RBA ACOUSTICS

140-146 CAMDEN STREET, NW1 9PF

Internal Building Fabric Assessment

Reference: 9587.RP02.IBF.3
Prepared: 11 January 2021
Revision Number: 3

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	8 October 2019	James Stokes	Alex Wyatt
1	Incorporating Design Team Comments	21 October 2019	James Stokes	Alex Wyatt
2	Updated Information	25 October 2019	James Stokes	Alex Wyatt
3	Further updates	11 January 2021	James Stokes	Alex Wyatt

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.

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Contents

1.0 INTRODUCTION

The mixed-use development at 140-146 Camden Street, London is currently being designed. The development is to comprise commercial premises at lower ground and ground floors, with residential apartments up to Level 7.

This report provides guidance in order to comply with Part E of the Building Regulations (2010) in relation to the following specific requirements:

Requirement E1 – Separating walls and floors between flats and between flats and common areas.
Requirement E2 – Internal walls.
Requirement E3 – Reverberation within common parts.

2.0 PLANNING CONDITIONS

Approval Notice (ref. 2019/3403/P) received on 10 December 2019 contains the following acoustic-related Planning Conditions with a summary title added for quick reference:

Condition 8 – External Fabric / Glazing & Ventilation

"The noise level in rooms at the development hereby approved shall meet the noise standard specified in British Standard BS8233:2014 for internal rooms and external amenity areas. Details of noise protection measures within the development shall be submitted to and approved by the local planning authority prior to the commencement of work on the superstructure. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained."

Condition 9 – Internal Fabric / Separating Walls & Floors

"Prior to the commencement of work on the superstructure, details shall be submitted to and approved in writing by the local planning authority, of an enhanced sound insulation value DnT,w and L'nT,w of at least 5dB above the Building Regulations value, for the floor/ceiling/wall structures separating different types of rooms/uses in adjoining dwellings (namely the living room and kitchen above the bedroom of a separate dwelling) . Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained."

Condition 27 – Plant Noise

"Prior to installation, full details of all plant equipment to be contained within the substation at ground floor level and plant room at lower ground floor level including manufacturers specifications, noise levels and attenuation, shall be submitted to and approved by the Local Planning Authority in writing. The use shall not proceed other than in complete accordance with such scheme as has been approved. All such measures shall be retained and maintained in accordance with the manufacturers' recommendations."

3.0 DESIGN CRITERIA & TESTING

3.1 Approved Document E (2003) Separating Walls and Floors

Building Regulations Approved Document E (2003 edition incorporating 2004, 2010 and 2015 amendments) provides guidance for levels of sound insulation within residential developments. These criteria are applicable to separating walls and floors between individual demises and also between demises and common parts. Therefore the sound insulation criteria to be achieved are as follows:

Separating Floors
Minimum airborne sound insulation of 45dB $D_{nT,w} + C_{tr}$. This is an on-site performance rating.
Maximum impact sound pressure level of 62dB $L'_{nT,w}$. This is an on-site performance rating.

Separating Walls
Minimum airborne sound insulation of 45dB $D_{nT,w} + C_{tr}$. This is an on-site performance rating.

3.2 Approved Document E (2003) Internal Floors and Walls within Residences

Approved Document E also sets a minimum performance requirement of 40dB R_w for internal floors and internal partitions surrounding bedrooms and internal partitions surrounding WCs. It should be noted that the R_w 40dB criterion is a laboratory rating only and cannot be measured on-site.

The criterion specifically does not apply to any walls containing doors or to walls between en-suite bathrooms and the associated bedroom.

3.3 Project Requirements

In addition to the above requirements, it is also desired to achieve enhanced performance requirements in the following locations:

- Separating walls between flats and communal amenity spaces
- Separating walls between kitchen/lounge/dining areas and bedrooms between flats

In accordance with Planning Condition 10, the following enhanced performance standards will be targeted for walls and floors separating apartments:

Separating Floors
Minimum airborne sound insulation of 50dB $D_{nT,w} + C_{tr}$. This is an on-site performance rating.
Maximum impact sound pressure level of 57dB $L'_{nT,w}$. This is an on-site performance rating.

Separating Walls
Minimum airborne sound insulation of 50dB $D_{nT,w} + C_{tr}$. This is an on-site performance rating.

4.0 SEPARATING WALL CONSTRUCTIONS BETWEEN FLATS

4.1 Main Separating Wall

We understand that the main separating wall construction between flats comprises the following;

- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)
- 12mm plywood
- Independent I studs with mineral wool (16kg/m^3) between studs
- Cavity fully filled with mineral wool (16kg/m^3)
- Independent I studs with mineral wool (16kg/m^3) between studs
- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)

The above construction equates to an overall dimension of 280mm.

Ensuring a high level of build quality and appropriate detailing of the flanking transmission paths we consider the proposed separating wall construction to be commensurate with the project criteria.

4.2 Long Concrete Columns/Shear Walls (>600mm long)

Care needs to be taken with the design of any plasterboard linings where the separating wall between flats is formed from long sections of concrete. Plasterboard linings are prone to acoustic resonance effects when mounted on masonry cores.

Generally speaking we would consider concrete sections that take up more than 25% of the separating wall area to require special treatment.

Critical Locations (Living Rooms and Bedrooms)

Should any long sections of concrete occur between habitable rooms we would advise a double plasterboard layer be introduced each side of the core and the void expanded to 30mm (minimum) to reduce the potential for resonance effects. The following overall separating wall construction make-up is recommended:

- 2No layers of 15mm dense plasterboard (12.5kg/m^2 each)
- GypLyner system creating a 30mm void, with 25mm mineral wool (minimum 10 kg/m^3) within cavity
- 250mm in-situ concrete shear wall
- GypLyner system creating a 30mm void, with 25mm mineral wool (minimum 10 kg/m^3) within cavity
- 2No layers of 15mm dense plasterboard (12.5kg/m^2 each)

The above build-up has an overall width of 370mm.

In some areas, the shear wall has a reduced width of 200mm, resulting in an overall width of 320mm.

Our recommended detailing is shown in Figure 1 in Appendix C.

Non-critical Locations

We would also advise that in the non-critical instances a GypLyner system will be used as a fixing system for the plasterboard finish.

The following overall separating wall construction make-up is recommended:

- 1No layer of 15mm dense plasterboard (12.5kg/m^2)
- GypLyner system creating a 25mm void, with 25mm mineral wool (minimum 10 kg/m^3) within cavity
- 250mm in-situ concrete shear wall
- GypLyner system creating a 25mm void, with 25mm mineral wool (minimum 10 kg/m^3) within cavity
- 1No layer of 15mm dense plasterboard (12.5kg/m^2)

The above build-up has an overall width of 330mm.

Our recommended detailing is shown in Figure 1 in Appendix C.

