35dB	-
Dining room/kitchen	L_{Aeq} 40dB	-
Bedrooms	L_{Aeq} 35dB	L_{Aeq} 30dB and ≤ 10no. events exceeding L_{AFmax} 45dB

Table 2-3 - Internal Ambient Noise Level Criteria.

[1] *ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise New Residential Development (2017).*

[2] *BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (2014).*

[3] *World Health Organisation Environmental Noise Guidelines for the European Region (2018).*

3 Sound Insulation Performance of Walls & Floors

3.1 General

Sound insulation refers to the ability of partition walls and floors in impeding the transmission of sound. A separating element's airborne sound insulation performance is generally dictated by the partition's mass and the stiffness and damping characteristics. 'Flanking sound' refers to the indirect sound transmission via adjoining elements or air paths around or through the partition, which can detract from the overall acoustic performance of the partition.

The *impact* sound insulation performance depends on the vibration transmission characteristics of the floor construction, the floor covering, and the adjoining elements. In practice, a resilient floor covering reduces impact sound at the source.

3.2 Computer Modelling of Building Elements

Predictions and calculations of airborne sound insulation were undertaken using a computer modelling software package *INSUL*. All calculations were made in accordance with EN 12354-3:2000 *Building Acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 3: Airborne sound insulation against outdoor sound.*

3.3 Proposed Separating Wall Buildup

Van Dijk Architects have provided iAcoustics with a typical party wall detail as follows:

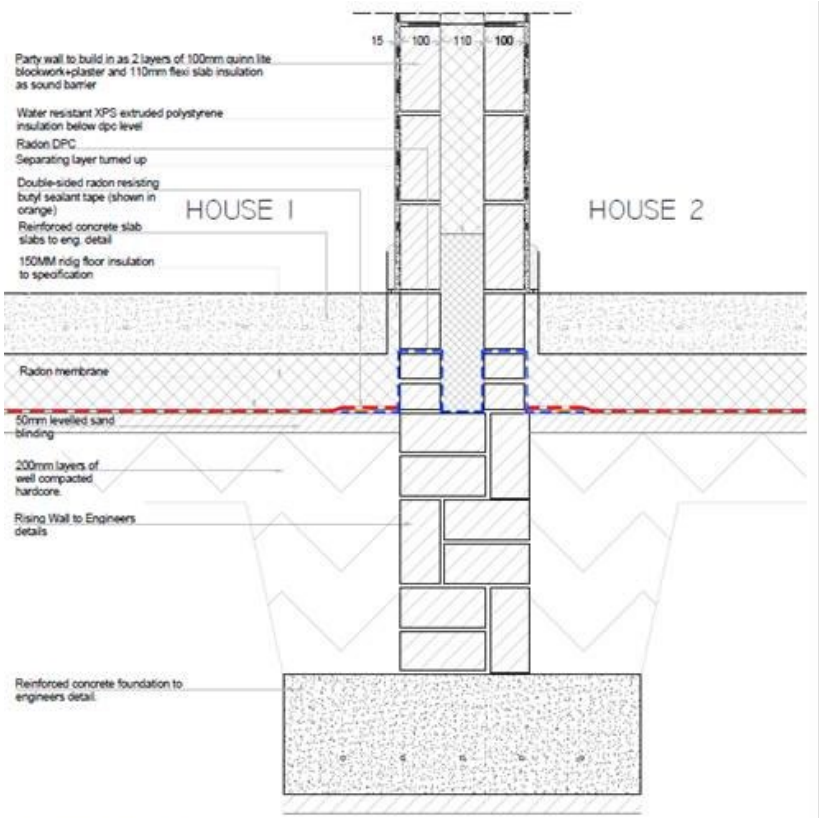
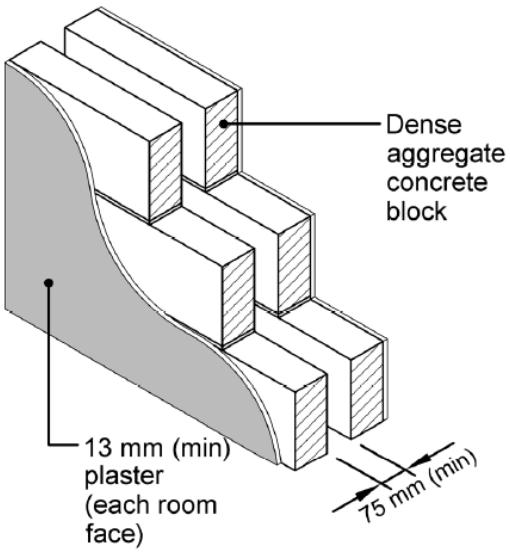


