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ASSESSMENT OF INTERNAL SOUND TRANSFER FOR COMPLIANCE WITH BUILDING REGULATIONS

UNITY STREET, BRISTOL

REPORT REFERENCE NO. J003251-4998-ECE-01

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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

At the request of Watkin Jones, PDA have been instructed to provide an acoustic assessment for the internal separating elements within the residential aspects of the development at Unity Street, Bristol.

This report has been prepared detailing our assessment of the internal sound insulation and contains our recommendations regarding the acoustic performance of the separating elements and associated flanking noise to achieve the requirements of ADE.

The report also includes critical details for the construction of party walls and floors and associated junctions and flanking elements. Attention is also drawn to the required quality standard of construction.

2.0 APPROVED DOCUMENT E 2003

2.1 Separating Walls and Floors

Approved Document E “Resistance to the Passage of Sound” 2003 edition (ADE) provides guidance to meeting the requirements of the Building Regulations 2010. The document provides specific values of sound insulation that are required in a number of situations. In the case of the airborne sound insulation of both separating walls and floors, the required sound insulation performance standards are quoted in terms of the $D_{nT,w}$ + C_{tr} values. In this case the C_{tr} value is a low frequency adaptation term.

The Development will contain three blocks:

Block A – Block consisting of student accommodation arranged as a row of townhouses. The townhouses consist of kitchen / dining on the lower ground floor, lounge on the upper ground floor and bedrooms on the upper ground to third floor. It is noted that the bedrooms have shared toilet and washing facilities. We would consider that this type of arrangement would be typical of an attached house in multiple occupation. This would therefore be considered as a purpose-built dwelling-house in accordance with ADE. Please note that in accordance with these requirements the sound insulation separation ($D_{nT,w}$ + C_{tr}) would be between the houses, but not between bedrooms within the house.

Block B – Block consisting of student studios and cluster flats over five floors. The lower ground consists of amenity and commercial use. The upper ground to third floor consist of studios and bedrooms within cluster flats. Please note that each studio and bedroom have an en-suite toilet and washing facilities. This would therefore be considered as a purpose-built rooms for residential purpose with ADE. Please note that in accordance with these requirements the sound insulation separation ($D_{nT,w}$ + C_{tr}) would be between the bedrooms/cluster flats/studios.

Block C – Block consisting of co-living studios over six floors. The lower ground consists of a common room, gym and commercial use. The upper ground floor consists of laundry, co-living kitchen, ancillary spaces and some studios. The first floor to fourth floor consist of studios. Please note that each studio has an en-suite toilet and washing facilities. This would therefore be considered as a purpose-built rooms for residential purpose with ADE. Please note that in accordance with these requirements the sound insulation separation ($D_{nT,w}$ + C_{tr}) would be between the studios

The required airborne and impact sound insulation values are as per the tables detailed below.

Table 1. ADE2003 required sound insulation for new build

Room Type	**Airborne Sound Insulation $D_{nT,w} + C_{tr}$ dB (minimum values)**	**Impact Sound Insulation $L'_{nT,w}$ dB (maximum values)**
Purpose built rooms for residential use: Walls Floors and stairs	 43 45	 N/A 62
Purpose built Dwelling-house Walls	 45	 N/A

With reference to the airborne sound insulation requirements, a separating element will be judged to have 'passed' the test providing the results exceed the minimum value detailed in the table above.

With reference to the impact sound insulation requirements, a separating element will be judged to have 'passed' the test providing the result do not exceed the maximum value detailed in the table above.

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

2.2 Internal Walls and Floors

New internal partitions and floors within the apartments and houses are required to meet the following sound insulation criteria;

Table 2 Building Regulation ADE requirements – E2

Laboratory values for new internal walls and floors within purpose dwelling houses and flats	**Airborne Sound Insulation R_w dB (minimum values)**
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.

It is noted that E2 indicates that the above applied to the following areas:

(a) Internal walls between a bedroom or a room containing a water closet, and other rooms

(b) Internal floors

Requirement E2 does not apply to

(a) an internal wall which contains a door

(b) and internal wall which separates an en suite toilet from the associated bedroom

(c) existing walls and floors in a building which is subject to a material change of use

2.3 Control of Reverberation Time in Common Internal Parts

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.

Please note that these requirement only apply to corridors, stairwells, hallways and entrance halls which give access to the flat or room for residential purposes. Further guidance with respect to this is provided by the DCLG document "Approved Document E Frequently Asked Questions" published in March 2016.

Within this document it indicates that to comply with E3 requirements it is recommended that absorbent treatment should normally be applied only to common areas onto which dwellings open directly. If further indicates that 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.

3.0 BREEAM NEW CONSTRUCTION 2018

3.1 Hea 05 - Acoustic performance

In accordance with the requirement of BREEAM New Construction 2018, Hea 05 indicates that upto four credits for the acoustic performance are available for residential institutions.