4.3 Short Concrete Columns

Where short columns exist within separating walls (i.e. ≤600mm) it is acoustically acceptable to run a single layer of plasterboard past the face of the column using a continuous ribbon of adhesive.

4.4 Socket Penetrations

Socket penetrations of flat-to-flat separating walls should be avoided wherever possible. Where not possible the following measures are recommended.

Back-to-back sockets should be avoided with sockets staggered by at least one stud dimension. Limited staggered socket penetrations should then preferably be treated with plasterboard boxing comprising 2 layers of plasterboard. Proprietary putty pads products would also be acoustically acceptable.

Multiple Socket Penetrations (i.e. more than a double box socket)

Where multiple socket penetrations are unavoidable (e.g. kitchen areas), and especially where there are multiple back-to-back socket penetrations, then we would advise a sacrificial lining be introduced on to the multiple penetration side of the separating wall. Socket penetrations within the sacrificial lining require no further treatment. Socket penetrations on the other side of the separating wall should be treated with putty pads (or plasterboard boxing) as above. A layer of 25mm mineral wool (minimum 10 kg/m^3) should be introduced within the void created by the sacrificial lining.

We understand the proposed construction in this case to be:

- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)
- 12mm plywood
- Independent I studs with mineral wool (16kg/m^3) between studs
- Cavity fully filled with mineral wool (16kg/m^3)
- Independent I studs with mineral wool (16kg/m^3) between studs
- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)
- Gyplyner cavity (as large as required) filled with mineral wool
- 1 layer of 12mm plywood
- 1 layer of 12.5mm WallBoard (9.8kg/m^2)

It is advised that the cavity behind the sacrificial wall lining is fully filled with mineral wool. Our recommended detailing is shown in Figure 2 in Appendix C.

Given the above, the above construction is considered acoustically acceptable.

4.5 Wall-Mounted TVs

In general, keeping wall mounted TVs off the separating walls is advised - the introduction of a screen with an associated speaker directly on to the separating wall could create structure-borne as well as airborne noise problems.

TVs should not be positioned on separating walls that back on to bedrooms. If mounting TVs on living room-to-living room separating walls is unavoidable, then we would advise as follows:

A full-height baffle box should be built behind the TV to allow for cabling and all associated perforations. The baffle box should be formed of 2 layers of 15mm dense plasterboard (min. 12.5kg/m^2 per board) supported off boxed studs in addition to the 2 layers of 15mm dense plasterboard (min. 12.5kg/m^2 per board) forming the lining of the separating wall and the required plywood to allow for fixings. This should be done either side of the separating wall when there is a TV mounted on both sides of the wall. The detailing is indicated in Figure 3 in Appendix C.

5.0 SEPARATING WALLS BETWEEN COMMON AREAS & FLATS

5.1 Criteria

Separating walls between flats and communal areas are not subject to acoustic testing. These walls should, however, achieve the numeric performance requirements for standard building regulations.

In addition, the project criterion requires enhanced acoustic performance standards between flats and communal amenity spaces.

5.2 Separating Walls between Flats and Common Corridors

We understand the corridor separating wall construction generally comprises the following:

- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)
- 12mm plywood
- 50mm metal C-studs with mineral wool (16kg/m^3) between studs
- Cavity fully filled with mineral wool (16kg/m^3)
- 50mm C-metal studs with mineral wool (16kg/m^3) between studs
- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)

The above construction equates to an overall minimum dimension of 280mm.

This construction is considered to be acoustically suitable. We understand that to simplify the installation, the design team may decide to upgrade this wall type to be in line with the main separating wall construction given in Section 4.1, which would also be acoustically suitable and would represent an enhancement on the Building Regulations requirement.

Relaxations will also prove possible in relation to socket box treatment as these walls will generally be "imperforate" on the corridor side. In the case of multiple socket penetrations, sacrificial linings on to corridors should not prove necessary provided the socket penetrations are treated with putty pads or plasterboard boxing.

5.3 Doors

In order to achieve the Approved Document E requirement of 29dB R_w for front entrance doors, we would advise flat entrance doors be solid core, of approximate thickness 45mm, with seals of the neoprene compressible bulb type fitted at the head and jambs. Any gaps at the threshold should be minimised as far as practicable. A break in the screed should be introduced at the door threshold.

5.4 Service Penetrations

Any services entering the flats from common areas should ideally enter above the flat entrance doors. Our recommended detailing for service penetrations of drywalls is shown in Figure 4 in Appendix C. N.B. there should be no service penetrations of separating walls between flats apart from the socket penetrations detailed above.

5.5 Walls between Stairwells and Residential Areas

We understand the stairwell separating wall construction generally comprises the following:

- 2No. layers of 15mm dense plasterboard (12.5kg/m^2 each)
- 1 layer of 12mm plywood
- 70mm metal studs with 70mm mineral wool between studs
- 50mm cavity filled with 50mm mineral wool
- Concrete shaft / dense blockwork

This construction is considered acoustically acceptable.

Note, for separating walls to non-habitable areas the above construction could be relaxed to

- 1No layers of 15mm dense plasterboard (12.5kg/m^2 each) on dot and dab
- 200mm (minimum) concrete shaft / dense blockwork

5.6 Walls between Communal Amenity Spaces and Residential Areas

For the enhanced project requirements to these areas, we would recommend the following construction is used:

- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)
- 12mm plywood
- Independent I studs with mineral wool (16kg/m^3) between studs
- Cavity fully filled with mineral wool (16kg/m^3)
- Independent I studs with mineral wool (16kg/m^3) between studs
- 2No layers 15mm dense plasterboard (12.5kg/m^2 each)

The above construction equates to an overall minimum dimension of 280mm.

This construction would meet the enhanced project requirements to the designated areas.

6.0 WALLS AROUND LIFT SHAFTS ON TO FLATS

Satisfactory noise levels within adjacent residential rooms will depend not only on the intervening sound insulation, but also on the quality/ type of lift installation.

6.1 Lift Specification

We would advise the following clauses be introduced within the lift supplier's contract specification:

1) Airborne noise levels within lift shaft

Noise levels within the lift shaft shall not exceed 75dBA $L_{max(f)}$ as measured with a fast meter response.

2) Structure-borne noise levels from lift operation

Where habitable rooms are directly adjacent, vibration levels from lift operation (including both lift motor and car movement along the guide rails) shall not exceed the following as measured on the lift shaft wall partying the residential unit:

Table 1 – Lift Shaft Wall Vibration Level Limits

Maximum acceleration level (dB) ref. 1 x 10^{-6} m/s^2 at Octave Band Centre Frequency (Hz)			
63	125	250	500
80	80	75	75

Achievement of the above may require isolation of certain lift system components (e.g. lift motor, roller frames, guide and deflection pulleys, cable fastening points and switchgear). The supplier shall ensure any mount selection is sufficiently resilient to provide isolation, but at the same time sufficiently stiff not to affect lift operation. The guide rails should not be fixed to the lift shaft wall facing the residential unit.