Figure 3-1 – Typical party wall base detail with typical ground bearing slab

We note that a *'Quinn lite'* aerated block is called up on the drawing. Aerated block are not suitable for this application, dense aggregate concrete block of block density 1900 kg/m^3 (minimum). *Note: Figure 3-1 as currently shown is to be replaced by updated details showing a dense aggregate concrete block.*

Section 3 of TGD Part-E provides examples of wall buildups which, if constructed correctly, should achieve the required airborne sound insulation performance between dwellings. The proposed buildup conforms to Wall Type 3 from TGD Part-E – *'Cavity masonry wall with plaster finish'*. The addition of the mineral wool insulation in the cavity will providing acoustic damping properties and improve the overall airborne sound insulation performance of the separating wall. Wall Type 3 also calls for a minimum cavity of 75mm; 110mm is being proposed for this project which exceedes the minimum depth requirement.



WT 3 - Cavity masonry with plaster finish

Specification

Dense aggregate concrete blockwork plastered on both room faces.
The minimum mass of the wall (including the plaster) should be 415 kg/m².
The thickness of the plaster should be 13 mm (min) per room face.
The width of the cavity should be 75 mm (min).
Connect the block leafs with wall ties with a dynamic stiffness < 4.8MN/m³ for the specified minimum cavity, at a standard density.

Example

Two leaves of 100 mm dense aggregate concrete block of block density 1900 kg/m³ (min). Provide 75 mm (min) cavity between leafs. 225 mm coursing (single course stretcher bond only), plaster on both faces with 13 mm (min) lightweight plaster of mass per unit area 10 kg/m² (min).

Figure 3-2 – Diagram 12 from TGD Part-E – Cavity masonry wall with plaster finish

Key Construction Details:

1. Provide dense aggregate concrete blocks of at least 1900 kg/m^3 density.
2. Provide a 13mm plaster/cement sand rende with plaster skim on both sides.
3. Lay the blocks in 225mm single course stretcher bond.
4. Fill all joints with mortar and fully seal the wall with all parts of the construction.
5. Connect the leaves of a masonry cavity wall only where necessary by butterfly ties. Alternatively, use wall ties with an appropriate measured dynamic stiffness for the cavity width < 4.8MN/m^3.
6. There is to be no rigid connection between the two leaves exceped for wall ties and foundation. The cavity and wall ties must be kept free from mortar droppings and debris.

3.4 Separating Wall - Flanking Requirements at the External Wall

Provide a butted and tied junction at the external wall. This method will improve the airborne sound insulation performance by 2-3dB compared to a tootched/bonded junction.

