

Internal Sound Insulation Design

Liverpool Road, Huyton

REPORT REFERENCE NO. J003932-5725-DH-01

AUGUST 2022

Tel: 01925 759380

Email: enquiries@pdaltd.com

Web: www.pdaltd.com



Document Control Sheet

Details of Assessment	
Client	ForHousing
Document Title	Internal Sound Insulation Design – Liverpool Road, Huyton
Report Reference	J003932-5725-DH-01

Client Address:	Company Address:
ForHousing 52 Regent Street Eccles Manchester M30 0BP	Philip Dunbavin Acoustics 3 Bridgewater Court Barsbank Ln Cheshire Lymm WA13 0ER

Issue	Date	Author	Remark	Status
01	15/08/2022	David Hible	Initial	Issued
02				

	Name	Position
Prepared By	David Hible BA(Hons) AMIOA	Graduate Consultant
Checked By	Richard Cookson BSc(Hons) PhD MIOA	Principal Consultant

This document has been prepared for the client only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law.

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	DESIGN STANDARDS	5
2.1	Building Regulations Approved Document E – Resistance to the Passage of Sound	5
2.2	Approved Document E Design Criteria.....	5
3.0	DESIGN SPECIFICATION	7
3.1	Walls	7
3.1.1	Separating Walls – Detail 3	7
3.1.2	Separating Walls – Detail 4	7
3.1.3	Party Walls – Detail 5	7
3.2	Floors	8
3.2.1	Separating Party Floors – First Floor Bedsit to Ground Floor Retail Units – Detail 6	8
3.2.2	Separating Party Floors – Second Floor Bedsit to Bedsit – Detail 7	9
3.3	Corridor Walls	11
3.4	Corridor Doors	11
3.5	Internal Walls and Floors	12
3.5.1	New Stud Partition – Detail 1.....	12
3.5.2	New Stud Partition (30 mins) – Detail 2.....	12
3.5.3	Internal Walls – Flanking Upgrade	12
3.6	Internal Doors	13
3.7	Roof Construction – Ceiling Upgrade – Detail 8.....	13
3.8	Enclosure of Services and Detailing at Penetrations	13
3.9	General Recommendations	14
3.10	External Walls	14
4.0	ACOUSTIC DETAILING.....	15
5.0	REVERBERATION IN COMMON INTERNAL PARTS OF BUILDINGS	17
5.1	Sound Absorption in Corridors and Stairwells.....	17

APPENDIX A – INTERNAL WALL UPGRADE PLAN MARK-UP

APPENDIX B – NOTES FOR QUALITY CONTROL

APPENDIX C – DEFINITION OF ACOUSTIC TERMS



1.0 SUMMARY

At the request of Whiteley Eaves Ltd, an acoustic appraisal report has been produced based on meeting the requirements of Building Regulations Approved Document E 'Resistance to the Passage of Sound' for the proposed conversion at 90, 92 and 96 Liverpool Road, Huyton.

The project consists of the refurbishment of 3 no. terraced properties with conversion from office spaces into 7 no. bedsits across the first and second floors. To the ground floor are commercial units which are proposed to remain unchanged.

The report covers the following areas: Internal sound insulation of walls and floors and achieving adequate levels of separation between spaces, controlling reverberation in the common internal parts of the building through proposed absorption within the spaces.

2.0 DESIGN STANDARDS

2.1 Building Regulations Approved Document E – Resistance to the Passage of Sound

Approved Document E (2003 edition, amended 2004, 2010, 2013 and 2015) of the current Building Regulations (2010), states the following requirements for residential buildings.

Protection against sound from other parts of the building and adjoining buildings

E1. Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.

Protection against sound within a dwelling-house etc.

E2. Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that:

- (a) Internal walls between a bedroom or a room containing a water closet, and other rooms; and*
- (b) Internal floors provide reasonable resistance to sound.*

Requirement E2 does not apply to:

- (a) an internal wall which contains a door;*
- (b) an internal wall which separates an en-suite toilet from the associated bedroom;*
- (c) existing wall and floors in a building which is subject to a material change of use.*

Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes

E3. The common internal parts of building which contain flats or rooms for residential purposes shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which give access to the flat or room for residential purposes.

2.2 Approved Document E Design Criteria

In order to fulfil the requirements above, Building Regulations Approved Document E offers the following design criteria that should be met for the dwellings. The residential accommodation is deemed to fall into the category of dwelling-houses and flats formed by material change of use.

The airborne sound insulation for walls and floors should be achieved as a minimum between a residential apartment and another part of the same building, or to an adjacent building. The maximum impact sound insulation allowance for floors should be achieved where the lower room is an apartment.

Table 1: Building Regulation ADE requirements – E1

<i>Dwelling-houses and flats formed by material change of use</i>	<i>Airborne Sound Insulation $D_{nT,w} + C_{tr}$ dB (minimum values)</i>	<i>Impact Sound Insulation $L'_{nT,w}$ dB (maximum values)</i>
Walls	≥ 43	–
Floors	≥ 43	≤ 64

It should be noted that the values given in the table above are on-site values to be confirmed by testing upon project completion.

Table 2: Building Regulation ADE requirements – E2

<i>Laboratory values for new internal walls and floors within dwelling-houses, flats and rooms for residential purposes, whether purpose built or formed by material change of use</i>	<i>Airborne Sound Insulation R_w dB (minimum values)</i>
Walls	≥ 40
Floors	≥ 40

It should be noted that the values given in the table above are laboratory tested values; laboratory test data will usually be provided by the manufacturer.

Approved Document E states that reverberation time in common internal parts of buildings containing flats or rooms for residential purposes can be controlled to a reasonable level to fulfil the requirements of E3 by either:

Method A: Cover a specified area with an absorber of an appropriate class that has been rated according to BS EN ISO 11654:1997 *Acoustics. Sound absorbers for use in buildings. Rating of sound absorption*.

Method B: Determine the minimum amount of absorptive material using a calculation procedure in octave bands. Method B is intended only for corridors, hallways and entrance halls as it is not well suited to stairwells.

3.0 DESIGN SPECIFICATION

3.1 Walls

3.1.1 Separating Walls – Detail 3

To meet Building Regulations Approved Document E requirements, all separating walls will need to achieve a minimum airborne sound insulation value of 43 dB $D_{nT,w} + C_{tr}$.