6.2 Sound Insulation

We understand the lift core separating wall construction generally comprises the following:

- 2No. layers of 15mm dense plasterboard (12.5kg/m^2 each)
- 1 layer of 12mm plywood
- 70mm Independent metal studs with 70mm mineral wool between studs
- 50mm cavity filled with 50mm mineral wool
- 250mm Concrete shaft

This construction is considered acoustically acceptable.

In non-noise sensitive areas it will be acceptable to resort to a GypLyner system in place of the independent lining. The typical construction would comprise:

- 2No layers of 15mm dense plasterboard (12.5kg/m^2 each)
- GypLyner system creating 30mm void minimum, with 25mm mineral wool insulation (10-36kg/m^3)
- 250mm (minimum) concrete lift shaft

If there are separating walls abutting the lift shaft we would recommend a 5mm polyethylene strip behind the end channels of the separating wall (and also to maintain the acoustic integrity of the independent lining).

7.0 WALLS AROUND MAOV / RISERS ON TO FLATS

The following applies to riser wall areas backing onto flats.

We understand that the following construction is proposed for service risers:

- 2No. layers of 15mm dense plasterboard (12.5kg/m^2 each)
- 1 layer of 12mm plywood
- 70mm metal studs with 70mm mineral wool between studs
- 50mm cavity filled with 50mm mineral wool
- Concrete shaft / dense blockwork

This construction is considered acoustically acceptable.

8.0 MAIN SEPARATING FLOORS

8.1 Separating Floor Construction

We understand that the separating floor between flats to comprise the following construction:

- 20mm Floor Finish Zone
- 55mm Underfloor heating screed
- 45mm rigid thermal insulation
- 5mm resilient layer (Yelofon HDS or similar)
- 225mm reinforced concrete slab
- MF suspended ceiling comprising 1 layer 12.5mm plasterboard (min 8.5kg/m^2)

Please note that the floating screed will require a high level of supervision to build quality. Acoustic failures are often encountered with floating screeds when the screed "bridges" on to the main structure. Attention will need to be given to ensure the following:

- Perimeter isolation strips are correctly implemented
- All joints within the resilient layer are well taped, with an adequate overlap

Subject to ensuring sufficient levels of build quality and control of the flanking paths the above construction is considered to be commensurate with the enhanced performance standards.

8.2 Common Corridor Floor Construction

Where common corridors are stacked, it is technically possible to remove the resilient layer from the corridor floor build-up when considering the Building Regulations requirements. However, although the transfer of horizontal impact sound is not covered by the Building Regulations, the implementation of such a resilient layer would prove beneficial in relation to this potential issue and its inclusion could be considered justifiable.

In instances where common corridors extend over dwellings the floor construction is required to be in strict accordance with the main separating floor construction detailed in Section 8.1.

8.3 Level 7 Amenity Area Floor Construction

The current layout of the Level 7 Amenity Area includes a Yoga Zone & Gym, which includes an area for free weights. These proposed areas are located directly above residential units. For experience such activities would require a significantly enhanced floating floor system consisting of multiple resilient layers as well as an enhanced ceiling in the residential areas below.

We understand the slab thickness in this location would be 275mm.

In non-impactful areas (e.g. reading nook, mindfulness zone, wellness area and bar area) a suitable floor build-up would comprise a resilient layer or resilient bar system. If noise levels in the bar were expected to be elevated or amplified music to be played (and/or if the bar is expected to stay open later than 11pm), it may be worth upgrading this floor system to provide additional airborne noise resistance.

For the yoga area, we would suggest that a slightly upgraded resilient layer, such as a 10mm rubber layer should be used under the floor finish – Note that if the area *may* be used by other activities such as Zumba/dance etc. then a more enhanced system would be required to suitably control impact noise.

In areas where free weights are proposed a significantly enhanced flooring system will be required to control impact noise from entering the building structure. Note controlling this issue at the source of the impact is critical as, once the impact energy has entered the building structure, it has the potential to generate re-radiated noise in other parts of the building (not only areas directly below). Furthermore, the level of enhancement will depend on the maximum weights that could be used; whether the space will be managed; when it will remain open until etc.

A typical build-up for these highly enhanced areas is likely to consist of a fully floated deck on a resilient cube system, with an additional number of foam/rubber layers to absorb impact energy. Typically a tough rubber finish would be recommended in these gym areas to provide a durable finish combined with a gym-like aesthetic.

Further feedback from the design team and client will be required to develop this floor.

9.0 SOUND INSULATION BETWEEN COMMERCIAL AND RESIDENTIAL

9.1 General

Commercial units are proposed for Ground and Lower-Ground levels. Therefore, commercial units will be located directly below residential apartments at first floor level.

We understand the planning use class for the commercial units to be B1 (offices).

9.2 Criteria / Strategy

In the first instance it should be noted that the Building Regulations performance standards are based on normal domestic noise sources. Higher levels of sound insulation should be targeted if higher noise levels are anticipated in areas directly below the residential flats.

Noise level limits should be imposed on the tenant within the Agreement for Lease. Should higher noise levels be anticipated it should be the responsibility of the tenant to introduce additional sound insulation measures and to undertake acoustic tests to prove that the measures are adequate. It should be noted that not all uses will require additional measures.

The Agreement for Lease should also cover potential structure-borne noise transfer.

9.3 Separating floor construction

We understand the separating floor construction will comprise:

- Floating floor comprising 75mm screed on 150mm insulation
- 225mm thickness full density concrete

9.4 Tenants' agreement for lease

Where commercial areas are to be located below residential areas, we recommend the following clauses be introduced into the commercial units' agreements for lease to prevent common noise issues from occurring:

x.1 The tenant, when fitting out the unit, is to ensure that adequate sound insulation is provided to suit their intended use, to ensure the avoidance of a noise nuisance to other occupiers within the building. The tenant shall control noise emissions from the Leased Area at all times to prevent disturbance to others and shall comply with any additional noise emission limits or restrictions on operating hours imposed by the local authority and/or licensing authority.

x.2 Activity noise, either airborne or structure-borne, from any commercial unit must not exceed the following NR criteria in any adjacent residential unit:

NR20 L1 - daytime (07:00 – 23:00 hours)
NR15 L1 - night-time (23:00 – 07:00 hours)

For guidance, the following airborne noise levels are not to be exceeded in the commercial unit:

Overall level: 80dBA, and 75dB per octave L1 from 63Hz-4000Hz (daytime)
Overall level: 75dBA, and 70dB per octave L1 from 63Hz-4000Hz (night-time)

x.3 If a higher noise level is needed in the commercial unit, it is the responsibility of the tenant to install additional sound insulation measures in their unit so that the above NR criteria are not exceeded in the residential unit due to noise from the commercial unit.