The criteria for each of these credits are as follows:

First and Second Credit – Sound Insulation

One credit

Airborne sound insulation values are at least 3 dB higher and impact sound insulation values are at least 3 dB lower than the performance standards in the relevant building regulations or standards.

Two credits

Airborne sound insulation values are at least 5 dB higher and impact sound insulation values are at least 5 dB lower than the performance standards in the relevant building regulations or standards.

Third Credit – Indoor ambient noise levels

Achieve indoor ambient noise levels that comply with the design ranges given in Section 7 of BS 8233:2014

Fourth Credit – Room Acoustics

Achieve the requirements relating to sound absorption within residential spaces and within the common spaces of the building described in the relevant building regulations or building standards national guidance.

Please note that this report has been prepared to review the internal sound insulation requirements for compliance with the Building Regulations Approved Document E 2003. We will therefore provide an assessment for the Sound Insulation and the Room Acoustics credits detailed above.

The indoor ambient noise levels have previously been assessed within PDA report J003251-4769-ECE-01 dated 24th January 2021.

4.0 SEPARATING WALL CONSTRUCTION

4.1 Block A – Separating Wall Between Attached Houses

The architect's drawings indicates that this separating wall between the attached houses will be constructed as follows:

Two layers of 15mm Gyproc SoundBloc board fixed to the outside faces of two Gypframe 48 S 50 'C' Stud frameworks (bracing at 1200mm max. centres where required) with studs at 600mm centres. 50mm Isover Acoustic Partition Roll (APR 1200) to full fill the cavity for thermal performance (cavity width 140mm). BG Ref: A216009

Manufacturers literature suggests that this would achieve a lab performance of 56 $R_w + C_{tr}$. Please note however that it is that the acoustic performance will be reduced when installed on site due to unfavourable mounting conditions, flanking sound transfer and variations in dimensions of the rooms.

However assuming that a high level of build quality we would estimate that the resultant onsite performance should achieve 48dB $D_{ntw} + C_{tr}$. This meets the requirements of ADE2003 and would be sufficient to achieve 1 Credit for sound insulation under BREEAM Hea 05 Sound Insulation.

It is noted that drawings indicates that there are some locations where the separating wall cavity will be increased to allow boards to run past each side of a structural column. We would consider the increased cavity depth will likely to improve the acoustic performance.

In addition to the above we would recommend the following:

- Boards should be abutted and all outer layer joints sealed with tape or caulked with sealant. All joints need to be staggered to avoid air paths.
- Ensure that the mineral wool covers the whole lining area, fitting tight between studs without sagging.
- Make sure there is no connection between the two leaves except via the mid-height brace.
- Studs should be located at 600mm centres
- A continuous bead of acoustic sealant should be applied to the wall perimeter.

4.2 Block B & C – Separating Wall Between Bedrooms / Studios

The architect's drawings indicates that this separating wall between the attached houses will be constructed as follows:

70mm Gypframe 'C' stud with 16mm resilient bar to one side & 2No. layers of 12.5mm Gyproc Soundblock plasterboard & skim to each side, including 50mm Isover insulation. BG System Ref: A316008

Manufacturers literature suggests that this would achieve a lab performance of 53 $R_w + C_{tr}$. Please note however that it is that the acoustic performance will be reduced when installed on site due to unfavourable mounting conditions, flanking sound transfer and variations in dimensions of the rooms.

Please note that PDA have been involved in the previous schemes where a similar construction between dwellings have been utilised. Though on commissioning the performance requirements of ADE2003 had been achieved, the results were very marginal. Very close care and attention in build quality is therefore essential in ensuring the performance is maintained. Assuming that a high level of build quality we would estimate that the resultant onsite performance should achieve 46dB D_{ntw} + C_{tr}. This meets the requirements of ADE2003. and would be sufficient to achieve 1 Credit for sound insulation under BREEAM Hea 05 Sound Insulation.

In addition to the above we would recommend the following:

- Boards should be abutted and all outer layer joints sealed with tape or caulked with sealant. All joints need to be staggered to avoid air paths.
- Ensure that the mineral wool covers the whole lining area, fitting tight between studs without sagging.
- Make sure there is no connection between the two leaves except via the resilient bar.
- Studs should be located at 600mm centres
- Resilient bars should be fixed at 90^{o} of the studs and at centres of no less than 600mm.
- A continuous bead of acoustic sealant should be applied to the wall perimeter.

<u>Notes on fixing of Resilient Bars</u>

The most common area that causes failure on site is the installation of the resilient bars. Should the resilient bar be bridged for any reason we would expect the wall performance to be in the region of 42dB D_{ntw} + C_{tr}, which would not be acceptable for the requirements of ADE2003.