It is understood that the new separating wall construction will conform to Detail 3 as described by Whiteley Eaves ref. '328_004_Liverpool Road – A1 – Proposed Ground and First Floor Plans and Elevations BR'. The detail of which is as follows:

- 2 no. layers of 15mm acoustic plasterboard on one side of 75mm timber stud frame, 60mm ISOVER APR1200 insulation, MuteClip channel and clip system with a 40mm gap and 2 no. layers of 15mm acoustic plasterboard.

The construction has been modelled within Insul, sound insulation prediction software, which states a predicted performance of 54 dB $R_w + C_{tr}$. In general as a rule of thumb and assuming that good build quality and flanking sound transfer paths are well controlled, we would recommend an allowance of 7dB between lab data and onsite data. This would therefore result in an estimated onsite performance of 47 dB $D_{nT,w} + C_{tr}$. This construction therefore has the capacity to comply with the requirements of Approved Document E.

It should be noted that the '15mm acoustic plasterboard' has been modelled with the performance data of the Gyproc SoundBloc 15mm plasterboard by British Gypsum which we would therefore recommend to be used for this construction build up.

3.1.2 Separating Walls – Detail 4

It is understood that the separating wall upgrade construction will conform to Detail 4 as described by Whiteley Eaves ref. '328_005_Liverpool Road – A1 – Proposed Second Floor Plan and Section BR'. The detail of which is as follows:

- 102.5mm existing single leaf masonry, 1 no. 15mm acoustic plasterboard one side, MuteClip channel and clip system with a 40mm gap and 2 no. 15mm acoustic plasterboard on opposite side of masonry leaf.

The construction has been modelled within Insul, sound insulation prediction software, which states a predicted performance of 52 dB $R_w + C_{tr}$. Assuming that good build quality and flanking sound transfer paths are well controlled, we would recommend an allowance of 7dB between lab data and onsite data. This would therefore result in an estimated onsite performance of 45dB $D_{nT,w} + C_{tr}$. This construction therefore has the capacity to comply with the requirements of Approved Document E.

It should be noted that the '15mm acoustic plasterboard' has been modelled with the performance data of the Gyproc SoundBloc 15mm plasterboard by British Gypsum which we would therefore recommend to be used for this construction build up.

3.1.3 Party Walls – Detail 5

To meet Building Regulations Approved Document E requirements, all party walls will need to achieve a minimum airborne sound insulation value of 43 dB $D_{nT,w} + C_{tr}$.

It is understood that the separating party wall upgrade construction will conform to Detail 5 as described by Whiteley Eaves ref. '328_005_Liverpool Road – A1 – Proposed Second Floor Plan and Section BR'. The detail of which is as follows:

- 102.5mm existing single leaf masonry, 1 no. TecSound SY70 acoustic membrane and 1 no. MuteBoard3.

In the absence of specific sound reduction test data for the TecSound SY70 acoustic membrane and MuteBoard3, we would consider the accuracy of the calculations to be limited and therefore recommend that all Detail 5 Party Walls are constructed to the same system as given within Detail 4 in Section 3.1.2.

Points to note

It should be borne in mind that sound insulation in terms of $\text{dB } D_{nT,w} + C_{tr}$ (as required by the Building Regulations ADE) is an on-site tested parameter that depends upon the separating wall performance, flanking sound transmission and room characteristics. The $\text{dB } R_w + C_{tr}$ parameter represents a laboratory tested value of sound insulation, for the separating element alone. Therefore on-site a partition or floor rated at a certain $\text{dB } R_w + C_{tr}$ is unlikely to achieve the same value when tested and assessed in terms of $\text{dB } D_{nT,w} + C_{tr}$; in most cases the on-site tested value will be less than the laboratory $R_w + C_{tr}$ value. This has been taken into account in our assessment.

The double lining boards should be staggered to ensure an overlap of joints. The perimeter joints of all plasterboard linings should be sealed airtight with a continuous ribbon of flexible acoustic sealant. The wall construction should be installed in accordance with manufacturer's instructions.

The mineral wool insulation should be selected to have a minimum density of 10kg/m^3 ; British Gypsum APR1200 is an example of a suitable product.

3.2 Floors

3.2.1 Separating Party Floors – First Floor Bedsit to Ground Floor Retail Units – Detail 6

To meet Building Regulations Approved Document E requirements, all separating party floors will need to achieve a minimum airborne sound insulation value of $43 \text{ dB } D_{nT,w} + C_{tr}$ and a maximum impact sound insulation of $64 \text{ dB } L'_{nT,w}$.

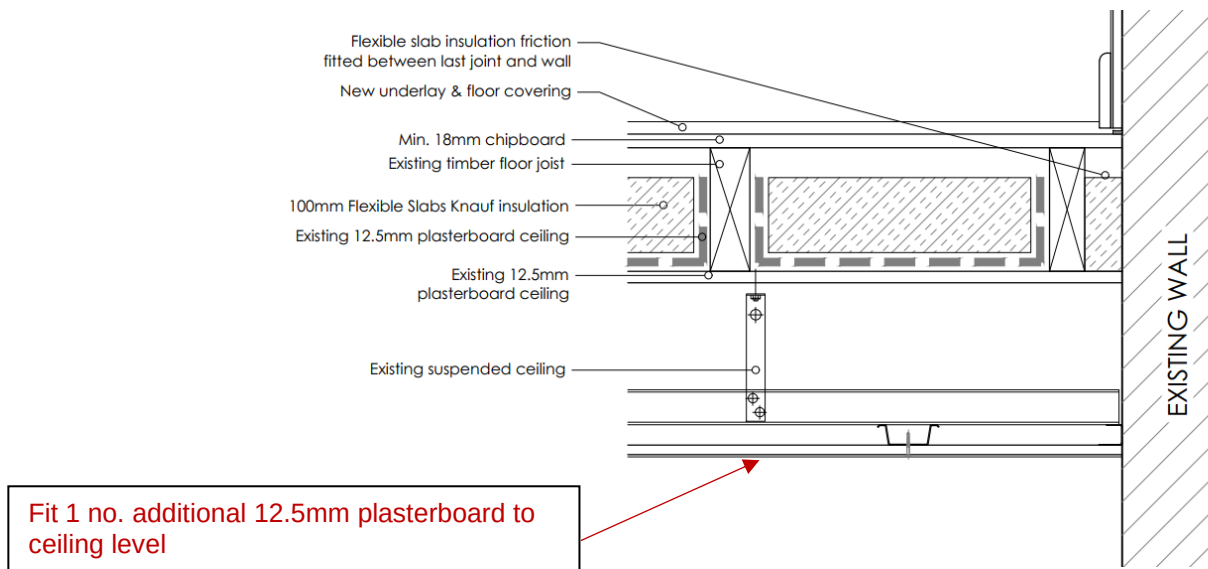
Buildings Regulations ADE requires that where a residential Bedsit is located above another part of the same building, the floor construction should meet the airborne sound insulation requirements. There is no impact sound insulation requirement to other parts of the same building, only where the lower room is residential.

