RBA ACOUSTICS

7 WIMPOLE STREET

Vibration Isolation Strategy

Reference: 10707.RP02.VIS.0
Prepared: 26 May 2021
Revision Number: 0

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	26 May 2021	Joe Allen	Torben Andersen

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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 in to full working drawings by the lead designer to incorporate all other design disciplines.

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1.0 INTRODUCTION

The redevelopment of 7 Wimpole Street, London W1 to provide a single-family dwelling is proposed. The London Underground Jubilee Line runs close to the property which is affected by groundborne noise and vibrations due to these underground train movements.

An assessment undertaken in March 2021 demonstrates that worst case re-radiated noise levels within the building are in the region of 40-45 dBA $L_{max(slow)}$ which are considered excessive given the nature of residential properties.

Due to the current typical re-radiated noise levels, it has been agreed that the vibration isolation strategy target a reduction to existing groundborne noise of 10-15dBA within the lower ground floor level staff quarters. This will be commensurate with achieving reasonable levels within these areas. Additionally, it was desired to achieve some reduction at ground level within the library and dining room.

Following discussions held between the project manager, architect, client, and ourselves, due to the nature of the existing building it is considered the best strategy to create a box-in-box system for the staff quarters at lower ground floor level. At ground floor level, it is desired to only try to isolate the floor, which is considered to be the main source of re-radiated noise within these areas.

This report presents an isolation strategy for the development.

2.0 OUTLINE OF TREATMENT SOLUTION

2.1 Introduction

A meeting was held on 13 May 2021 with the design team. During this meeting, numerous potential solutions were discussed and the various implications of each addressed.

After discussion, the following measures are proposed:

- Box-in-box solution within the staff areas, i.e. floating screed, independent wall linings, and a drop ceiling
- Floating timber floor solutions within library and dining room areas at ground floor

Performance specifications for each of these items is provided within the following sections along with some issues we would suggest be considered by the key design team members.

It is expected that these specifications will be reviewed by the Structural Engineer, Architect, Contractor and Product Supplier in order to ensure there are no non-acoustic issues relating to the proposals e.g. Fire. These can subsequently be incorporated into the design drawings by the Structural Engineer and Architect.

2.2 Staff Suites

A box-in-box solution is required within the staff suites which will comprise a floating floor, independent wall linings built up off the screed, and an acoustically hung ceiling. The following provides a detailed specification for each item.

We would expect the full implementation of the following to achieve a noise reduction of 10-15dB within the staff suite areas due to re-radiated noise from underground train movements.

Floating Floor

The floating floor would comprise the following:

- Concrete slab (approximate depth 100mm)
- Metal deck supported on resilient bearing creating a minimum void of 50mm

The deck should have edging protection to ensure concrete does not pour over the edges. A gap should be left between the new floating floor and the existing walls.

Figure 2 provides an example of this detail.

Independent Wall Lining

The independent wall lining should comprise the following:

- Existing wall
- Nominal 10mm gap
- 48mm independent metal I-studs creating approximate 60mm void
- 50mm Mineral Wool between studs
- 1 layer of 10mm CPB
- 2No. layers of 15mm dense plasterboard (min. 12.5kg/m^2 each)

This would equate to an overall dimension of 100mm from the existing walls.

The wall lining should be built up off the floating floor and should not connect with the existing structure. At the head it would be fixed into the acoustically hung ceiling.

The independent wall lining should also be installed on all walls within both staff suites. Figure 1 indicates the relevant walls on the proposed site plan.

Figure 2 provides an example of this detail.

Acoustically Hung Ceiling

The ceiling should comprise the following:

- Acoustic hangars supported from the existing joists creating 200mm void
- 100mm mineral wool within cavity
- 3No. layers of 15mm dense plasterboard (min. 12.5kg/m^2 each)

It is understood the existing plaster ceiling is being retained. The acoustic ceiling will require penetration of the existing ceiling in order to fix to the joists.

Figure 2 provides an example of this detail.