x.4 This requirement will normally only arise if the commercial unit is to be used for amplified music of some kind or the commercial unit is to be used during the night-time period. Seek advice from The Landlord in case of any doubt.

x.5 Speakers must be resiliently mounted to avoid structure-borne transmission of noise into adjoining areas. In addition, resilient layers/ isolation products may need to be implemented within the commercial unit should the structure be subject to structure-borne sound sources.

x.6 Full details of typical noise levels and any proposed sound insulation measures should be forwarded to The Landlord for approval.

x.7 Following implementation of any additional sound insulation measures, The Landlord reserve the right to undertake acoustic tests within the adjacent residential units to demonstrate their effectiveness. The Landlord reserve the right to impose further noise limits if required.

x.8 Noise emissions from the cumulative effect of all items of plant shall achieve Local Authority requirements at noise sensitive adjacencies (both within and outside the development). All plant shall be adequately vibration isolated such that vibration is not perceptible within the residential apartments. All plant shall be adequately attenuated such that noise transmission through the structures is not audible within the residential apartments. The tenant shall provide details of proposals to The Landlord to demonstrate how the acoustic requirements are to be achieved for any air-handling, refrigeration, ventilation and filtration equipment to be installed.

10.0 RISERS

10.1 Acoustic Issues

There are two issues that need to be considered from an acoustic viewpoint:

(a) Potential flanking noise transfer across the separating floors via the risers.
(b) Potential fluid noise break-out from the risers. This issue is naturally important if any riser wall areas are found on to habitable rooms.

Where pipes pass through the floor slabs, it is advised that gaps around the pipework be sealed with full-depth concrete, although the pipes should have flexible collars to reduce the potential for structure-borne noise transfer. Care should be taken to ensure this flexible collar is not bridged.

10.2 General & Zoning

Vertical offsets (i.e. bends and horizontal runs) within SVP/ RWP pipework invariably give rise to noise problems, especially when found above habitable rooms (i.e. bedrooms, living rooms, living/ kitchens).

In the first instance, every effort should be made when designing the drainage to zone offsets away from habitable rooms.

The below recommendations should be employed as a last resort should rezoning offsets away from habitable rooms not be possible and may not result in ideal conditions in habitable rooms in all circumstances.

10.3 Vertical Runs

In non-habitable rooms the pipework should be independently boxed with 2 x layers of 12.5mm standard plasterboard (min. 8.5kg/m^2 each). There should be no contact whatsoever between the boxing/ associated framework & pipe. The pipework must remain independent. Within the boxing, introduce 25mm mineral wool (10 – 36kg/m^3). The mineral wool must not be packed and must remain uncompressed.

In habitable rooms we would recommend the boxing be upgraded from 2 x 12.5mm standard plasterboard to 2 x 12.5mm dense plasterboard (min. 10kg/m^2 each) and the mineral wool thickness increased form 25mm to 50mm.

10.4 Offsets and Horizontal Runs Measures

Should it not prove possible to zone offsets away from habitable rooms, then the design should incorporate the following:

(a) The offset (bends and horizontal run) should be formed from cast iron pipe or acoustic composite type pipe (e.g. Friaphon). The change to cast iron or acoustic composite type pipe should occur on the floor level above. The bends should be as gradual as possible (i.e. use 2 x 45 degree bends rather than 1 x 90 degree bend if possible).

(b) The pipework should be resiliently supported via brackets containing rubber inserts, the rubber being 5-10mm thick. In addition, the pipework penetration through the slab should be resilient.

(c) The pipework should be independently boxed with 2 x layers of 15mm dense plasterboard (min. 12kg/m^2 each). There should be no contact whatsoever between the boxing/ associated framework & pipe. The pipework must remain independent. Within the boxing, introduce 50mm mineral wool (10 – 36kg/m^3). The mineral wool must not be packed and must remain uncompressed.

(d) The construction of the boxing should be undertaken prior to the construction of any partitions. Partitions should therefore be notched around the boxing. No frame / partition should be in rigid contact with the boxing.

(e) The standard ceiling should then be introduced below, spaced off the boxing with a clear gap of 25mm (minimum). There should be no contact between the boxing and the ceiling frame.

The Figure 5 in Appendix C illustrates the above N.B. should there be a problem with head-height, then the framing and mineral wool could be omitted below the pipe provided a clear gap (between pipe and boxing) is maintained.

10.5 Non-Habitable Rooms

The above measures should also be introduced within non-habitable rooms (i.e. flat hallways, bathrooms, kitchens), although we do not consider a change of pipe type to prove necessary (i.e. the pipework can remain as standard PVC).

10.6 Services Penetrations and Access Hatches

Our recommended detailing for service penetrations of drywall structures is shown on Figure 4 in Appendix C.

Access hatches for risers should have the following acoustic performance:

- R_w 30dB for habitable rooms (living rooms, bedrooms, etc.) – (e.g. Exitile Multipurpose MP SB AC30).
- R_w 25dB for non-habitable rooms (Corridors, bathrooms, etc.) – (e.g. Exitile Acoustic AC/26/SB/FD).

11.0 INTERNAL WALLS

11.1 Criteria

Approved Document E sets a sound insulation requirement of 40dB R_w for:

(a) internal walls between bedrooms and other rooms
(b) internal walls between bathrooms and other rooms
(c) internal floors

N.B. the wall requirement does not apply to walls containing doors or to walls separating bedrooms from their associated en-suite bathrooms.

11.2 Internal Walls

We understand that the internal wall construction aims to achieve an enhancement over the minimum requirement of R_w 40dB given in Building Regulations. As stated in Section 2.2, the wall requirement does not apply to walls containing doors or to walls separating bedrooms from their associated en-suite bathrooms.

The following construction should be capable of achieveing R_w 47dB:

- 1 layer 15mm dense plasterboard (min. 12.5kg/m^2)
- 70mm metals stud at 600mm centres with 25mm mineral wool (minimum 10kg/m^3)
- 1 layer 15mm dense plasterboard (min. 12.5kg/m^2)

If a further enhancement is desired by the design team, for example between a living room and a bedroom or if higher levels of noise separation are desired in general, the following construction should be capable of achieveing R_w 53dB:

- 2no. layers 15mm dense plasterboard (min. 12.5kg/m^2)
- 50mm C-stud at 600mm centres with 25mm mineral wool (minimum 10kg/m^3)
- 2no. layers 15mm dense plasterboard (min. 12.5kg/m^2)

If wall mounted TV's are desired on these internal walls, then *either* the R_w 53 build-up could be used *or* a sacrificial lining could be built off the Rw 47 wall consisting of a 25mm Gyplyner + 12mm Ply + 12.5mm Wallboard.