It is understood that the separating party floor upgrade construction will conform to Detail 6 as described by Whiteley Eaves ref. '328_005_Liverpool Road – A1 – Proposed Second Floor Plan and Section BR'. The detail of which is as follows:

- Underlay and floor covering on a minimum 18mm chipboard, 170mm timber joists with 100mm flexible slabs Knauf insulation, 12.5mm plasterboard, suspended ceiling with 710mm cavity, 12.5mm plasterboard on a bar.

When modelled within Insul, this construction would provide a sound reduction performance of $50 \text{ dB } R_w + C_{tr}$. In order to predict the $D_{nT,w} + C_{tr}$ performance, Bastian building acoustics software has been utilised to assess the airborne sound transmission, including flanking, which results in $46 \text{ dB } D_{nT,w} + C_{tr}$ for the specific partition. We would therefore consider the floor construction to be adequate in achieving the required building regulations. However, due to being within 3 dB of the minimum criteria we would suggest that an early on-site test is carried out with the floor upgrades in place to verify the performance before completion. If the on-site measurement results are unsatisfactory then the following upgrade could be carried out.

Figure 1 – First Floor Party Floor Upgrade – Detail 6



With the additional upgrade highlighted in Figure 1, the first floor party floor construction is predicted to achieve 56 dB $R_w + C_{tr}$ and 48 dB $D_{nT,w} + C_{tr}$ which would therefore be likely to satisfy the requirement set out within ADE. Please see Section 3.6 in regards to additional treatments to internal walls which are considered flanking elements within this calculation.

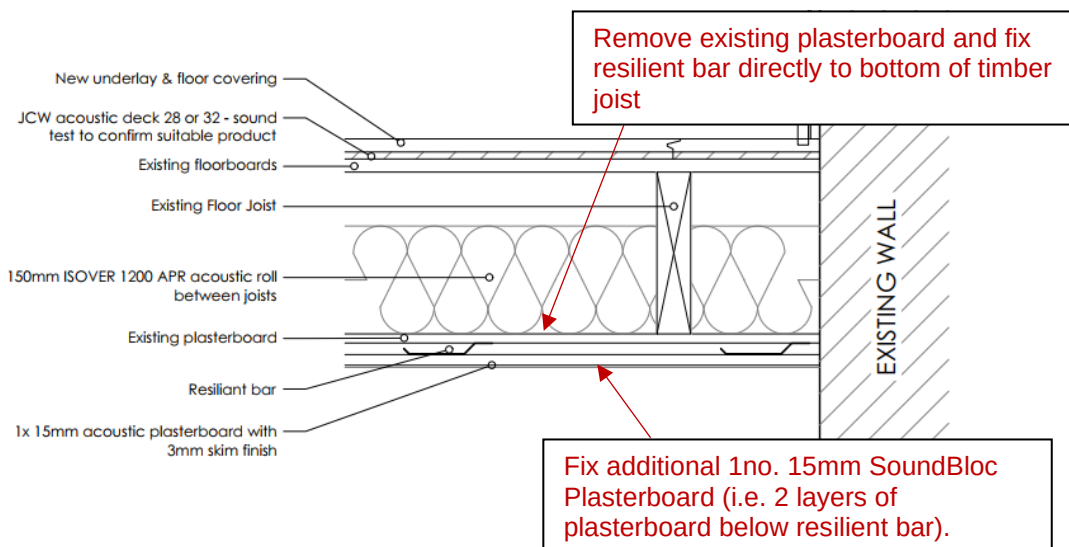
3.2.2 Separating Party Floors – Second Floor Bedsit to Bedsit – Detail 7

It is understood that the separating party floor upgrade construction will conform to Detail 6 as described by Whiteley Eaves ref. '328_005_Liverpool Road – A1 – Proposed Second Floor Plan and Section BR'. The detail of which is as follows:

- Underlay and floor covering on JCW acoustic deck 28 or 32, existing floorboard, 200mm timber joist with 150mm ISOVER 1200 APR insulation between joists, existing plasterboard, resilient bar with 1 no. 15mm acoustic plasterboard.

When calculated in Insul this construction is predicted to achieve 46 dB $R_w + C_{tr}$ and calculated at 45 dB $D_{nT,w} + C_{tr}$ in Bastian, however when considering all flanking elements the overall predicted performance is 39 dB $D_{nT,w} + C_{tr}$. We would therefore suggest the following alterations highlighted in red in order to improve the party floor sound insulation performance.

Figure 2 – Second Floor Party Floor Upgrade – Detail 7



Following the alterations to the construction detailed in Figure 2, the sound insulation performance of the party floor is calculated within Insul and Bastian to achieve 53 dB $R_w + C_{tr}$ and 52 dB $D_{nT,w} + C_{tr}$. When modelled with all flanking elements the, performance is predicted to be 48 dB $D_{nT,w} + C_{tr}$. Please see Section 3.6 in regards to additional treatments to internal walls which are considered flanking elements within this calculation.

Given the alterations stated within Figure 2, we would expect the construction to be capable of achieving the impact sound insulation requirements. PDA have previously tested similar floor build ups which has provided data that suggests the conversion criteria can be achieved.

It is considered that the construction has the capability to achieve the Building Regulations ADE requirements. This is subject to appropriate acoustic junction detailing and good standards of workmanship. It should be noted that as impact sound insulation tests represent transmitted sound, a lower value represents a better result.