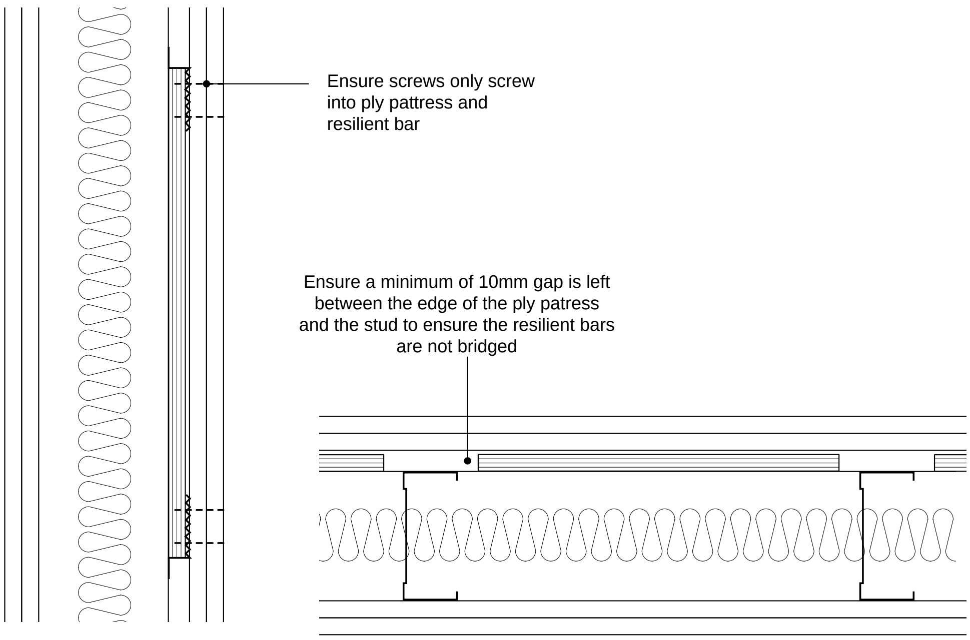
The idea of the resilient bar is to separate one plasterboard lining from the studs. The following points should also be noted:

- It is of particular importance to ensure that resilient bars are fixed in line with manufacturers specifications.
- It is of paramount importance to ensure that the plasterboard is only attached to the free lip of the resilient bar, and that the other lip of the resilient bar is only attached to the stud.
- It cannot be stressed enough in ensuring that screws are not overlong, as screws should <u>not</u> screw from the plasterboard directly through to the stud. Should this happen the wall will <u>fail</u> to meet the requirements of ADE2003. Screws lengths should be as specified by the manufacturer.
- As a further safeguard it must be ensured that the screws are not inline with the framing.

In addition to the above specific care and attention is required if it is proposed to install patressing behind the plasterboard lining as this could also compromise the wall construction.

Typical patressing is detailed as per the following sketch:

Figure 1. Detail of patress within resilient bar wall



4.3 Block B & C Separating Wall Construction Between Stair Core and Bedrooms / Studios

The architect's drawings indicate that the separating wall between the stair core and the studios / bedrooms will be constructed as follows:

200mm In-situ concrete lined with 1No. layer 12.5mm Soundbloc plasterboard on 70mm I Stud, 50mm mineral wool insulation within Nominal 10mm air gap separation from concrete core walls

We do not have any specific test data for this wall construction. However calculation would indicate that this wall would achieve a performance is 63dB $R_w + C_{tr}$. We would consider that this construction would comfortable comply with the minimum requirements within ADE. In addition it would be our estimation that the independent wall lining could be omitted and still comply with ADE.

5.0 BLOCK B & C SEPARATING FLOOR CONSTRUCTION

The architect's drawings indicate that the separating floor will be as follows:

250mm thick in-situ concrete. Details would indicate that the suspended ceiling is to consist of a single layer on a MF system. The cavity depth and plasterboard ceiling has not been specified. However we would consider that a minimum of 100mm void with a single layer of 12.5mm would be acceptable

Our calculations indicate that this floor should comfortably achieve the minimum airborne requirements of Approved Document E and will achieve two credits for BREEAM Hea 05 Sound Insulation.

ADE2003 also requires impact noise to be controlled and for a concrete floor construction of this type it is usually sufficient to overlay a soft floor covering to the floors. The drawings indicate that the floor will be finished with a Regupol type system. Please note that it will need to be ensured that the floor finish achieves a minimum Impact sound insulation improvement of 17dB ΔL_w (in accordance with BS EN 140-8:1998).

6.0 BLOCK A INTERNAL WALLS AND FLOORS

It is noted that within the Block A the internal wall between bedrooms is specified as per Section 4.2. In addition the internal floors are specified as Section 6.0.

We would consider that these wall and floor constructions would comfortably comply with the requirement for internal walls and floors as described within Section 2.2.