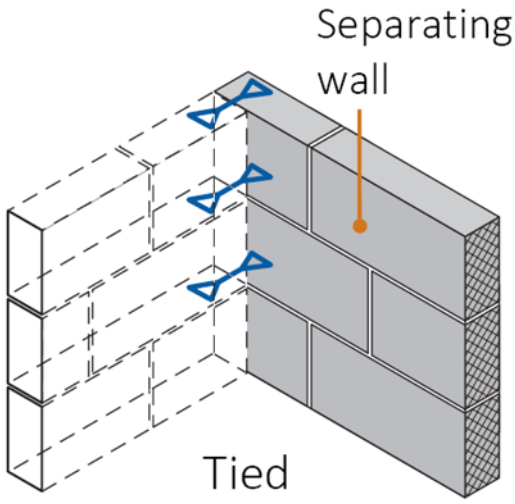


Figure 3-3 – Illustration of a butted and tied junction

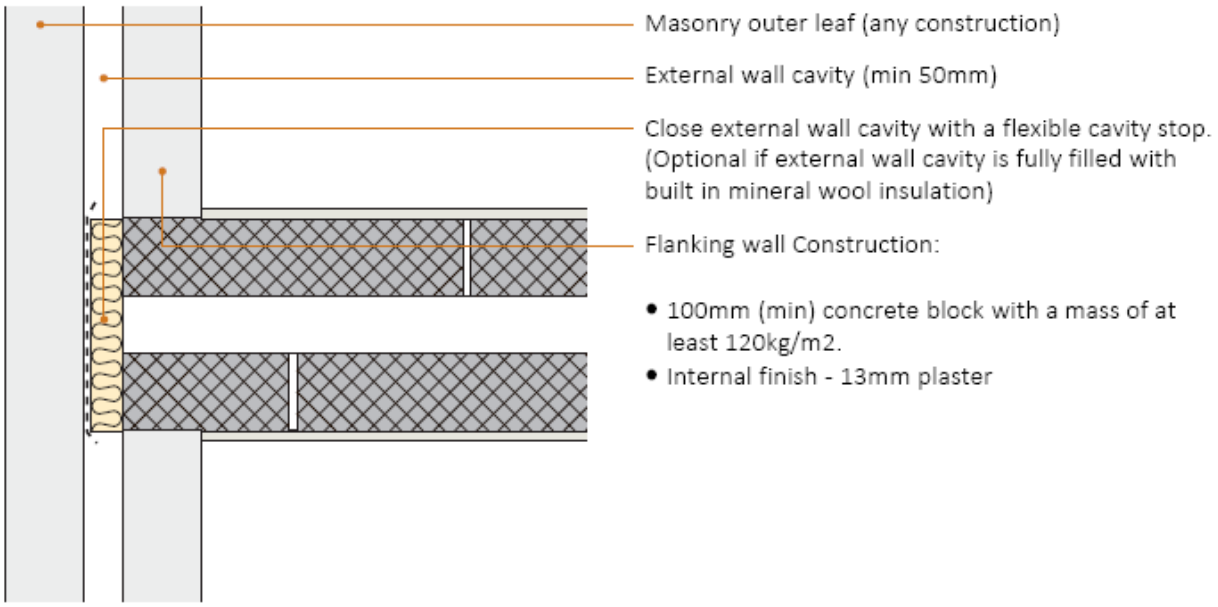


Figure 3-4 – External wall (flanking) requirements.

Note: Please refer to the Architects' details for clarity. These figures are for illustrative purposes only. Cavity stops are spacified for the purposes of minimising flanking sound along the external wall cavity. A cavity stop may also be required for the purposes of compliance with Part B – Fire Safety, see TGD Part-B.

3.5 Separating Wall – Key Junction Detailing

We note Diagram 16 from TGD Part-E which illustrates key junction details for Wall Type 3 *(Cavity masonry wall).* For the purpose of clarity, we have recalled Diagram 16 verbatim in Figure 3-5 below.