Detail 7 – Alternative Construction

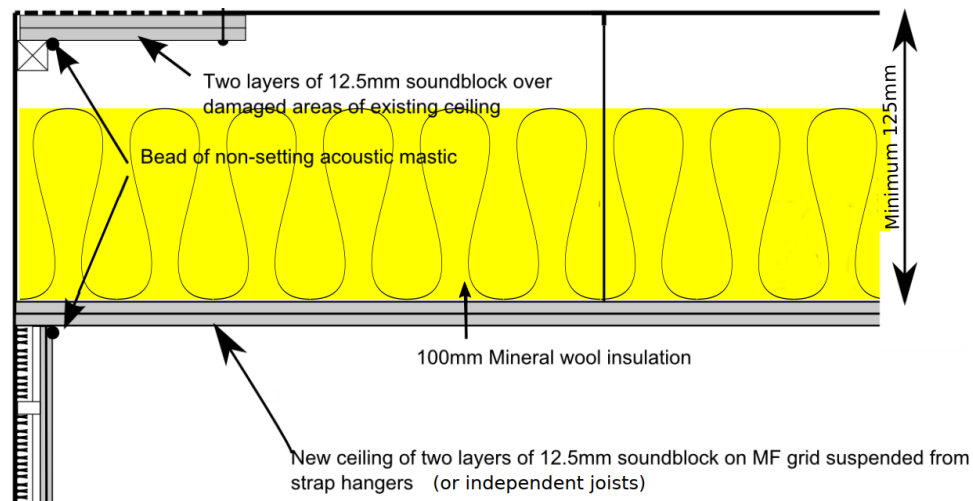
As an alternative upgrade to the floor construction suggested in Detail 7, we would suggest the following remedial floor treatment which is based upon 'Floor Treatment 1' as given in paragraph 4.27 of Approved Document E.

Install a British Gypsum 'Casoline MF' suspended ceiling below the existing ceiling as follows;

- Upgrade existing ceiling to 20kg/m²
- Ceiling to be constructed so that the distance from the existing ceiling to the new linings is a minimum of 150mm.
- Ceiling to be suspended from 'Strap Hangers or angle' at 1200mm centres fixed through the existing ceiling to the joists using 'soffit cleats'.
- MF intermediate channels and MF ceiling sections fixed below to manufacturers instructions with MF ceiling sections at 450mm centres and fixed in MF perimeter channels at the walls.
- 100mm glass fibre mat (minimum density 10kg/m³) laid on top of the metal grid.
- Two layers of 12.5mm SoundBloc gypsum board fitted below the grid (with joints staggered between layers). All joints filled with joint filler or acoustic mastic and taped. Perimeter of the ceiling sealed to walls with fire / acoustic sealant.

The above ceiling is as per British Gypsum system reference C106006. See figure below:

Figure 3 - Proposed Alternative Additional Ceiling (either on MF grid or independent joists)



Please note that as a result of the alternative system, no upgrade treatments would be required to the floor as suggested within Detail 7 however, as this system is creating an additional ceiling, the proposed room height will be reduced by approximately 150mm.

Points to note

See Section 4 for illustrating acoustic principle details.

The Building Regulations ADE impact sound insulation requirements are to be achieved where the receiving room (below) is a bedsit. The JCW acoustic deck layer should be installed in all rooms directly above a bedsit, as per manufacturer's recommendations. If using the suggested alternative construction to Detail 7, the JCW acoustic deck is not required.

Bathroom Units

The impact sound insulation requirements for bathrooms should be checked with Building Control. If the bathrooms are required to meet the impact requirements of Building Regulations ADE, the floor will require a resilient layer within the build-up, e.g. foam backed vinyl or a proprietary resilient layer located under the floor finish.

3.3 Corridor Walls

With regards to corridor walls, Building Regulations ADE requires that the sound insulation requirements are met between any flat and other parts of the same building. ADE states, '*separating walls ... should be used between dwelling-houses, or flats formed by material change of use, and corridors in order to control flanking transmission and to provide the required sound insulation. However, it is likely that the sound insulation will be reduced by the presence of a door.*'

It is understood from the drawings provided that all corridor walls are to be treated to Detail 3 or Detail 4. It is considered that these constructions have the capability to meet the requirements of the Building Regulations ADE. This is subject to appropriate acoustic junction detailing and good standards of workmanship. For guidance on junction detailing, see Section 4.

3.4 Corridor Doors

Building Regulations ADE requires that corridor doors are selected to have a minimum mass per unit area of 25kg/m², with full perimeter sealing (including the threshold where practical). Alternatively the doorset may be selected to achieve a minimum sound reduction index of 29 dB R_w measured in accordance with BS EN ISO 140-3:1995 and rated in accordance with BS EN ISO 717-1:1997 (amended

2006). To achieve this it is recommended that good quality solid-core doorsets be used with good perimeter sealing.

3.5 Internal Walls and Floors

Building Regulations ADE requires that internal walls within dwellings between a bedroom or a room containing a water closet, and other rooms, should be selected to have a minimum laboratory sound insulation of 40 dB R_w . This requirement does not apply where the partition includes a door, or for a wall separating a bedroom from its associated en-suite.

3.5.1 New Stud Partition – Detail 1

It is understood that the new stud partition wall construction will conform to Detail 1 as described by Whiteley Eaves ref. '328_004_Liverpool Road – A1 – Proposed Ground and First Floor Plans and Elevations BR'. The detail of which is as follows:

- 12.5mm Gyproc WallBoard either side of a 75mm timber stud with 25mm ISOVER APR 1200 insulation.

The construction has been modelled within Insul, sound insulation prediction software, which states a predicted performance of 38 dB R_w . As the proposed use of this partition is internal and encompasses en-suite water closets, it is expected that this construction should comply with Building Regulations ADE.

3.5.2 New Stud Partition (30 mins) – Detail 2

It is understood that the new stud partition (30mins) wall construction will conform to Detail 2 as described by Whiteley Eaves ref. '328_004_Liverpool Road – A1 – Proposed Ground and First Floor Plans and Elevations BR'. The detail of which is as follows:

- 15mm Gyproc WallBoard either side of a 63mm timber stud with 50mm ISOVER APR 1200 insulation.

The construction has been modelled within Insul, sound insulation prediction software, which states a predicted performance of 40 dB R_w . It is expected that this construction should achieve the requirement of Building Regulations ADE.

Point to note

Internal walls built from off of the floor may stop at the underside of the ceiling to ensure that the full party floor construction is maintained between apartments. Internal walls should be installed after the full separating/corridor and external wall constructions are completed.

There are no internal floors within the development.

3.5.3 Internal Walls – Flanking Upgrade

As discussed within Section 3.2, there are walls which require upgrading in order to reduce flanking transmission. Due to the existing masonry walls being continuous throughout the structure and assumed to be 102.5mm single leaf brick, the flanking transmission will vastly effect the performance of the separating floors. It is recommended that these walls are upgraded to the MuteClip system as discussed in Section 3.1.2, which have been highlighted in green within Figures 9 and 10 which can be found in Appendix A. This would require the following internal lining on *both sides* of the masonry wall:

- MuteClip channel and clip system with a 40mm gap and 2 no. 15mm SoundBloc plasterboard.