7.0 FLANKING DETAILS

Please note that the drawings provided here are not to scale and are for acoustic principles only. Fire protection, structural and fixing details must be confirmed by others.

7.1 Junction of Separating Wall with External Wall

It will need to be ensured that the internal lining of the external wall is not continuous between studios / bedrooms / townhouses, across a party wall.

Figures 2 and 3 detail the junction with the external wall

Figure 2 Junction of Separating Wall with External Wall

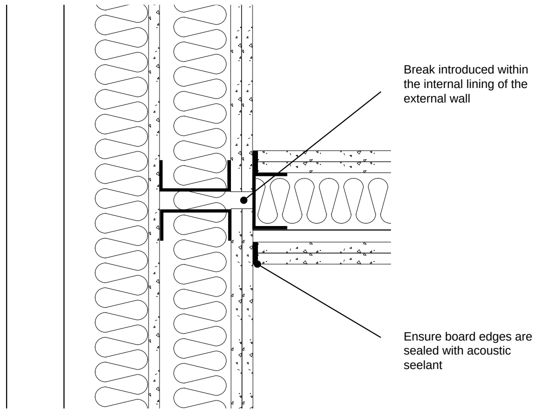
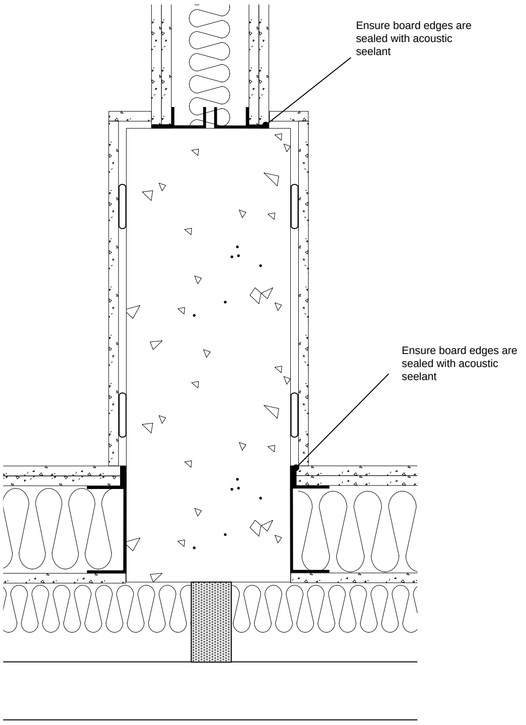


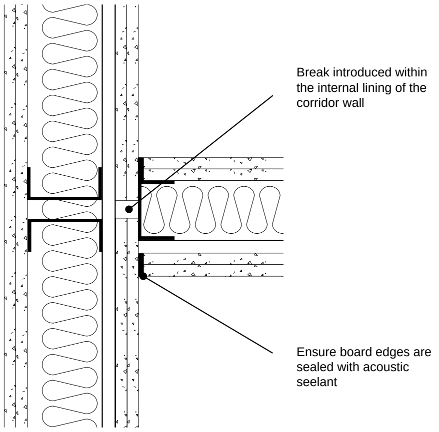
Figure 3 Junction of Separating Wall with External Wall with concrete column



7.2 Junction of Separating Wall with Corridor Wall

It will need to be ensured that the internal lining of the corridor wall is not continuous between studios across the party wall.

Figure 4. Junction of Separating Wall with Corridor Wall



7.3 Junction of Separating Wall with En-suite Pod

It is noted that in instances between studios the separating wall is continuous to the corridor wall with a separate service riser for each en-suite pod. However it is also noted that there is a common riser between the en-suite pods in the cluster bedrooms and the separating partition stops at this riser. There is therefore the potential for flanking transfer noise transfer via the riser which will reduce the sound insulation between the pods.

Please note that Approved Document E indicates that pre-completion testing is not normally undertaken between non-habitable rooms such as en-suite rooms. The effect of the common service riser will not impact on the sound insulation between bedrooms. In addition ADE indicates that testing should not be undertaken within small rooms. The small size of the room can also be detrimental to the sound insulation regardless of the separating wall construction.

