BUROHAPPOLD ENGINEERING

Design Note

Project	St. Giles' Circus. Zones 1&2
Subject	Discharge of Planning Condition 20
Project no	032930
Date	23 February 2016

Revision	Description	Issued by	Date	Approved (signature)
00	For Issue	MDR	26/02/16	MH

1 Planning Condition 20

The aim of this document is to provide evidence for the discharge of Planning Condition 20 for the St Giles' Circus Development Zones 1&2.

Condition 20 states:

'Before the residential units are occupied, sound insulation shall be provided between all B1, A1, A3, A4 floor space or plant rooms to adjacent floors within the same building or adjacent properties on the same floor, in accordance with a scheme to be submitted to and approved in writing by the local Planning Authority prior to the commencement of development. The use shall thereafter not be carried out other than in complete with the approved scheme.'

The condition refers to controlling the sound insulation between residential units of the development and the retail and office spaces (B1, A1, A3, A4) and also the plant room in Building D.

The residential uses are Building D in Zone 1 and the residential units in Zone 2, at the 21 to 26 Denmark St buildings.

Condition 20 does not refer to internal partitions within residential units, or to separating partitions between residential units, therefore, they are considered to be out of the scope of this document.

The figures below, show mark-ups of the type of use for each unit of zones 1&2 of the development. These identify that:

- Most circumstances relating to Planning Condition 20 concern the adjoining floor between offices and residential units.
- In Building D, this is extended to include one compartment wall and a floor adjoining a retail space and an office space.
- In Building 21 Denmark St. this is extended to include a compartment wall adjoining an office space.
- In Building 26 Denmark St. this extended to include a compartment wall adjoining an office space and compartment walls adjoining retail spaces.