If the internal masonry wall construction is of 225mm thickness, then it would be considered that the performance of the wall alone would be satisfactory and no internal lining would be required.

3.6 Internal Doors

It is recommended that good quality well fitted door sets be used with good perimeter sealing.

3.7 Roof Construction – Ceiling Upgrade – Detail 8

It is understood that the roof construction consists of slate tiles upon timber rafters. The ceiling below is proposed to be upgraded to Detail 8 as described by Whiteley Eaves ref. '328_005_Liverpool Road – A1 – Proposed Second Floor Plan and Section BR'. The detail of which is as follows:

- Replacement of existing loft insulation with 2 no. layers 150mm rockwool laid perpendicular, 150mm ISOVER APR 1200 between timber joists, 1 no. 12.5mm Gyproc WallBoard fixed to existing plasterboard.

The construction has been modelled within Insul, sound insulation prediction software, which states a predicted performance of 64 dB R_w . It is expected that this construction should achieve the requirement of Building Regulations ADE.

It is considered that the ceiling upgrade is sufficient to control flanking sound insulation for top floor rooms. However, care should be taken to make sure that any gaps in the continuous separating masonry wall are filled and junctions are closed with a flexible sealer as shown in the Figure below:

Roof Construction - Dormer

Where the roof construction protrudes into a dormer or the room becomes a room-in-roof construction, it should be ensured that these walls are internally lined to the same performance as the internal separating wall. A typical internal lining would be:

- 2 no. 15mm Gypsum Wallboard on the timber rafters, 150mm cavity with 100mm of ISOVER APR 1200 insulation.

It is predicted that this lining, including the roofing tiles, will achieve 44 dB $D_{nT,w} + C_{tr}$ and therefore be satisfactory at controlling flanking and also external ingress sound.

3.8 Enclosure of Services and Detailing at Penetrations

If any pipes internal to habitable rooms, e.g. soil pipes, water pipes, rainwater pipes etc. are to be run in risers or horizontal service ducts between apartments, then these need to be boxed out with material of at least 15kg/m², e.g. two layers of 12.5mm plasterboard. The boxed out enclosure is to be mechanically independent of the pipes. The pipes either need to be wrapped in 25mm unfaced mineral-fibre or the enclosure should be lined with 25mm unfaced mineral-fibre.

Penetrations across separating partitions, whether boxed out or not, should be slightly oversized around the penetrating member (e.g. pipe or other) utilizing approximately 5-10mm gap around the perimeter to suppress structure-borne noise transmission across the partition. The remaining gap should then be well-sealed on both sides of the partition with minimum 10mm depth acoustic non-setting mastic with the cavity loosely packed with mineral wool (minimum density 10kg/m³). Alternatively acoustically acceptable firestopping collars can be used as long as they do not rigidly connect the penetrating member to the partition structure.

All pipe enclosure detailing would need to be checked to ensure the integrity of party structures is maintained, and would need checking with Building Control, who may want to see risers treated as a separating wall.

If a centralised extract system is employed, ducts that serve adjacent apartments may require crosstalk attenuators to be installed on the line of the separating partition, or alternative acoustic treatments, e.g. internally lined ductwork, to ensure the sound insulation of the separating walls is maintained.

Electrical services and sockets

Wall sockets, or other fixing penetrations (e.g. aerals, light-switches etc), in plasterboard walls or linings should be staggered on either side of partitions to ensure they are not back to back (recommended stagger of at least 600mm). In addition the penetrations should be treated either with proprietary acoustic back boxes, e.g. Hilti CP617 Putty Pad, or sealed plasterboard backing to an equivalent specification to the wall lining.

Where sealed plasterboard backing to sockets is used it would be recommended that once the backing boards are screwed on, mineral wool be stuffed into the gaps all around the perimeter of the backing board leaving 10mm depth around the perimeter to be filled with non-setting mastic. It cannot be too strongly stated that total sealing of all gaps in the socket back-boards will be paramount to maintain performance on-site.

Steelwork

Where a separating partition incorporates structural steel, either columns, or beams at the head, the steel should be boxed out for its entire length with plasterboard; the build-up should be a minimum 2 no. layers of plasterboard (total minimum mass per unit area 20kg/m²) and the cavity packed with mineral wool. It should be ensured that the plasterboard is not in direct contact with the steel.

Should any steelwork pass through a separating party or corridor wall, this would also need to be boxed out with two layers of plasterboard and stuffed to full wall depth with dense mineral wool in the web of the steel. The enclosure would then need to be sealed with copious amounts of acoustic mastic. Where steelwork is above the plasterboard ceiling, the enclosure may be reduced to one layer. It should be ensured that the plasterboard is not in direct contact with the steel.

3.9 General Recommendations

Toilets, Bathrooms and Kitchens

Metal pipe-work or soil pipes etc. should not be rigidly fixed to any wall, floor or riser internal wall and resilient fixings should always be used. Where pliable plastic water-pipes etc. are used then normal fixings may be used.

Basins, toilets, baths or showers should not be rigidly fixed to masonry walls, and should be mounted either on separate stud walls off the masonry or mounted using resilient fixings. Pipes or ductwork in the risers or partitions should not be rigidly fixed to any wall that is common to a habitable room, or any concrete floor soffit.

Radiators

Where radiators are installed back to back on either side of separating partition, ideally separate flow and return lines should be used. If it is proposed to connect both radiators using a 'T' connection from a single pipe, pliable plastic water-pipes should be used to reduce sound transmission through the system. Any pipe penetrations through the separating walls should be sealed as per Section 4.9.

3.10 External Walls

It is PDA's understanding that the external wall construction is of a double leaf 102.5mm brick, 100mm cavity with 50mm of rockwool (10kg/m³) insulation. Within our calculations we would consider this as an issue for flanking sound transmission. Therefore we would recommend the same internal wall upgrade as that discussed within Section 3.5.3 with the MuteClip channel system and 2 no. layers of 15mm SoundBloc to the internal side of the wall.