Optional – Staff Suite Separating Walls

The walls within the staff suite areas (i.e. separating wall between staff suites and walls with doors to staff each staff suite, as marked on Figure 1) will contain vibrational energy and will therefore need to be treated. The first option would be to line the wall with the independent wall lining, as detailed previously. However, two other (more intrusive but with a lower loss of floor area) options are also available:

Option 1 – Construct a new wall

The existing wall will be removed, and new walls will be constructed, built up off the floating slab and abutting the acoustic ceiling. The wall construction should comprise the following:

- 2No. layers dense plasterboard (min. 12.5kg/m^2 each)
- 70mm Metal studs with 50mm mineral wool between studs
- 2No. layers dense plasterboard (min. 12.5kg/m^2)

Option 2 – Isolate existing wall

The existing wall can be isolated by installation of resilient bearings within the existing walls. This is to be achieved by incrementally removing out bricks from the walls (for the full depth of the wall) between the existing slab and the floating floor creating a void within the walls. Resilient bearings (having a natural frequency of 15Hz) are then placed within the brick void.

2.3 Dining Room

It is understood that independent wall linings within the dining room are not possible / desired. However, isolation of the floor within the dining room is recommended. This will be achieved by removing the existing floorboard and timber joists and installing the following floating floor system on the concrete between the steel beams:

- 1 layer 18mm plywood
- 3No. layers of 10mm CPB
- Resilient bearings plus floor supporting system with 100mm mineral wool in the void
- Existing clinker floor supported between steel beams

This can be built up to the required depth to ensure that the floor within the dining room is level with the floor throughout the ground floor so that a step is not required. The void would therefore be 128mm.

Figure 3 provides a sketch of the construction.

We would expect the above to lead to a noise level reduction of approximately 2-3dB within the dining room due to noise from train movements.

2.4 Library

As with the dining room, it is understood that independent wall linings are not desired, but that a possible solution for isolating the floor would be considered. It is understood that the options within the library are limited as it is not possible to remove the existing joists. The following solution will provide floor isolation, but will lead to an increased depth of floor construction (i.e. a reduction in floor-to-ceiling height).

Within the library, the existing floorboards should be removed. It is then recommended to install battens between the existing floor joists and lay a layer of board on these battens at the appropriate height of the joists, to effectively create a new supporting floor system halfway down the joists. This will then be used to support the following isolated floor construction:

- 1 layer 18mm plywood
- 3No. layers 10mm CPB
- Resilient bearings plus supporting floor system creating minimum 100mm void with 100mm mineral wool
- New floor supported between joists

A minimum clearance of 10mm between the CPB and the joists must be provided. The minimum depth above the existing joists would therefore be approximately 52mm, leading to a reduced floor-to-ceiling height of the same dimension. This would lead to a step up that would be required when entering the library from the hallway.

Figure 4 provides a sketch of the construction.

We would expect the above to lead to a noise level reduction of approximately 2-3 dB within the library due to noise from train movements.

2.5 Performance Specification

The bearing supplier shall ensure that the floor isolation systems shall provide a vertical natural frequency of 15Hz when loaded to the estimated normal working load, defined as the full dead load plus the estimated normal live load (typically 0.3 times the maximum live load). It is expected that a 50mm resilient bearing will be required in all locations. Additionally, the acoustic ceiling hangars will need to be designed to provide a vertical natural frequency of 15Hz when loaded with the ceiling construction.

In order to design the bearings, the suppliers will need information on the loading of the floors in the relevant locations (dead and live loads) and the loading spacing layout.

Typical suppliers for the above products would be TVS Acoustics, CDM-UK, Mason UK, and Farrat. Contact details are attached separately.