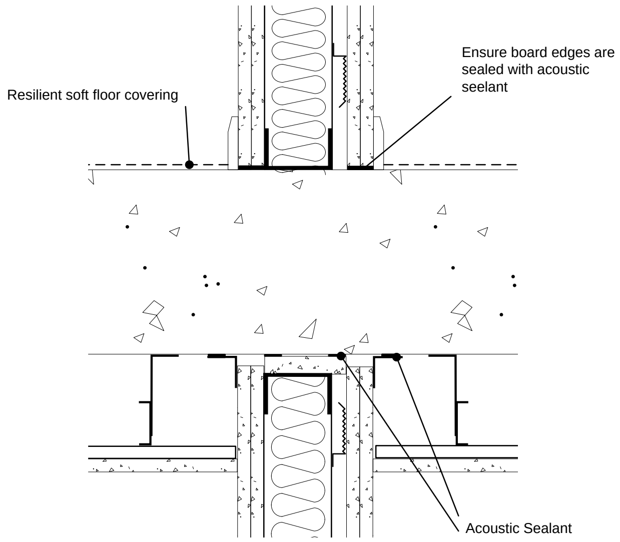
In our experience as en-suite pods are not considered to be habitable rooms, there will be a higher tolerance of sound transfer than the sound insulation between bedrooms. In addition it is noted that en-suite pods will also have extract ventilation which will reduce audibility of any sound transfer from the adjacent pod. We would therefore consider that it would be acceptable for the sound insulation between the en-suite pods to deviate from the from the requirements of ADE.

It would be recommended that the building control are consulted on the above and confirm that the above approach will be acceptable.

7.4 Junction of Separating Wall with Separating Floor

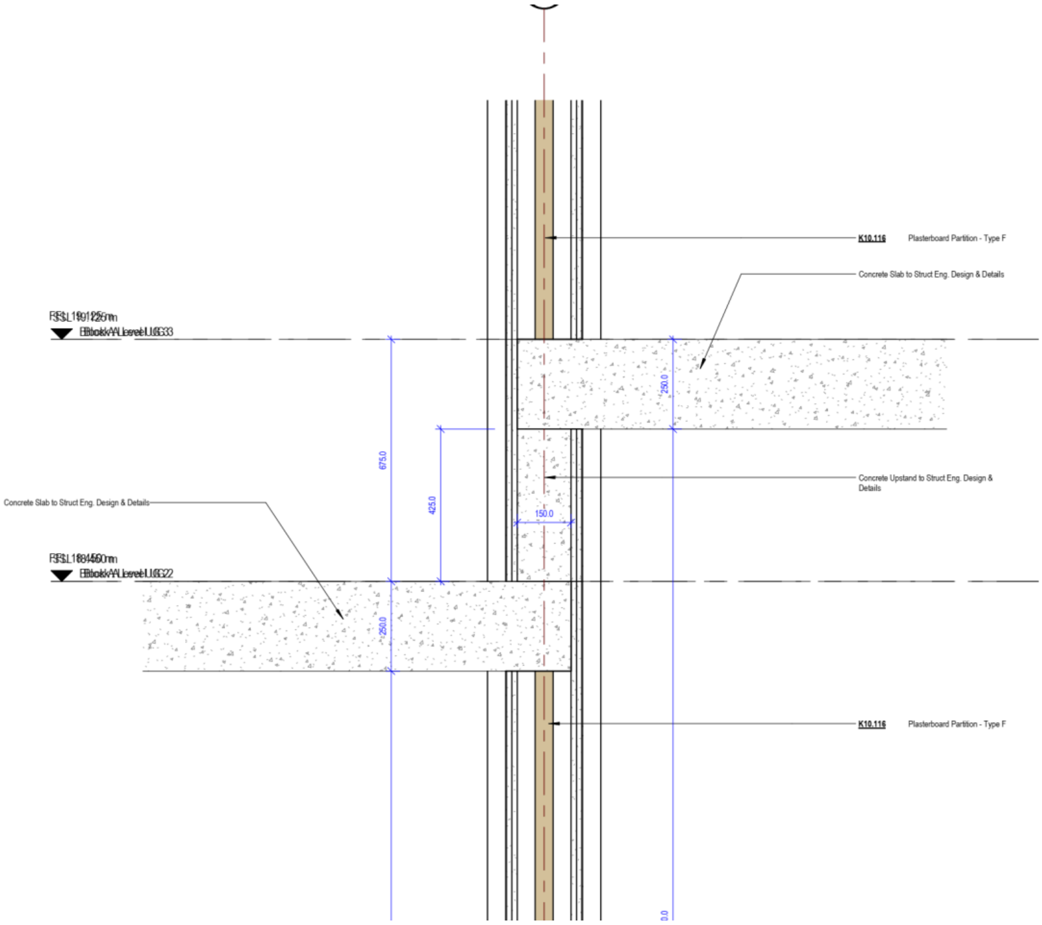
It will need to be ensured that the party wall is continuous from floor to soffit.

Figure 5. Junction of Separating Wall with Separating Floor



In addition it is noted that within Block A there the floors are offset due to the change in floor height. It is noted that where this step occurs there is a 150mm concrete upstand and it is in line with the separating wall. Tim Groom Architects drawing 1074-TGA-XX-ZZ-DR-A-2125 Rev. A provides details of this junction and this is detailed as follows:

Figure 6. Junction of Separating Wall and Separating Floor at step in floor (extract from Tim Groom Architects Drawings)



In general I would consider that the above drawing would be sufficient to control any potential noise transfer through the upstand area. However it is not clear from the drawing how the deflection head would be implemented and further information would be required.