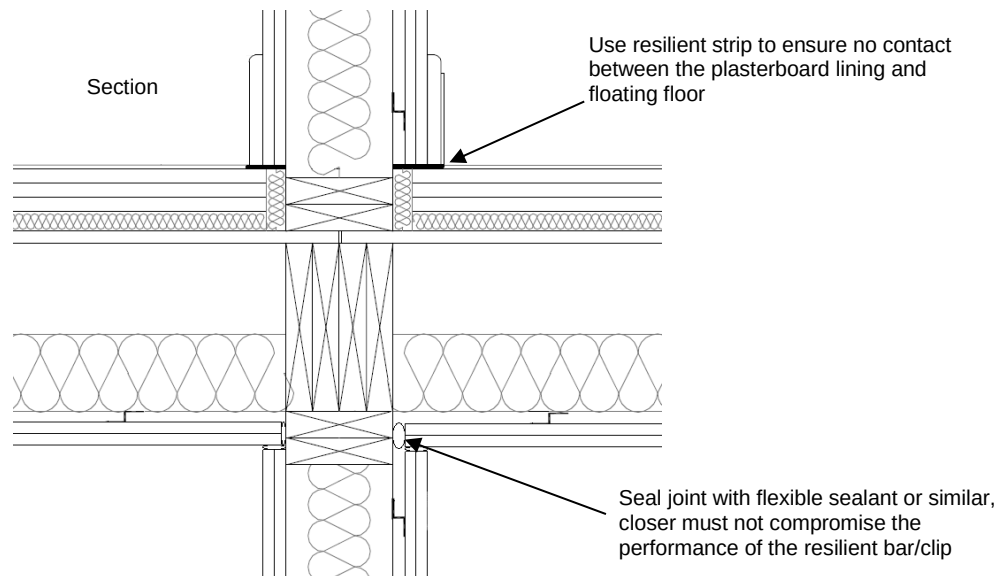
4.0 ACOUSTIC DETAILING

It must be ensured that all partitions are installed in accordance with manufacturer recommendations. Details are to illustrate acoustic principles only and should be checked with the manufacturer, and for suitability to meet other requirements, e.g. fire.

New Separating Walls

- The perimeter joints of all plasterboard linings/ceilings should be sealed airtight with a continuous ribbon of caulk or flexible acoustic sealant.

Figure 5 – Separating wall and floor junction (acoustic principles only)



Existing Building

- Separating party walls should be continuous all the way from the foundation to the underside of the soffit/roof.
- Where a brick wall is built from off of an existing floor all cavities in the timber underfloor/above ceiling will need to be closed with full depth timber blocking or similar along the line of the party wall. A break in any floorboards will be required so that they are not continuous between adjacent apartments.
- It is understood that the internal walls are to be lined with plasterboard on a metal MuteClip resilient mount system. It is recommended that the external wall elements are installed prior to the internal wall lining to ensure an overlap.

Figure 6 – Separating wall and external wall junction (acoustic principles only)

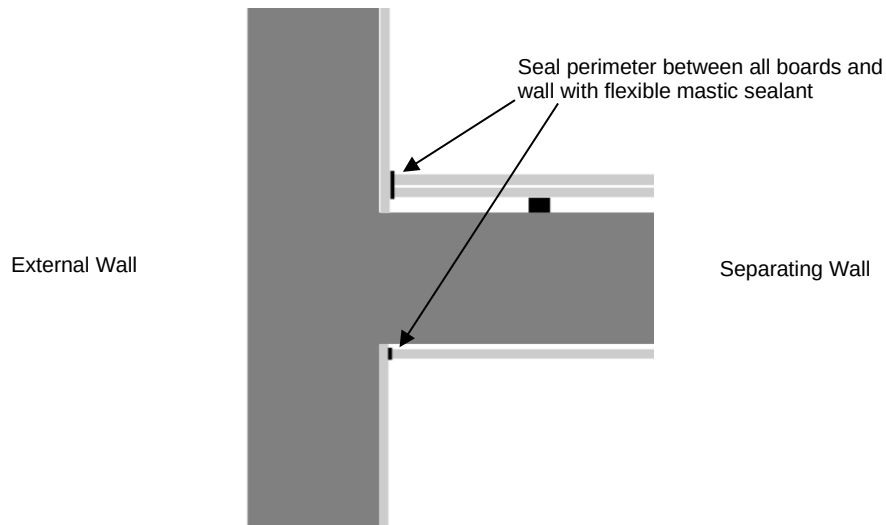


Figure 7 – Separating floor and external wall junction (acoustic principles only)

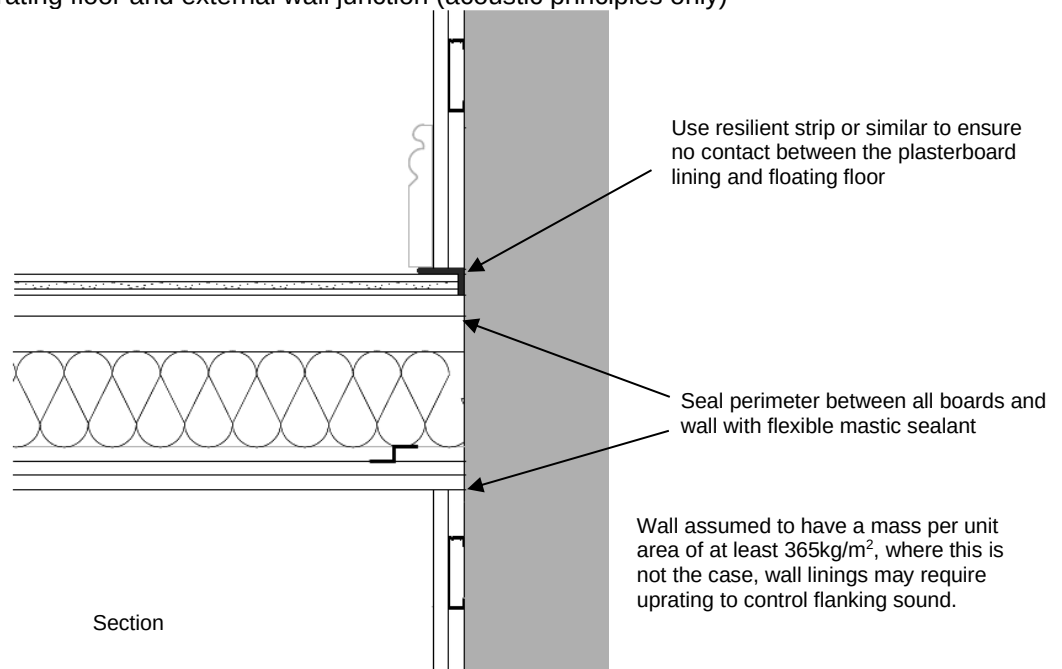
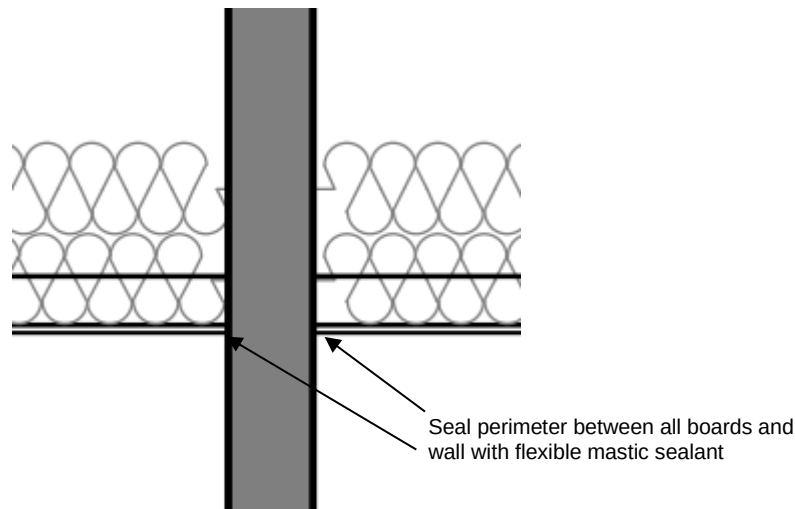