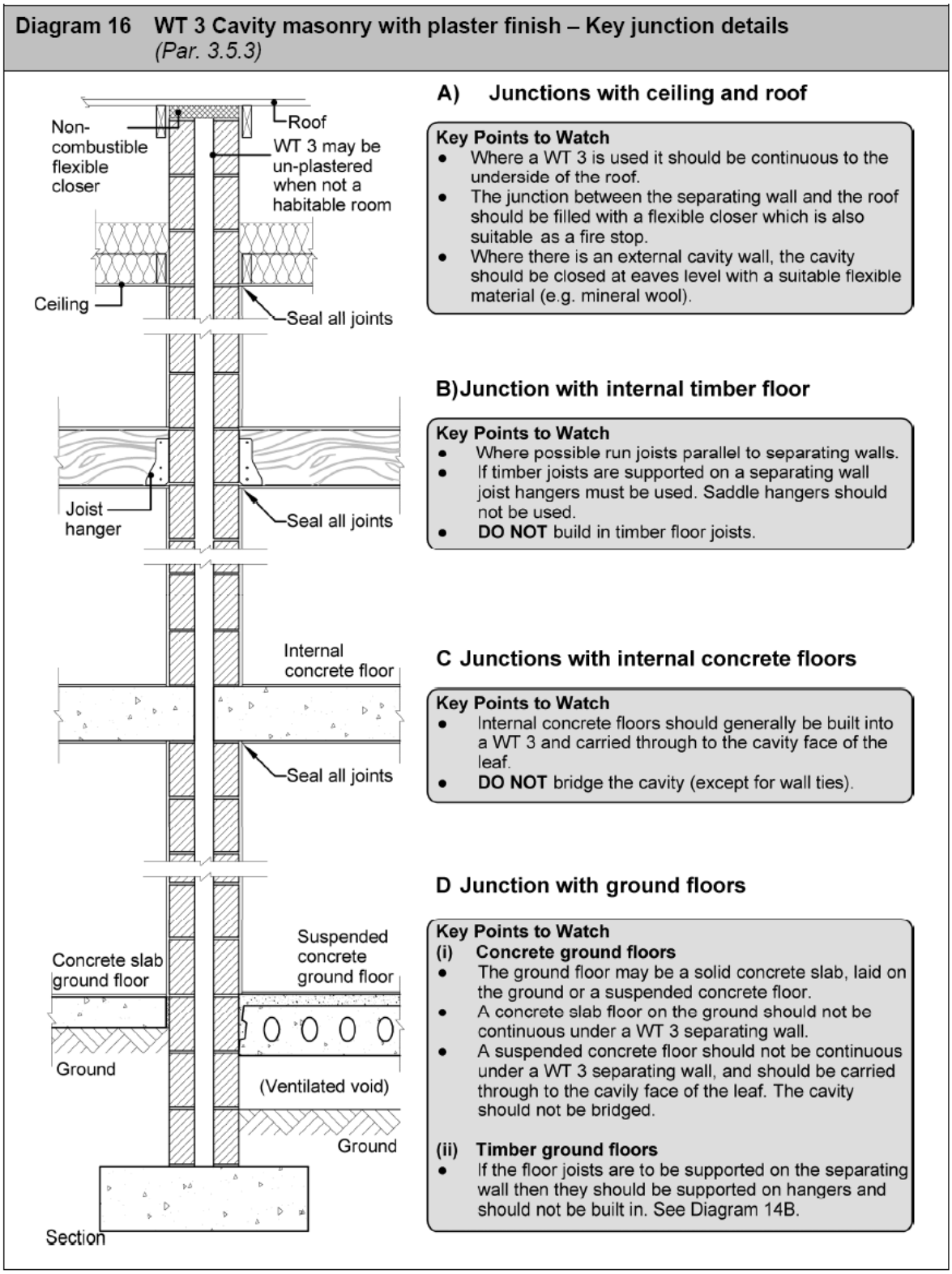


Figure 3-5 – Diagram 16 from TGD, Part-E showing the key junction details when the separating wall is a cavity masonry wall.

3.6 Proposed Separating Floor Buildup

We understand that the floor buildup will consist of a 75mm liquid screed ontop of a 10mm resilient layer, with a 75mm structural screed ontop of a 100mm precast slab. Beneath the slab is a 240mm service zone with a 15mm Gypsum-board on a mf system.

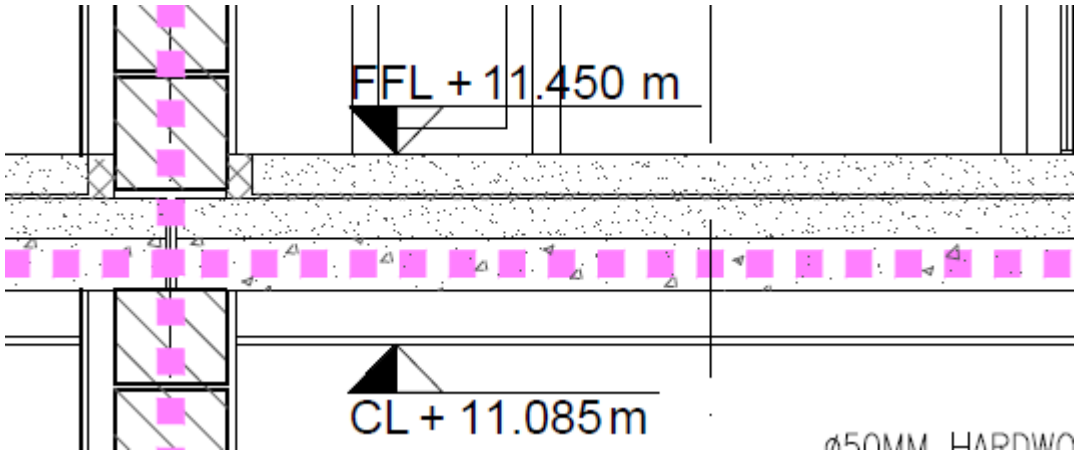


Figure 3-6 – Outline sketch of the floor buildup

The proposed separating floor buildup does not conform to any of the *Approved Floor Types* from TGD, Part-E. Therefore, we have undertaken desktop modelling to estimate the airborne and impact sound insulation performance of the proposed buildup. For modelling purposes, we used data for a *15mm Gyproc Soundbloc board.* We have also included a 25mm fibreglass/mineral wool quilt in the services void.