Note that where possible, back to back sockets should be avoided, however where this cannot be avoided, putty pads could be applied to the rear of the sockets.

12.0 REVERBERATION WITHIN COMMON PARTS

Requirement E3 of the Building Regulations requires common areas within buildings containing flats be acoustically treated to reduce the build-up of reverberant sound.

12.1 Extent

It has been clarified by the Communities and Local Government (CLG) that only areas giving direct access to the residential accommodation need to be considered.

Based on the current drawing layouts we understand that stairwells are separated from the common areas, giving direct access to dwellings, by doors. Treatment could therefore be limited to common corridors in both the private and affordable areas, excluding the stairwell areas.

12.2 Absorption Treatment

In accordance with Method A of Section 7.0 of the Approved Document E, an absorptive ceiling achieving Class C (or better – Class A being the most absorptive) status should be introduced throughout the above stated areas.

Class C status can typically be achieved by the following ceiling types – the ceiling manufacturer will be able to confirm the absorption rating of any particular product:

- Mineral fibre tiles within a lay-in grid system
- Perforated metal tiles backed with mineral wool within a lay-in grid system
- Perforated/slotted plasterboard products

It may prove possible to relax the ceiling specification (in terms of both absorption rating and extent) if detailed calculations are undertaken in accordance with Method B of Section 7.0 of the Approved Document E. This method takes in to account the absorption of other surfaces within the common areas under consideration, such as carpeted floors. We can naturally undertake such calculations should it be desired to implement any specific ceiling not achieving Class C status to determine its suitability.

The main issue is typically with regard to accessibility to any services in the ceiling void. If access is required, the optimum solution would be to install a mineral fibre lay-in grid type ceiling (e.g. Ecophon, Armstrong or similar). If no access is required, a perforated plasterboard ceiling (e.g. British Gypsum Gyptone or similar) could be installed.

We would of course be pleased to review any options you select as to their acoustic suitability.

N.B. the above is concerned with the reduction of reverberant noise build-up. Although horizontal impact noise transfer is not covered by the Regulations, hard floor finishes (such as ceramic tiles) may result in horizontal impact noise transfer from the stair cores and corridors to adjacent bedrooms and we would therefore advise consideration be given to the introduction of a soft floor covering (e.g. carpet) or resilient underlay within these areas.

13.0 CONCLUSIONS

A review of construction allowances has been undertaken for the development at the 140-146 Camden Street, London.

Recommendations have been given for internal building fabric elements in order for the scheme to be compliant with Building Regulations (2010) Approved Document E (2003).

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10}, L_{A90})	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiply the two scores and is then used to determine the course of action.

Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

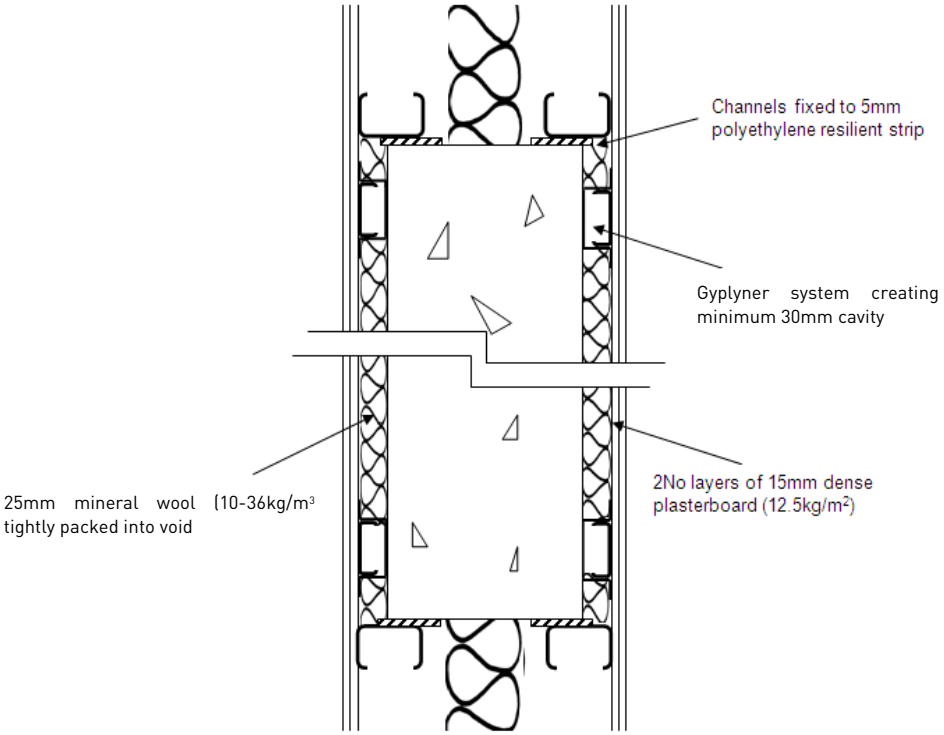
The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3

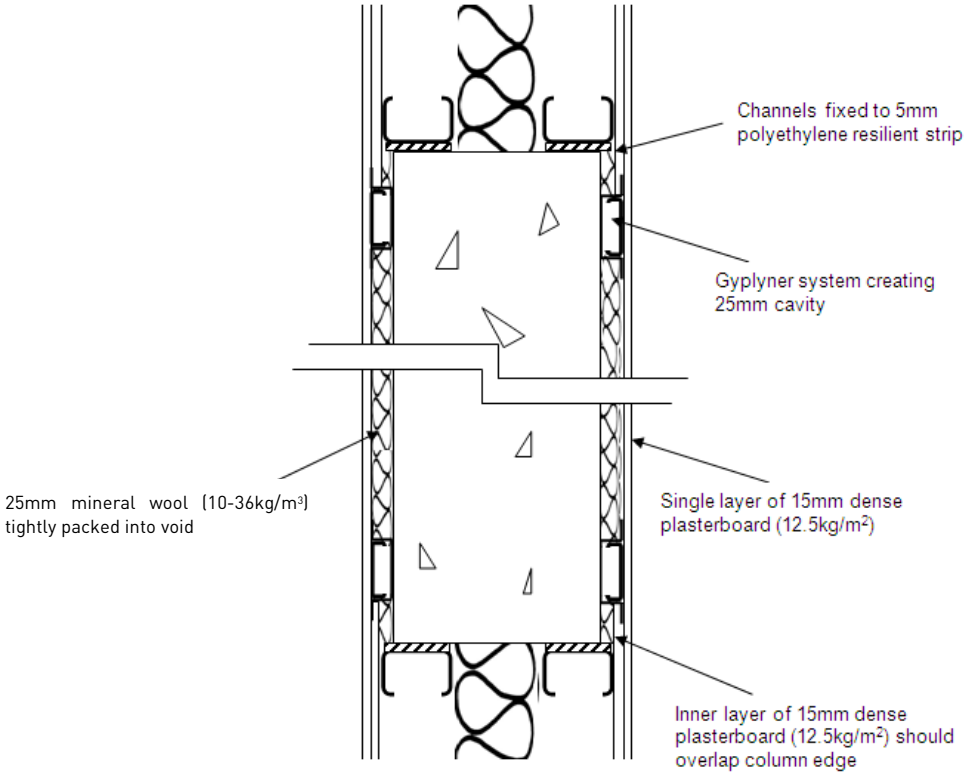
L: Likelihood S: Severity R: Rating

Appendix C – Details

Critical Long Concrete Column/ Shear Wall Detail



Non-critical Long Concrete Column/ Shear Wall Detail



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Shear Wall / Column Treatments