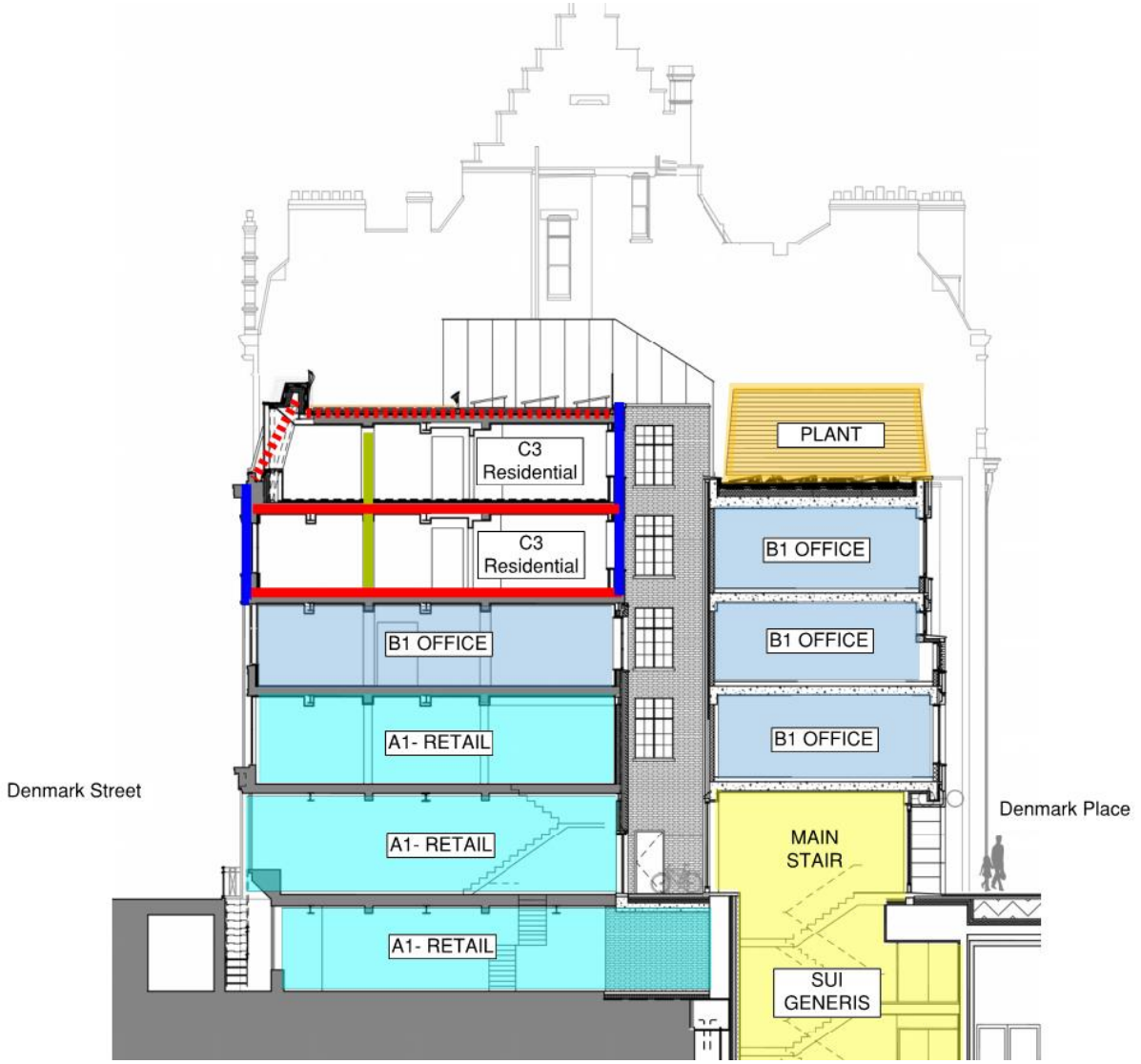

Figure 1. 21-25 Denmark St residential units typical section

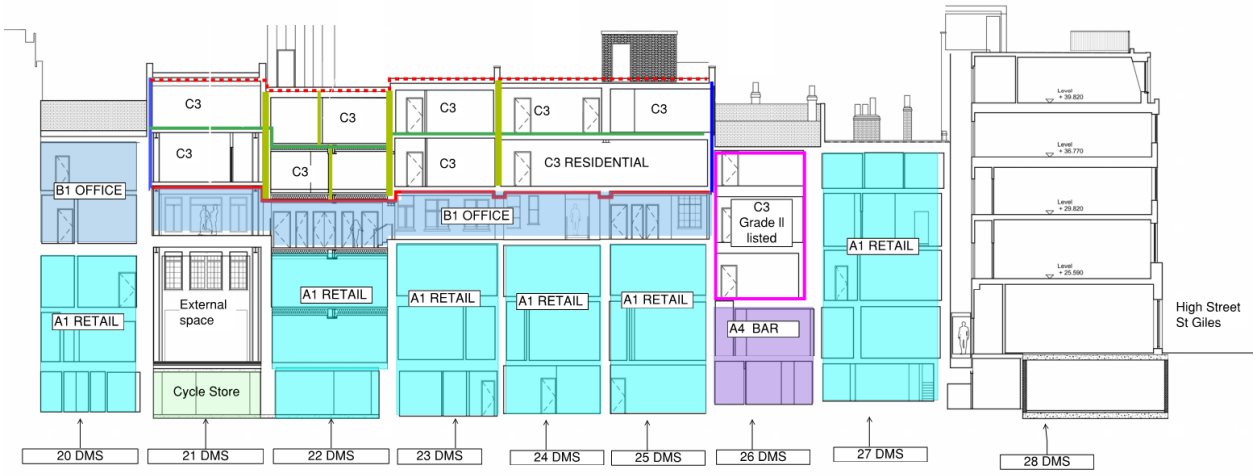

Figure 2. 21-26 Denmark St residential units typical section

Figure 3 Building D residential units typical section

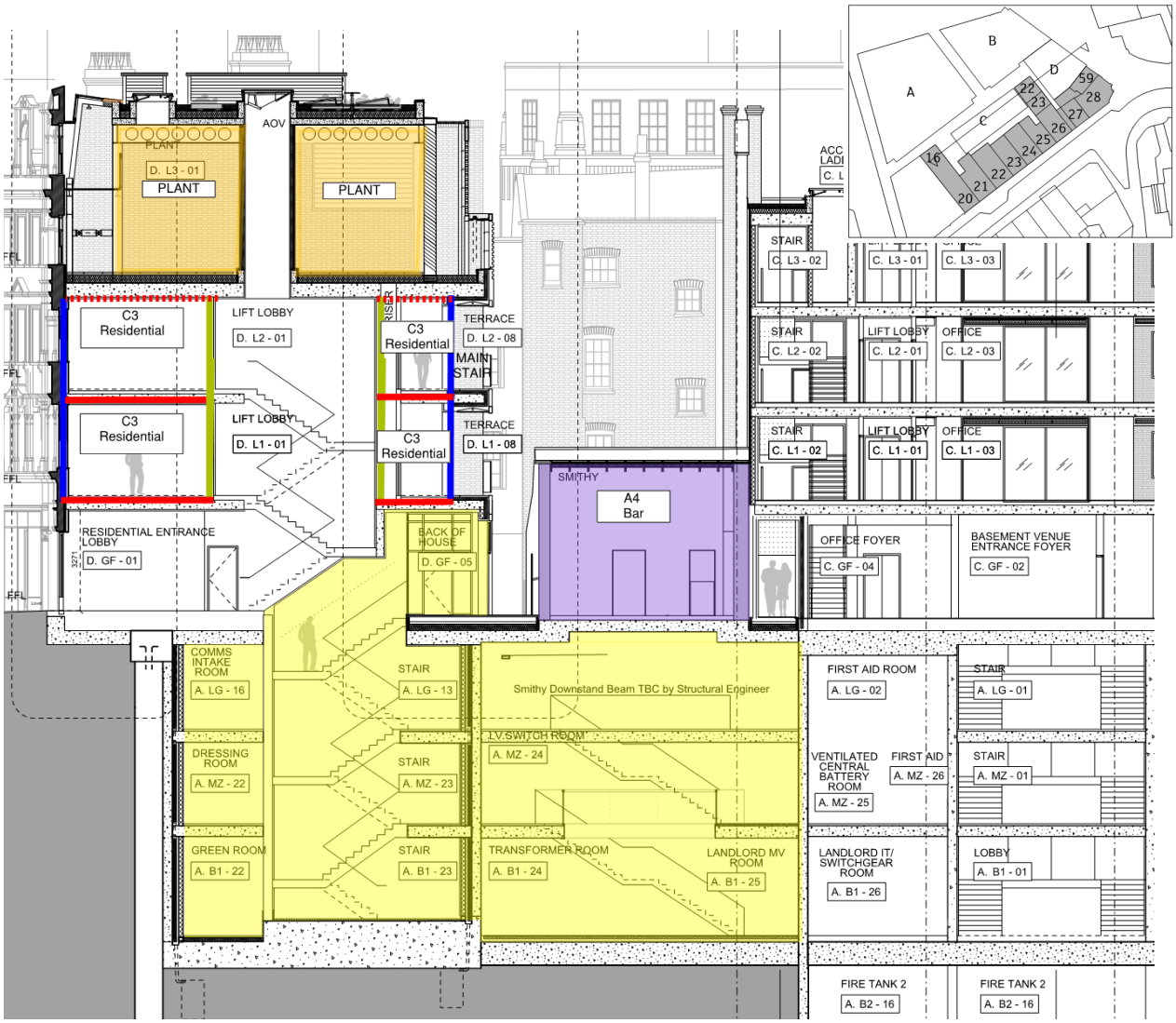

Figure 4. 21-25 Building D typical section

2 Acoustics Criteria

2.1 Internal noise criteria

The internal noise level in any unoccupied room is a function of:

- The exterior noise level and the sound insulation provided by the building envelope (facades, roofs, windows, external doors, vents and louvers)
- The sound insulation provided by internal separating walls and partitions (as fitted – including the effects of flanking transmission, reduced sound insulation through glazing and doors, reduced sound insulation due to penetrations in partitions)
- The noise caused by mechanical and electrical plant

Internal noise criteria in published standards and guidance tends to exclude any activity noise caused by occupants of a building.