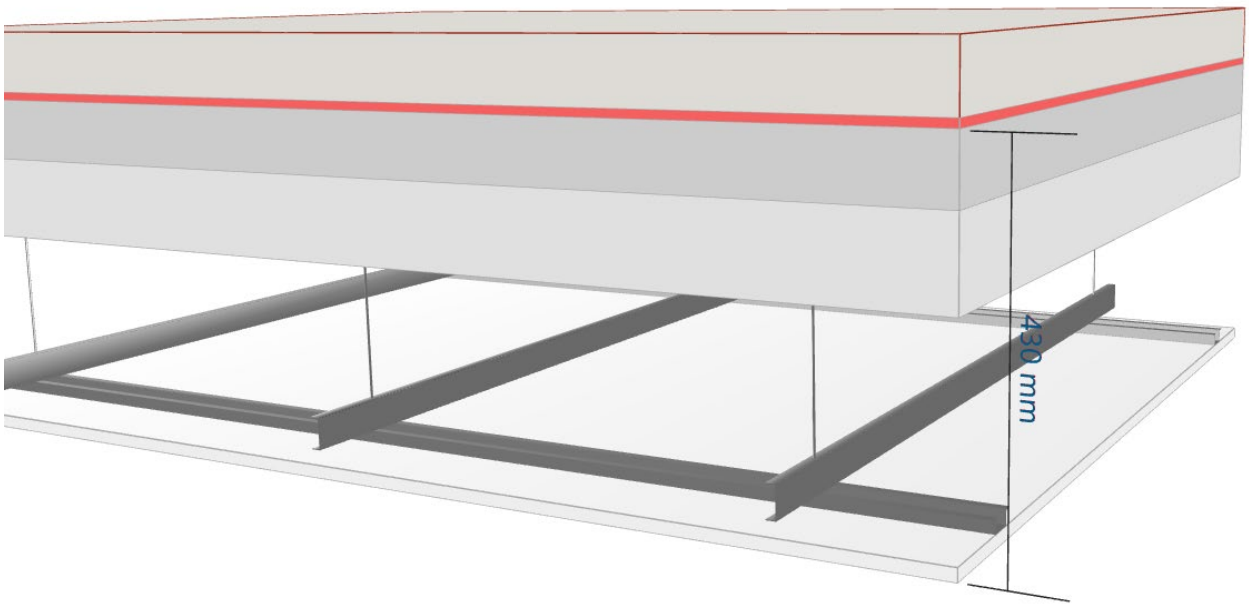


Figure 3-7 – Floor buildup constructed in acoustic modelling software (for illustratiove purposes only).

The predicted airborne sound insulation performance for this buildup is R_w 69dB. It is typical to apply the following correction to estimate the likley on-site performance:

$$D_{nT,w}\text{(on-site performance)} = R_w\text{(predicted performance)} - 7dB$$

Using this approximation, an onsite airborne sound insulation performance of $D_{nT,w}$ 56dB can be expected, which complies with the minimum Part-E performance standards of ≥ $D_{nT,w}$ 53dB.

The predicted impact sound insulation performance for the buildup is $L_{n,w}$ 47dB. There is no widely accepted apprioximation to estimate the likley on-site performance (in terms of $L_{nT,w}$ dB), however, we consider that compliance to the minimum performance standards of ≤ $L_{nT,w}$ 58dB is readily achievable given the includion of the 'acoustic' 10mm resilient layer.

In summary, compliance with the minimum airborne and impact performance standards of Rguklation E-1 have been deomstrated for the proposed floor buildup. Appendix A presents detailed calculation sheets for further information. We recommend the use of a 15mm Gyproc Soundbloc board and a 25mm fibreglass/mineral wool quilt in the services void.