It is also noted that it is recommended that board edges where they abut the floor and the soffit are well sealed with acoustic sealant.

7.5 Junction of Separating Wall with Roof

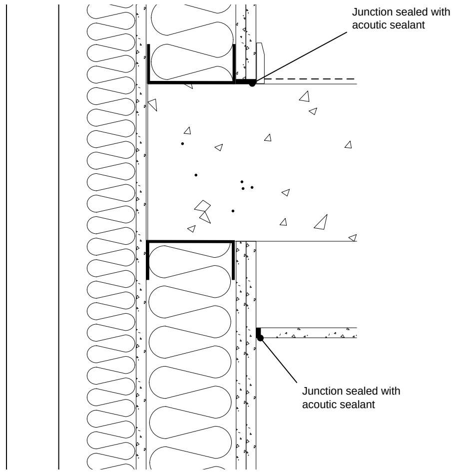
The details suggest the room will be 250mm insitu concrete with a suspended ceiling. It is therefore recommended that the junction with the soffit is as detailed within Figure 5 above.

7.6 Junction of Separating Floor with External Wall

It will need to be ensured that the inner leaf of the external wall is not continuous between storeys. In addition it is needs to be ensured that were the plasterboard abuts the floor and the external wall that they are well sealed with acoustic sealant.

Please refer to the drawing below for details

Figure 7. Junction of the Separating Floor with the External Wall



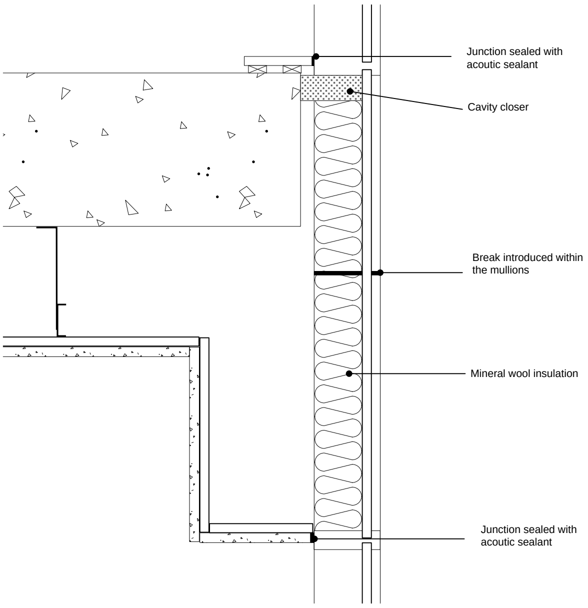
7.7 Curtain Walling

It is noted that there appears to be some areas of curtain walling within Block C that run vertically between studios.

There are a number of noise transmission paths within a curtain walling system which can be detrimental to the acoustic performance when assessing the sound insulation between floors. Primarily these are the gaps created by the void between slab edge and the curtain glazing, structural transmission via continuous mullion elements and airborne transmission via the continuous void within the mullion cavity.

In order to minimise structural noise transmission from the continuous mullion elements we would recommend that a break is introduced within mullions in line with the floor. The most ideal method to isolate the curtain walling would be to have independent structural support to the floor slab for the windows above and below the separating floor. Alternatively it would be acceptable to introduce an internal insert within the mullion to maintain the structural integrity as long as there is a physical break is maintained within the mullion itself. In order to reduce the noise transfer via the continuous void within the mullion we would recommend that the mullions are filled with mineral wool insulation either side of the break. In order to reduce the noise transfer via the gaps between the slab edge and the curtain glazing it will be necessary to provide acoustic sealant between the MDF window board edge and the top transom and the plasterboard ceiling edge and the bottom transom. In addition it is recommended that there is mineral wool insulation within the void between the slab edge and the curtain walling and there is a full depth mineral wool based cavity closer.

Figure 8. Junction of the Separating Floor with the Curtain Walling



8.0 GENERAL RECOMMENDATIONS

8.1 Electrical services and sockets in the separating wall

Electrical sockets, switches, etc. within lightweight plasterboard partitions can significantly affect the performance of the partition within which they are installed. It is recommended that the sockets are staggered a minimum of 150mm distance edge to edge and a board of similar thickness as used in the partitions should be installed behind the socket box, sealed around with mineral wool to a minimum 10mm depth with non-setting mastic.

Alternatively, an intumescent mouldable putty pad such as the Hilti CP617 putty pads to protect electrical sockets could also be employed.