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Figure 1

11 January 2021

Not to Scale

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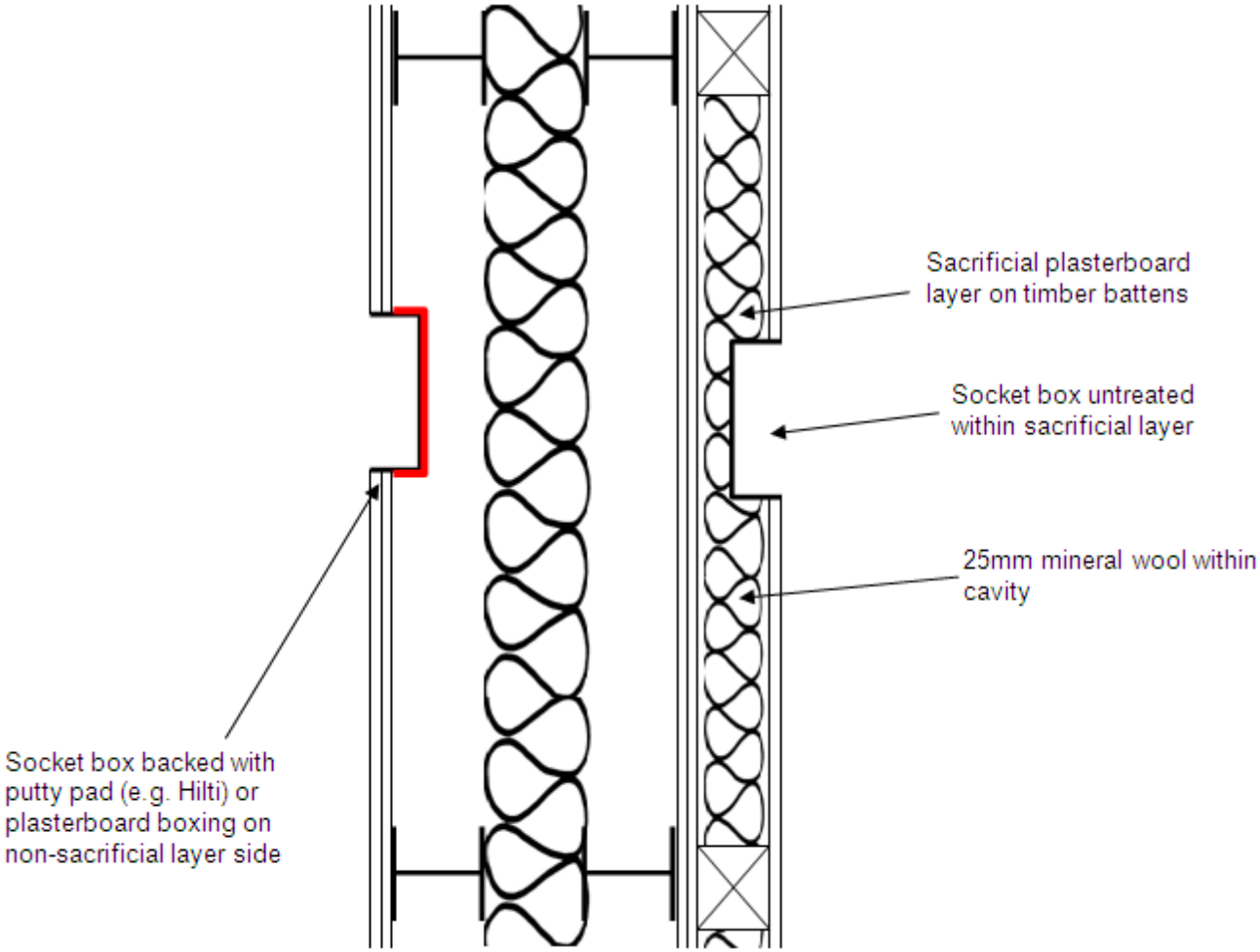

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Socket Penetration Details

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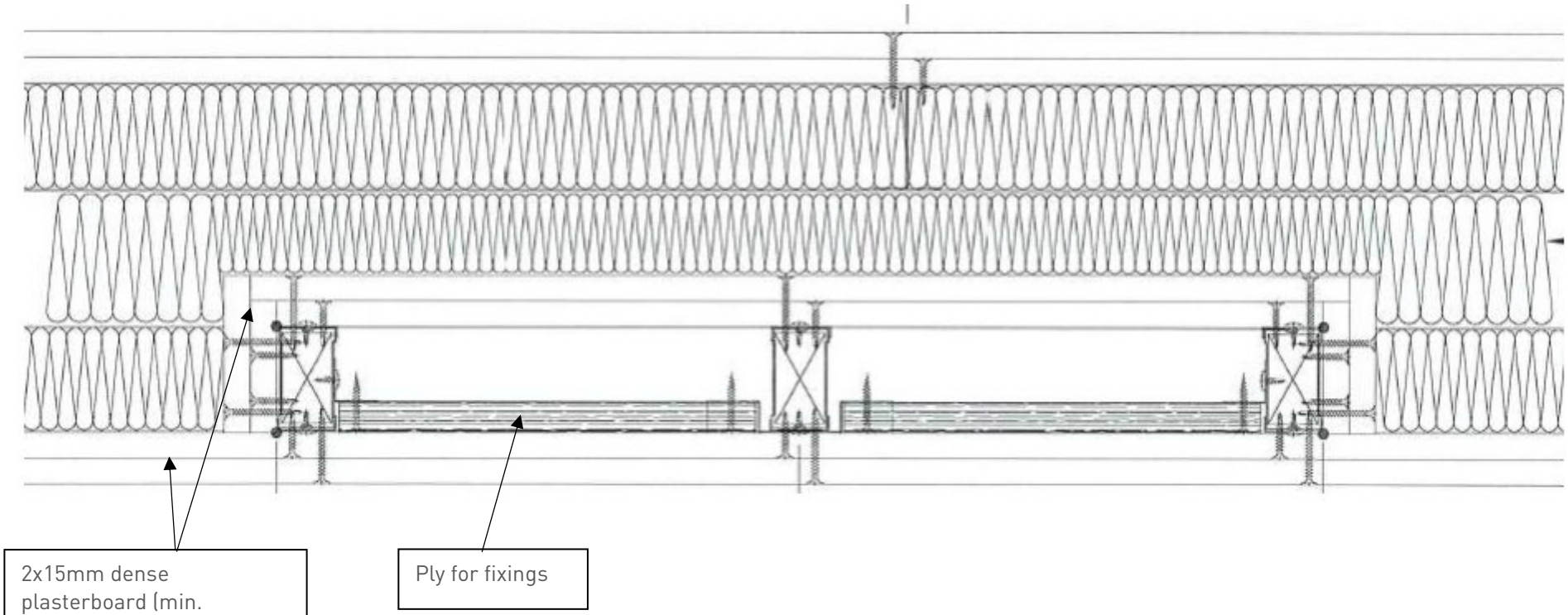
Figure 2