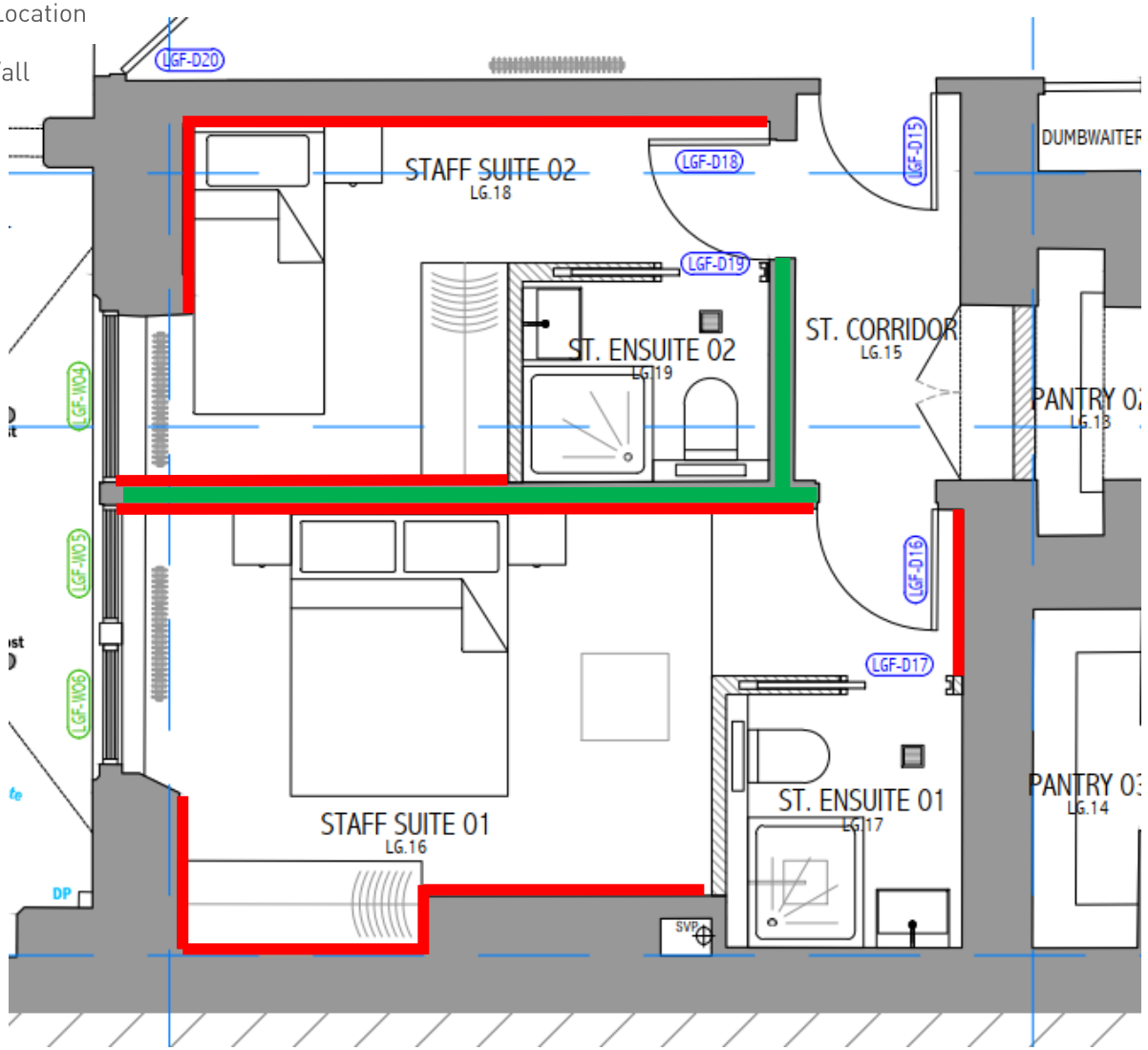
Appendix A - Acoustic Terminology

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 – Figures

Independent Wall Lining Location

Option 1 and 2 Isolation Wall



7 Wimpole Street
Lower Ground Floor Site Plan
Project 10707

Figure 1
26 May 2021