3.7 Separating Floor – Flanking Requirements at the External Wall

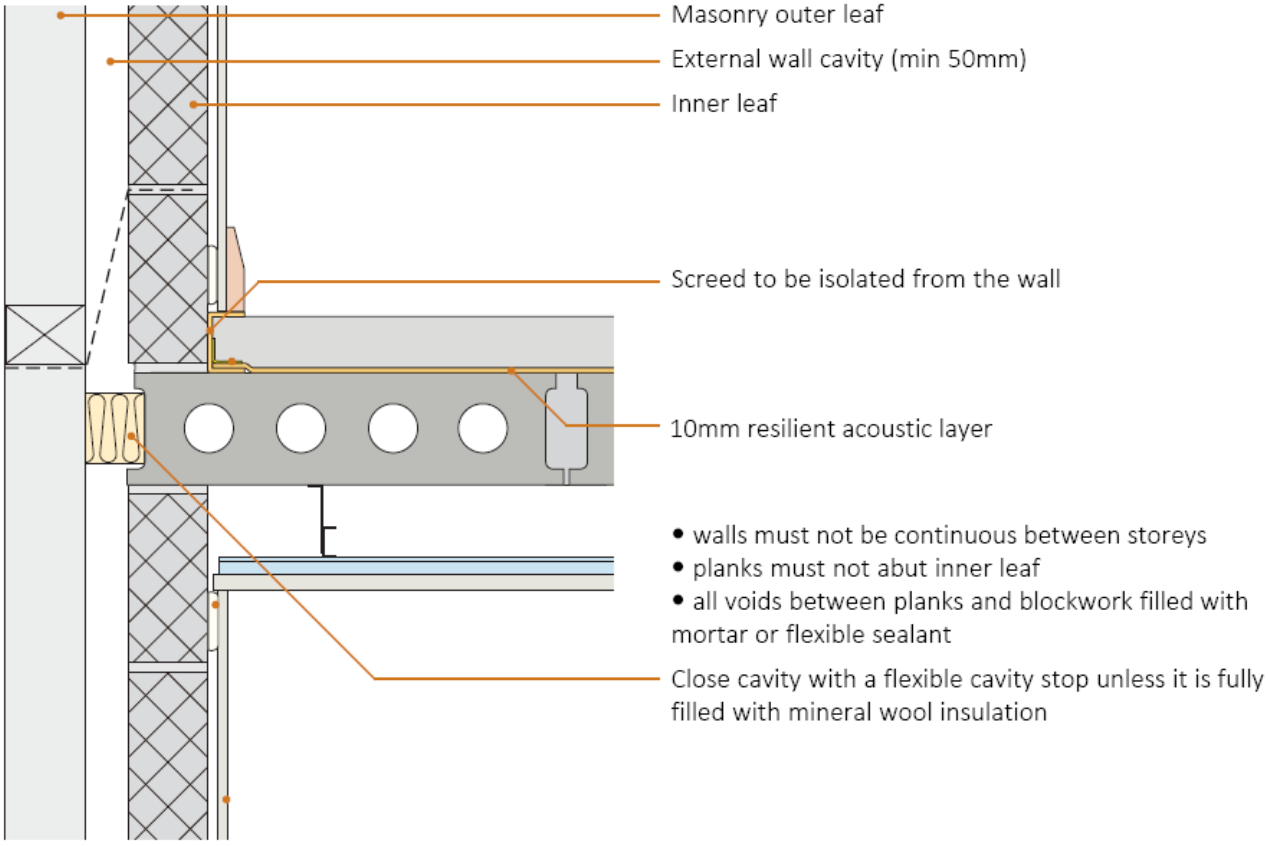


Figure 3-8 – Separating wall junction with the external wall

Note: Please refer to the Architects' details for clarity. These figures are for illustrative purposes only. Cavity stops are spacified for the purposes of minimising flanking sound along the external wall cavity. A cavity stop may also be required for the purposes of compliance with Part B – Fire Safety, see TGD Part-B.