8.2 Enclosure of Services

Penetrations through separating partitions within the ceiling void should be slightly oversized around pipes (approximately 5-10mm gap formed around penetrating element) to suppress structure-borne noise transmission across partitions. The remaining gap should then be well-sealed on both studs of the partition wall to a minimum 10mm depth with acoustic non-setting mastic with mineral wool or soft foam backing (if required). Larger gaps would need to be filled with plasterboard cut to shape, again leaving approximately 5-10mm gap formed around pipe, and finished and sealed with acoustic non-setting mastic to minimum 10mm depth, with mineral wool or foam backing if required, to seal all gaps.

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 in at least 15kg/m^2 e.g. two layers of 12.5mm plasterboard. The boxed out enclosure is to be mechanically independent of the pipes with at least 25mm clearance to pipe systems. 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 elements should be slightly oversized around pipes etc. (approximately 5-10mm gap formed around pipe) to suppress structure-borne noise transmission across the separating element. The remaining gap should then be well-sealed on both studs of the separating element to a minimum 10mm depth with acoustic non-setting mastic utilising mineral wool or soft foam backing (if required).

Any pipes or ductwork should be resiliently mounted to avoid any mechanical link between the two separate leaves forming the partition. In addition pipes or ductwork in risers should not be rigidly fixed to a wall that is common to a habitable room

8.3 Corridor Doors

Doors separating studios and flats from corridors and common areas should have good perimeter sealing and a minimum mass per unit area of 25kg/m^2 or a minimum sound reduction index of 29 dB R_w.

9.0 LIFT NOISE

It is noted from the drawings that there are some areas where the lift shaft is directly adjacent to a residential room. The design indicates that the wall construction will be as per the stair core construction described within section 4.3.

In order to adequately control the noise transfer from the lift shaft we would recommend the wall lining is increased to two layers of 15mm plasterboard.

It should also be noted that the noise level associated with the lift will be dependent upon the location and mounting of the lift shaft motor, car rails and counterweight. It will need to be ensured that the lift manufacturer provides suitable anti-vibration mounting for the proposed lift shaft wall such that structural transfer of lift noise is minimised.

It is further recommended that to minimise any structure borne noise that the hoisting mechanism and the counterweight are not located on the wall that is adjacent to the residential rooms.

10.0 GROUND FLOOR AMENITY AREAS

10.1 General Recommendations

It is noted that there are amenity areas on the ground floor with residential above and below these areas. Approved Document E states the following with reference to the performance set out within the standard:

"0.8 The performance standard set out in Tables 1a and 1b are appropriate for walls, floors and stairs that separate spaces used for normal domestic purposes A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space."

Therefore if the noise generation associated with the amenity areas is similar to typical domestic purposes then the sound insulation performance described within this report will be acceptable. However should it be the case that higher noise generation is likely such as from amplified entertainment noise, then an increase in sound insulation may be warranted.

With the exception the Gym within Block C, it is considered that these amenity spaces would be no different from typical domestic activities and as such the normal sound insulation requirements within Approved Document E would be suitable.

10.2 Gym

The Drawings indicate that Gym will be located on the lower ground floor though the details indicate that this is a double height space so will have residential directly above it.

10.2.1 Airborne Sound Insulation

We have modelled the likely sound insulation between the Gym and the bedroom above in Bastian software, using the methods of BS EN 12354. The results of the modelling indicate an airborne sound insulation in excess of 55 dB $D_{nT,w} + C_{tr}$ between the Gym and the apartments above. These calculations have been carried out assuming the ceiling has been omitted in these areas. We would expect the airborne sound insulation between the gym and studios to be acceptable without further treatment.

Please note that the above assessment assumes that flanking paths have been adequately treated. As such any penetrations through the separating floor should be over-sized around the penetrating services / element and should be packed to full depth around the penetrating element with dense mineral wool and sealed around the penetrating element both above and below the slab using abundant fire / acoustic sealant.

The inner leaves of lightweight flanking external walls should be broken by the separating floor and constructed as described within Section 5.6. Please note that it is assumed that there is no curtain walling between the ground floor and the studios above and below.

10.2.2 Impact Noise Due to Gym equipment

In addition to impacts from footfalls, untreated gym equipment is liable to introduce impact noise into floors onto which the equipment is rigidly connected or into floors where weights are dropped.

In the case of weights being dropped these are very difficult to remediate in terms of impact noise. In general we would not recommend that 'free weights' are used in gyms within mixed used developments unless these are on an independent ground-bearing slab on the ground floor. Should the floor slab be rigidly connected to the walls and concrete columns there is likely to be impact sound that will transmit to the floors above.

Alternatively, some form of impact resistant floor could be utilised to minimum the amount of vibration entering the structure. Typical products are available from TVS Acoustics or CMS Danskin. It should be noted that due to the complex nature of the vibration transfer between the lower ground and the residential use above, should it be required to utilise free weights in the gym further investigation will be required on the completed scheme to establish if and what type of product could be used to minimise structural sound transfer.