11 January 2021

Not to Scale

RBA ACOUSTICS



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Baffle Box Detail for TVs

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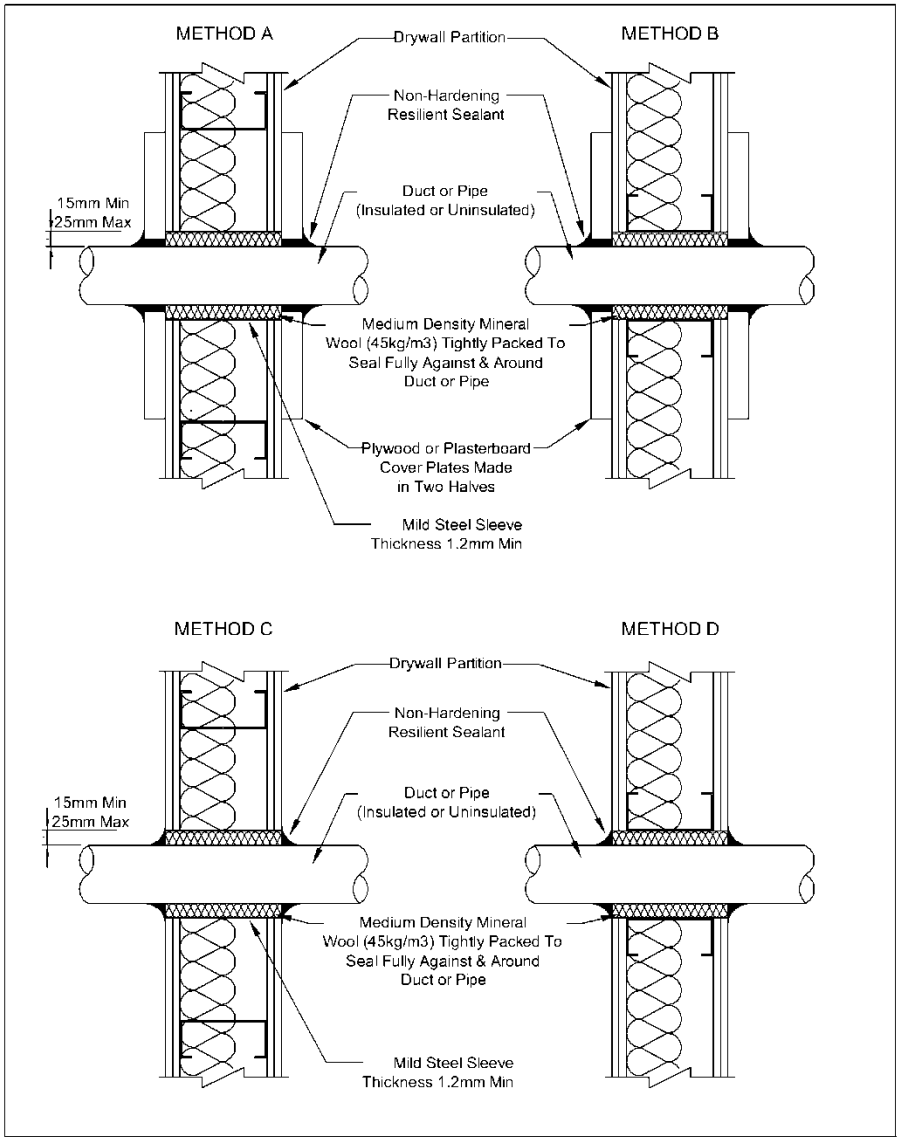
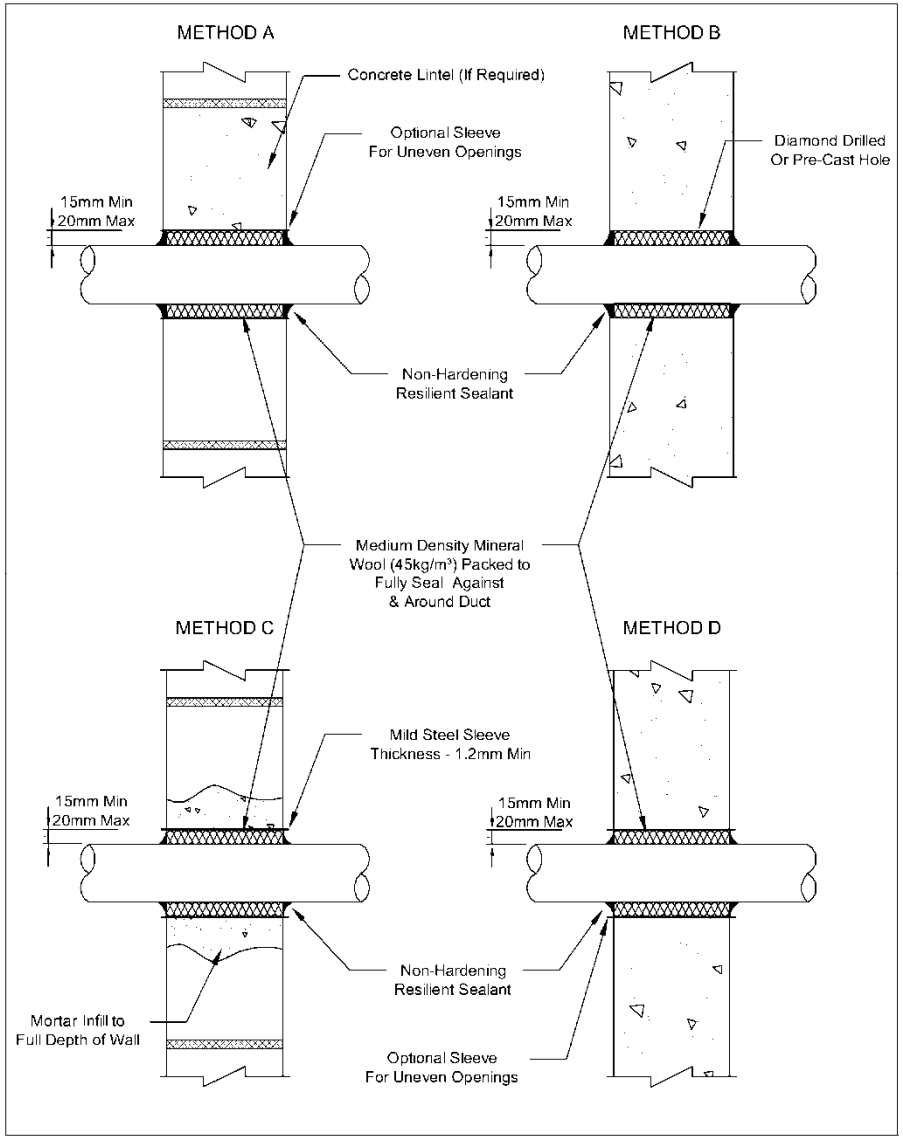
Figure 3