3.8 Separating Floor – Key Junction Detailing

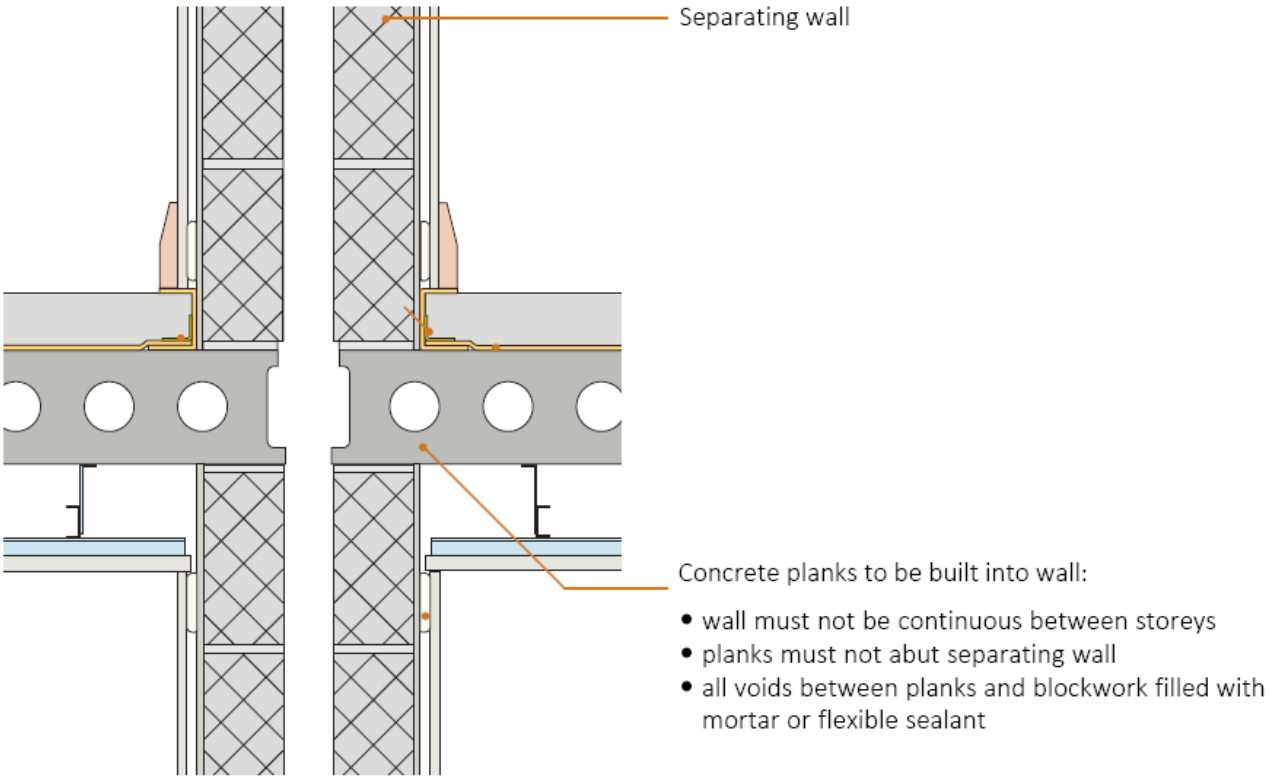
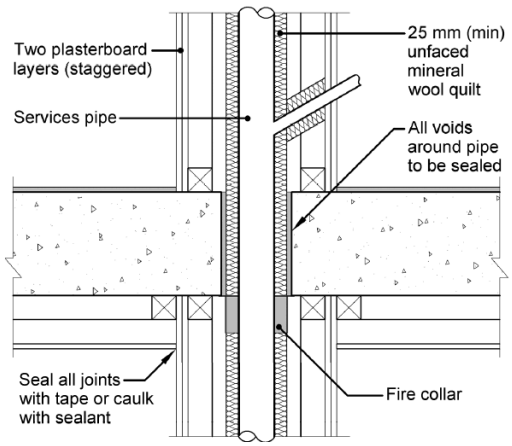


Figure 3-9 – Key Junction detailing at the separating wall

The ends of the cores should be sealed with mortar at the separating junction.

3.9 Service Pipes Through Separating Floors

Penetrations through a separating floor should be suitably treated to minimise the indirect transmission of sound between apartments. We recommend the detail shown in TGD Part-E as follows:



- Fully wrap the service pipe over its full height with at least 25mm of mineral wool lagging;

- Seal any voids between the pipe (including its wrap) and the separating floor using a firestop compound or an acoustic intumescent sealant. Alternatively, densiely packed minerall wool will suffice.
- Services must be boxed in with a double layer of plasterboard (min 12.5mm boards).
- 'Acoustic-rated' access hatched must be provided, giving a weighted sound reduction index of Rw 30dB (min) when tested to BS EN ISO 140-3.
- Firestopping must be flexible to prevent rigid contact between the pipe and the floor.