Not to Scale

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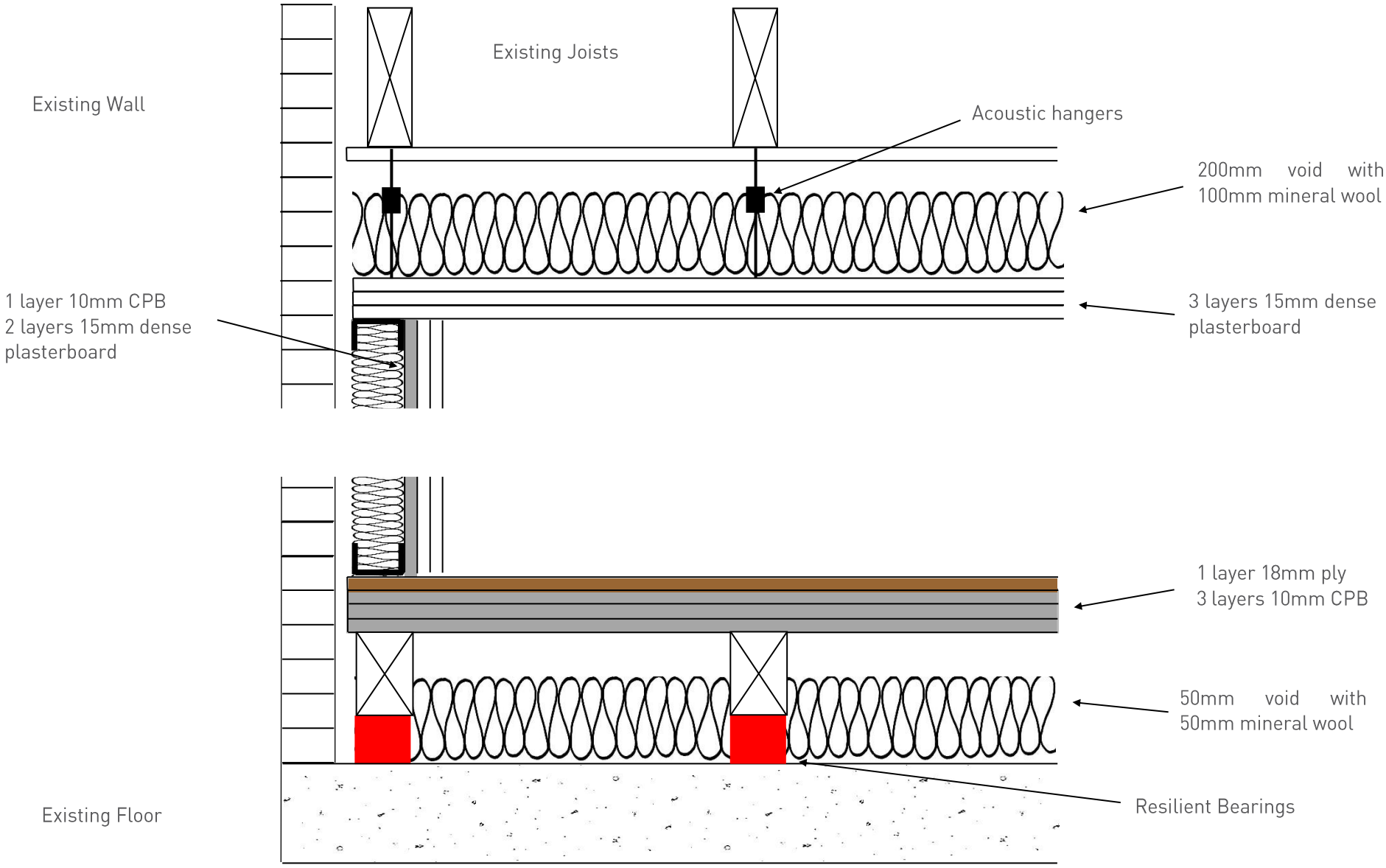

7 Wimpole Street
Staff Suite Box-in-Box Sketch
Project 10707

Figure 2
26 May 2021
Not to Scale

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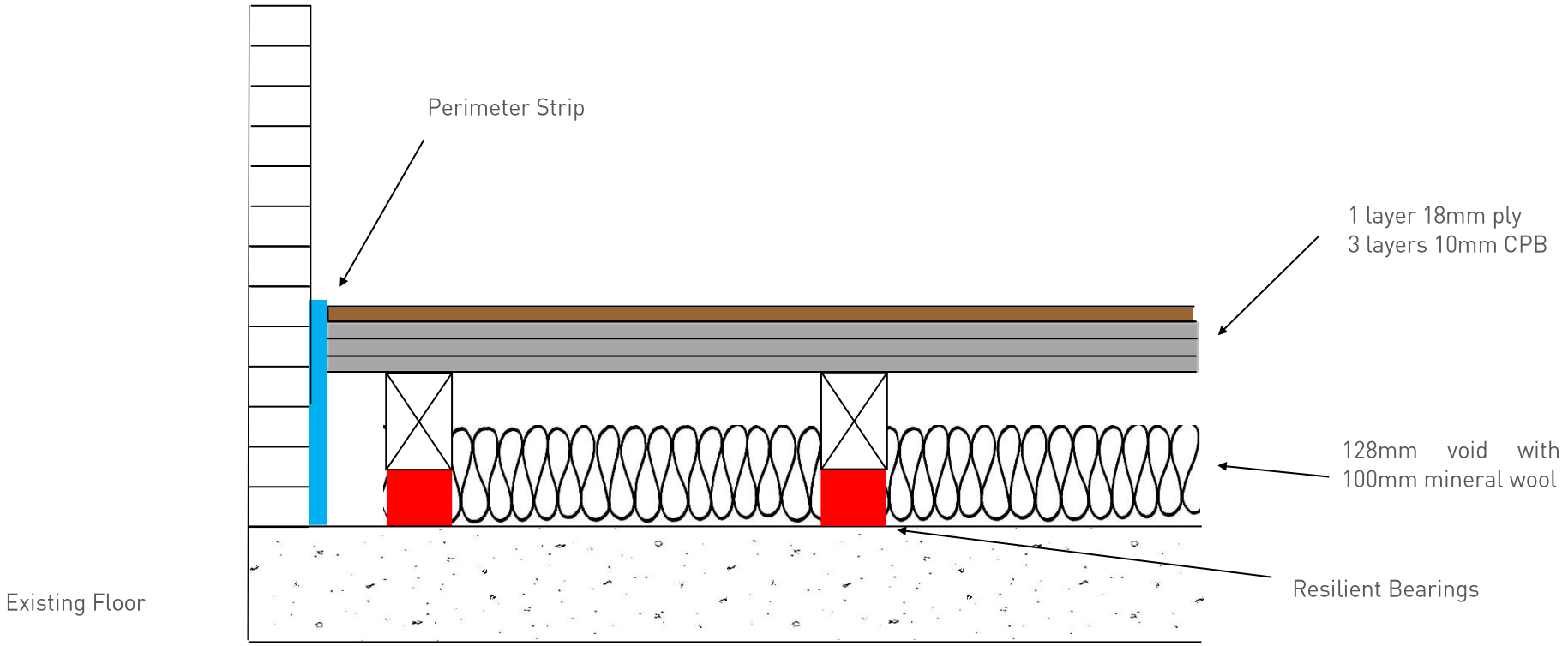