Figure 8 – Ceiling junction (acoustic principles only)



- Where a partition meets the underside of the soffit/roof, care must be taken to ensure a good junction to maintain acoustic performance. Gaps between the top course of blockwork walls and the soffit should be sealed with a flexible closer, e.g. dense mineral wool batt (Lamaphon or Rockwool), and well-sealed with mastic sealant.
- Ensure all joints in the blockwork are fully filled to the full depth of the wall with mortar.
- The perimeter joints of all plasterboard linings/ceilings should be sealed airtight with a continuous ribbon of caulk or flexible acoustic sealant.

General

Dry-Lining

We would recommend that when the plasterboard dry-lining to masonry separating, external and internal walls is undertaken that dabs should be no more than 450mm centres. This will reduce vibration of the board lining under sound excitation.

Window and Glazed Door Frame Detailing

All sills etc. to sliding door and window thresholds, heads and vertical edgings should be carefully sealed at all junctions with floors and walls with non-setting mastic and mineral wool if required to ensure that no gaps to the wall, floor cavity or exterior are present.

5.0 REVERBERATION IN COMMON INTERNAL PARTS OF BUILDINGS

5.1 Sound Absorption in Corridors and Stairwells

Building Regulations Approved Document E (ADE) requires that sufficient absorption be included within communal corridors in multi-residential development to reduce the reverberant noise in corridors and to reduce noise transfer around the building.

Requirement E3 states,

'The Common Internal parts of building which contain flats or rooms for residential purposes shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.'



Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which give access to the flat or room for residential purposes.'

The Frequently Asked Questions (FAQ) section of the Planning Portal website (<http://www.planningportal.gov.uk/buildingregulations/approveddocuments/parte/faqs>) offers the following clarification:

The purpose of this Requirement is to protect residents from noise produced in reverberant common areas. The Requirement only applies to "corridors, stairwells, hallways, and entrance halls which give access to the flat or room for residential purposes". To comply with this, it is recommended that absorbent treatment should normally be applied only to common areas onto which dwellings open directly. Where separating walls, without doors or windows, are adjacent to common areas it would not normally be necessary to treat the common areas, assuming normal usage.

The requirement may be satisfied according to one of two methods, these are:

- A) For entrance halls, corridors or hallways, cover an area equal to or greater than the floor area, with a Class C absorber or better.

For stairwells or a stair enclosure, calculate the combined area of the stair treads, the upper surface of the intermediate landings, the upper surface of the landings (excluding the ground floor) and the ceiling area on the top floor. Either cover at least an area equal to this with a Class D absorber, or cover an area equal to 50% of this area with a Class C absorber or better.

- B) In comparison to Method A, Method B takes account of the existing absorption provided by all surfaces. For entrance halls provide a minimum of 0.20 m² total absorption area per cubic metre of the volume. For corridors or hallways, provide a minimum of 0.25 m² total absorption area per cubic metre of the volume. Absorption areas should be calculated for each octave band between 250Hz and 4kHz inclusively.

Discussion

For corridors that lead directly into an apartment, the requirements may be achieved using Method A, by having an area of minimum Class C absorber which is equivalent to the floor area.

The above may be achieved using a Class C absorbent ceiling tile; suitable products are available from suppliers such as Rockfon, Soundsorba and Armstrong ceilings. Perforated plasterboard products meeting the Class C requirement are also available including the British Gypsum Gyptone and Rigitone ranges, Knauf Apertura and LaFarge GTEC Pregybel. Other manufacturers are available.

A calculation in accordance with Method B may allow the area of absorbent ceiling to be reduced as it takes into account other finishes, e.g. carpet. Hard wearing carpets are typically Class E absorbers, and therefore it is unlikely that the requirement can be achieved through use of carpet alone. The Building Control representative may agree to a relaxation of the requirement where only a small amount of additional absorber is required.

Absorption Class should be checked with the manufacturer and verified by laboratory reports where necessary. In addition, carpeting would be recommended in all cases to control reverberant impact noise in the stairwells and corridors.