10.3 Loudspeakers / AV Equipment / HVAC Equipment

We note that the gym area feature an exposed ceiling soffit. Any suspended loudspeakers, AV Equipment or HVAC equipment / ductwork must be suspended using proprietary anti-vibration hangers such as those available from AV Industrial Products or Christie & Grey or similar . Note that the selection and spacing of the hangers is dependent on the weight of the equipment and manufacturer's advice should be followed to ensure that the hangers are correctly loaded to give optimum vibration isolation.

In addition to the structure-borne sound transmission, we have assumed that noise levels will not be excessive within either the Gym or the Amenity space. As such any music noise or other entertainment noise should not be greater than typical noise levels would be in a domestic setting. For example, although music noise will be acceptable at reasonably loud levels without causing a disturbance to surrounding properties, the playback levels should not be louder than those typically associated with music played in the home, particularly during the night-time period.

11.0 REVERBERATION TIMES

11.1 Reverberation Criteria

In accordance with Approved Document E requirement E3 of the Building Regulations, reverberation in common in parts of building containing flats must be suitably controlled. The standard gives two methods to determine reverberation time in common areas:

Method A

A) For entrance halls, corridors or hallways cover an equal area to or greater than the floor area with a Class C absorber or better. It is normally convenient to cover the ceiling with the additional absorption.

B) For stairwells the combined area of the stair treads, the upper surface of intermediate landings, the upper surface of landings (excluding ground floor) and the ceiling area on the top floor should be calculated. Either, cover at least an area equal to this area with a Class D absorber, or cover an area equal to at least 50% of this area with a Class C absorber or better. The absorptive material should be distributed between all floor areas.

Method B

Method B is a calculation that takes into account the existing absorption provided by all surfaces. The absorption coefficient and area is calculated for each surface to determine the total absorption area in the room. ADE 2003 requires the following minimum total absorption areas

A) For entrance halls, provide a minimum of $0.20m^2$ total absorption area per cubic meter of the volume.

B) For corridor or hallways, provide a minimum of $0.25m^2$ total absorption area per cubic meter of the volume.

As detailed within Section 2.3, therefore the requirements of E3 are only with reference to the common areas on which the dwellings open directly.

11.2 Assessment

It is noted that Block A are houses and therefore there are no common areas that require acoustic treatment for absorption.

Architects' drawings for the reflective ceiling plan in Block B and Block C indicate that communal corridors that lead onto flats and studios are to be compliant with Part E, but the proposed product has not been specified.

If the ceiling within these corridors achieve a Class C absorbent performance such as a perforated plasterboard (Gyptone Quattro 41 or equivalent) then the acoustic performance described within Method A would be complied with.

It is noted that we have been informed that the floor finish is to be carpeted which may provide some additional absorption. If the absorbent ceiling was omitted and replaced with a hard plasterboard ceiling then it would be required to comply with Method B. We have therefore undertaken additional calculations to determine the impact the absorption in the corridor space should the absorbent ceiling be omitted.

The Calculations have been based upon the following surface finishes

Ceiling: 12.5mm SoundBloc board with a skimmed finish.

Walls: Plasterboard separating walls

Floor: Tessera Diffusion carpet tiles

Based upon these floor finishes we would estimate the absorption areas per cubic meter of the worst-case corridor as follows:

Table 3. Calculated absorption area per cubic meter of volume

Frequency (Hz)	**250**	**500**	**1000**	**2000**	**4000**
Total Absorption Area (m^2) per m^3 volume	0.25	0.15	0.17	0.24	0.30

As indicated within Method B, it is necessary to have a minimum of $0.25m^2$ total absorption area per cubic meter of the volume. It is noted however that our calculations show there is a shortfall in this minimum requirement within the octave band frequencies at 500Hz, 1kHz and 2kHz.

We have calculated that based upon this shortfall, the reverberation time would increase from 0.65 seconds (if the $0.25m^2$ was met) to 0.9 seconds in the average of the 500, 1kHz and 2kHz frequency bands. We would consider that this will have minimal impact on the future occupants as they would unlikely to be able to discern the difference between the reverberation time as it would make 1.4dB difference to the reverberant noise generation within the corridor.

In this situation the shortfall will need to be discussed with Building Control, they may consider that the impact on the future residents is not significant.

However should if it is required to achieve these fourth credit in BREEAM Hea 05 then it is likely that a Class C ceiling as indicated within Architects drawings will be necessary.

12.0 BUILD QUALITY

It is essential that high levels of build quality be maintained on site during construction. Poor build quality will result in greatly reduced sound insulation properties of the separating floors and walls and failure to meet the performance specification contained within.

Guidance on the acoustic requirements for quality control is attached at the rear of this report.

APPENDIX A – NOTES FOR QUALITY CONTROL

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.

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.

Mineral Fibre

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

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 packed with a dense mineral fibre prior to mastic sealing.

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.

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.

Penetrations

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

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 B – 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.