7 Wimpole Street
Dining Room Floor Isolation Sketch
Project 10707

Figure 3
26 May 2021
Not to Scale

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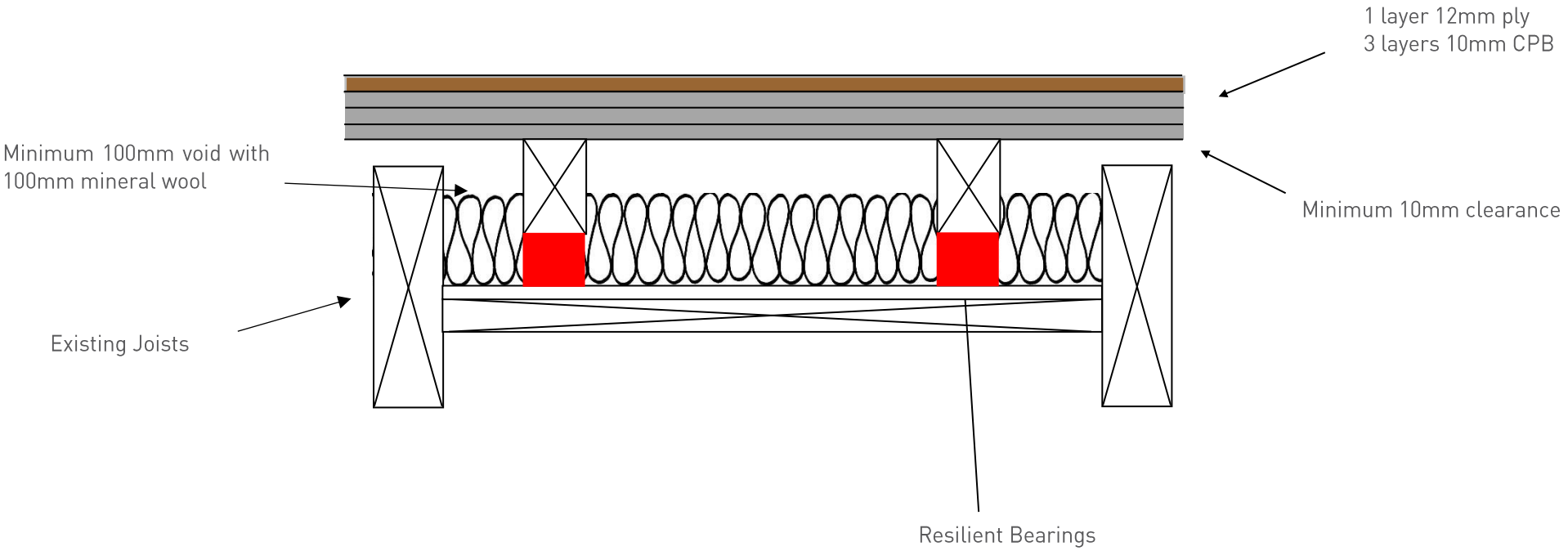

7 Wimpole Street
Library Floor Isolation Sketch
Project 10707

Figure 4
26 May 2021
Not to Scale

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