APPENDIX A – INTERNAL WALL UPGRADE PLAN MARK-UP

Figure 9 – Internal Wall Upgrade Mark-up – First Floor

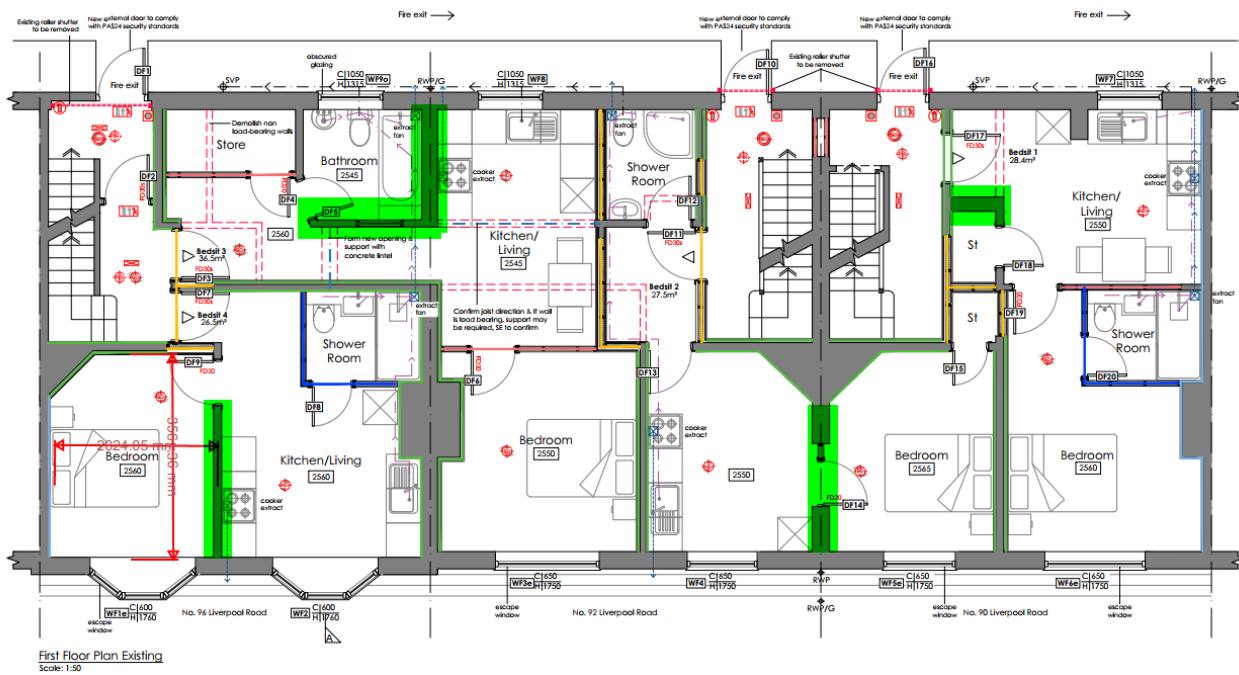
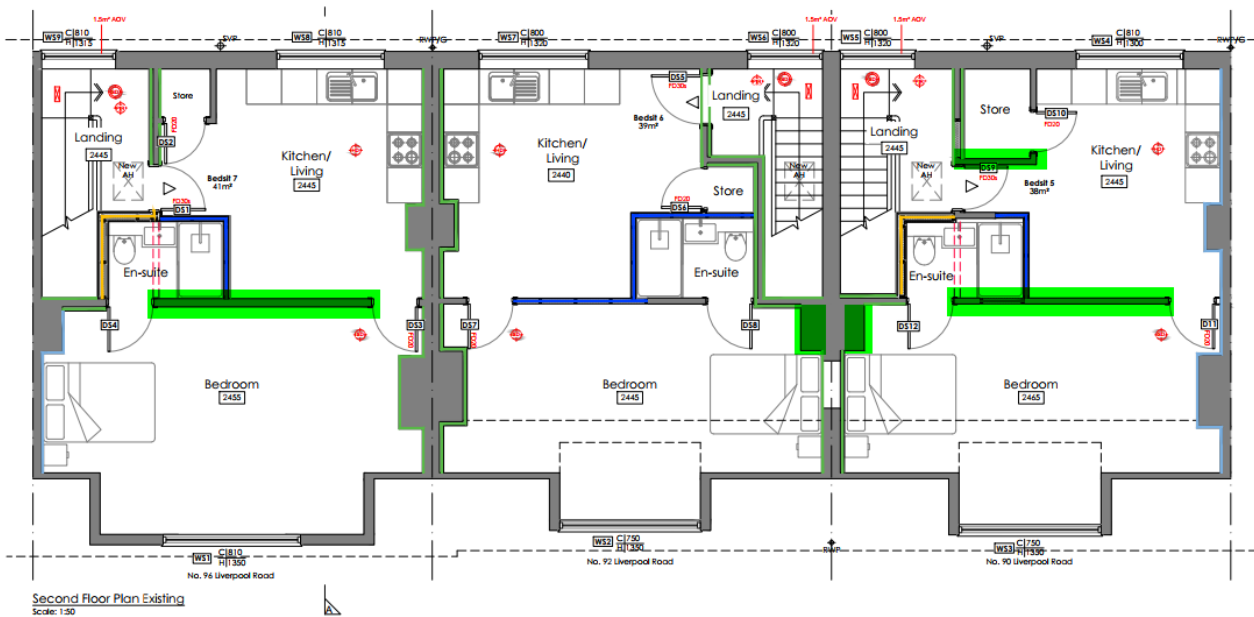


Figure 10 – Internal Wall Upgrade Mark-up – Second Floor





APPENDIX B – NOTES FOR QUALITY CONTROL

1. Blockwork

All blockwork is to be mortared to an almost fair faced standard both horizontally and vertically. Only perfect blocks may be used with no pitting or cracks. The blockwork must seal effectively to the underside of the soffit.

Where blockwork walls form a cavity wall, care should be taken to avoid rubble and snots from bridging the cavity. This is especially important where one or more of the leaves is floating.

2. Plasterboard

All plasterboard joints are to be butted tight. The rule of thumb is that the joint should be tight enough over its entire length to prevent a normal business card from being inserted. Multiple layers should be fitted with staggered joints.

Base details and deflection heads are to be as per the British Gypsum White Book unless otherwise stated, and copious amounts of mastic to be used when fitting to the walls, floor and ceiling respectively.

3. Mineral Fibre

Mineral fibre slabs are to be butted tightly together and to boundary structures, to form a homogeneous layer.

4. Windows

All window frames are to be a good tight fit into the building structure with any gaps to be filled both internally and externally with a non-setting mastic in addition to the usual weather proofing seal to the exterior. Any gaps between the frame and building that are greater than 5 mm are to be packed with a dense mineral fibre prior to mastic sealing.

5. Electrical Sockets

Electrical sockets must not be fitted back to back and removed areas of blockwork and plasterboard should be kept to an absolute minimum.

6. Water Pipes

All water pipes (and any other pipework) are to be resiliently mounted to avoid "water hammer". This is particularly important for plasterboard walls.

7. Penetrations

Penetrations are to be dealt with as described in this report. Details for specific services penetrations may be supplied upon request.

8. Approved Samples and Inspections

Samples of each individual acoustic element should be provided for inspection at the beginning of its installation. Once approved, the Clerk of Works must ensure that the same level of quality continues throughout construction.

APPENDIX C – DEFINITION OF ACOUSTIC TERMS

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.

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.