Note: Please also refer to the Regulations of Part-B – Fire Safety

Appendix A – Sound Insulation Calculation Sheets

Sound Insulation Prediction (v9.0.17)

Program copyright Marshall Day Acoustics 2017
margin of error is generally within Rw +/- 3 dB
iAcoustics - Key No. 1221
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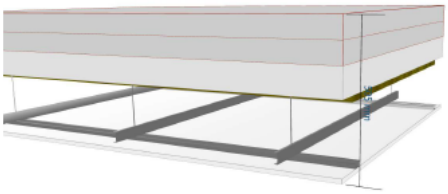
Job No.: Initials:glen.plunkett
Date:30/08/2021
File Name:

Notes:



Rw 69 dB
C -1 dB
Ctr -2 dB

Mass-air-mass resonant frequency = =30 Hz

Panel Size = 2.7 m x 4.0 m

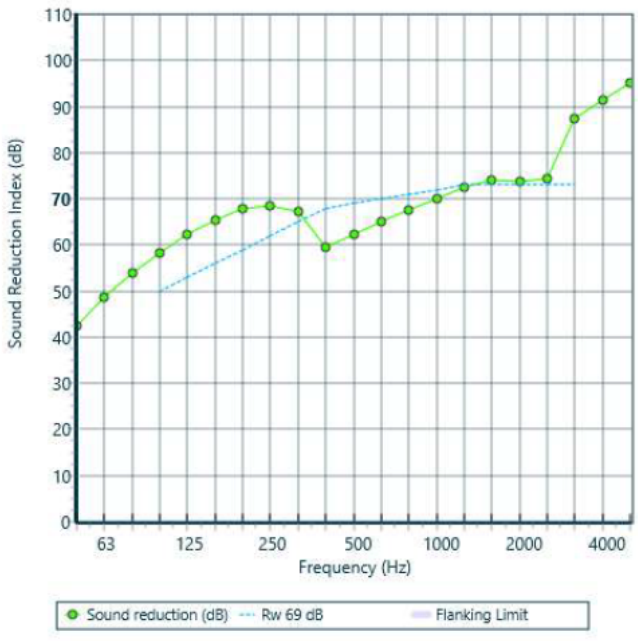
Partition surface mass = 371 kg/m²

System description

Panel 1 : 2 x 75 mm Lightweight concrete (ρ:1300 kg/m3,E:3.7GPa,η:0.02, ρs:97.5 kg/m², fc:513 Hz) + 1 x 100 mm Bison Hollowcore Floor

Frame: Suspended Light Steel Grid (4.3E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 240 mm , 1 x Fibreglass (10kg/m3) Thickness 25 mm
Panel 2 : 1 x 15 mm Gyproc SoundBloc 15mm (ρ:840 kg/m3,E:3.1GPa,η:0.01, ρs:12.6 kg/m², fc:2246 Hz)

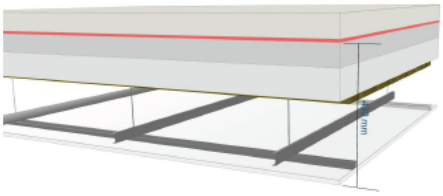
freq.(Hz)	R(dB)	R(dB)
50	43	
63	49	46
80	54	
100	58	
125	62	61
160	65	
200	68	
250	68	68
315	67	
400	59	
500	62	62
630	65	
800	68	
1000	70	70
1250	72	
1600	74	
2000	74	74
2500	74	
3150	87	
4000	91	90
5000	95	



Sound Insulation Prediction (v9.0.17)

Program copyright Marshall Day Acoustics 2017
margin of error is generally within Ln,w +/- 3 dB
iAcoustics - Key No. 1221
Job Name:
Job No.: Initials:glen.plunkett
Date:30/08/2021
File Name:

Notes:



Ln,w 47 dB

Mass-air-mass resonant frequency = =35 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 273 kg/m²

System description

Panel 1 : 1 x 75 mm Lightweight concrete (ρ:1300 kg/m3,E:3.7GPa,η:0.02, ρs:97.5 kg/m², fc:513 Hz) + 1 x 100 mm Bison Hollowcore Floor

Frame: Suspended Light Steel Grid (4.3E2 mm x 45 mm), Stud spacing 600 mm ; Cavity Width 240 mm , 1 x Fibreglass (10kg/m3) Thickness 25 mm
Panel 2 : 1 x 15 mm Gyproc SoundBloc 15mm (ρ:840 kg/m3,E:3.1GPa,η:0.01, ρs:12.6 kg/m², fc:2246 Hz)

Floor Cover: Embelton Impactamat (10mm) loose laid under Screed (75mm) Thickness 75 mm

freq.(Hz)	Ln(dB)	Ln(dB)
50	55	
63	47	56
80	45	
100	43	
125	43	48
160	43	
200	46	
250	48	52
315	49	
400	50	
500	49	54
630	47	
800	45	
1000	42	47
1250	39	
1600	38	
2000	36	43
2500	40	
3150	43	
4000	42	46
5000	39