11 January 2021

Not to Scale

RBA ACOUSTICS





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Drywall / Masonry Penetration Details

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Figure 4

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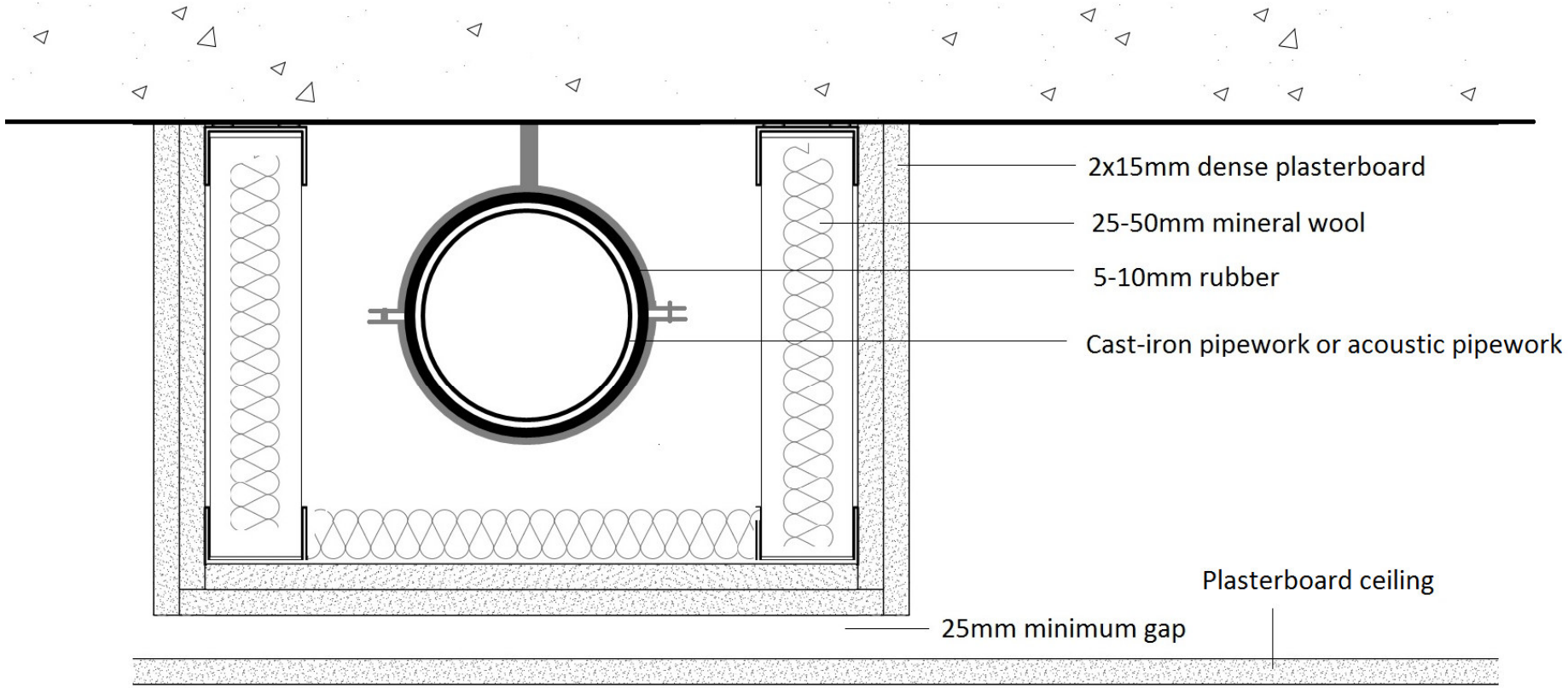
Not to Scale

RBA ACOUSTICS



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Pipework Offsets Boxing Detail

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Figure 5

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Not to Scale

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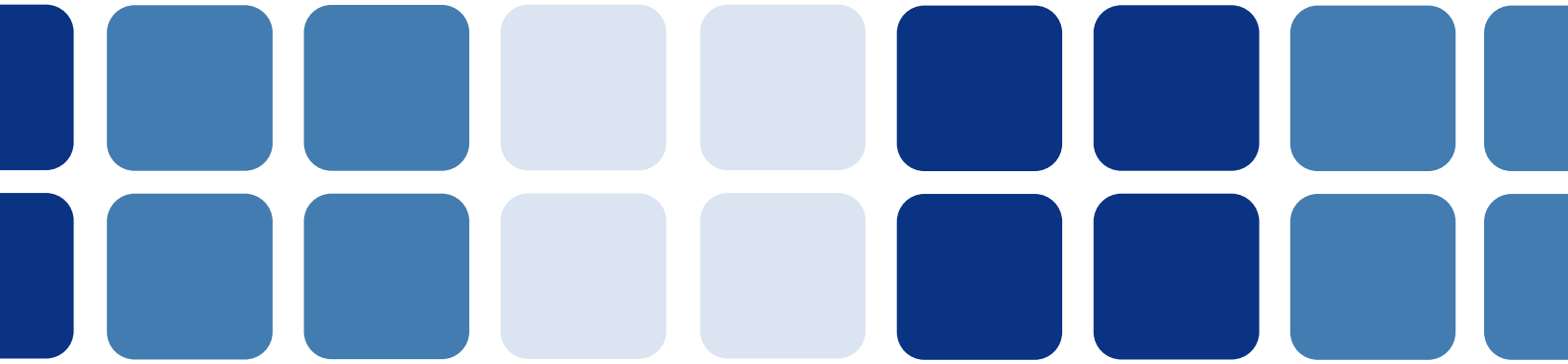

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