2.1.1 Internal noise criteria for residential units

For bedrooms, the World Health Organisation guidance for internal noise level during night time hours has been noted (WHO, 1999)

In dwellings. The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source.

The design intent is to match the WHO quality standard for bedrooms at night (2300hrs – 0700hrs).

The design intent is to achieve the indoor ambient noise standards set out in BS 8233: 2014 during the day which is 35 dB $L_{Aeq,16hr}$ for bedrooms (for daytime resting) and in living rooms and 40 dB $L_{Aeq,16hr}$ for dining rooms.

2.2 Sound insulation requirements of internal partitions

2.2.1 Building D (Zone 1) & Buildings 21-25 Denmark St. residential refurbishment

The refurbished residential elements of the scheme for the non-historic buildings have been set in accordance with the requirements of Approved Document E and Code for Sustainable Homes.

The ambition has been to design the sound insulation of these buildings to achieve up to **4 credit level** under Code for Sustainable Homes with

- Airborne sound insulation values are at least 8 dB higher and
- Impact sound insulation values are at least 8 dB lower

than the performance standards set out in the Building Regulations approved for England and Wales Approved Document E. See panels 1, 2 and 3 below with requirements. This is possible for separating walls and floors in Building D and for the compartment walls in buildings 21 to 25 Denmark St. Nevertheless it is not possible to be achieved by the separating floors in 21 to 25 Denmark St. Therefore, this floors are expected to achieve just the minimum sound insulation requirements of Approved Document E.

2.2.2 Building 26 Denmark St. historic building residential refurbishment

Appendix A gives the design requirements for the historic buildings.

2.2.3 Plant rooms

In order to achieve the interior noise requirements set out in Section 2.1.1, partitions and floors should be rated at not less than R_w = 60 dB.

3 Evidence for the discharge of Planning Condition 20

3.1 Strategy

The sound insulation standards adopted for the development are summarised in Section 3.2. Example build-ups developed by the design team are given in Section 3.3.

3.2 Resume of sound insulation design standards

The development has been designed to the following standard:

- **Residential units with retail/offices for non-historic buildings (building D and buildings 21 to 25 Denmark St)**:

These will follow the minimum acoustic requirements of Approved Document E:

Acoustic performance standards for separating **walls, floors and stairs (when they have a separating function)**

$D_{nT,w}$ +C_{tr} = 45 dB (airborne sound insulation) or 42 dB for cases where there is material change of use

$L_{nT,w}$ = 62 dB (impact noise criteria for floors) or 64 dB for cases where there is material change of use

- **Residential units with retail/offices for historic buildings (building 26 Denmark St.):**

Maintain or improve the sound insulation performance before refurbishment and allow achievement of the indoor ambient noise levels requirements within the residential units.

- **Residential units with plant rooms**

In order to achieve the interior noise requirements set out in Section 2.1.1, partitions and floors should be rated at not less than **R_w = 60dB**. Ideally, when adjacent to residential units, the rating is increased to R_w = 80dB.

3.3 Zone 1. Building D

The separating partitions between residential units and other uses for Building D are the following:

- **Separating floor between plant room (Level 3) and residential unit (Level 2).**

The following floor build-up was proposed in Stage 4 acoustics report for Zone 1:

- Floor finish
- Thermal insulation
- 400mm concrete slab minimum

The plant will be sitting on plinths. Any of the following elements of plant shall be provided with antivibration mounts:

- fans
- AHUs
- compressors
- chillers
- motors
- transformers
- boilers
- pumps
- ducts*
- pipes*

*Ductwork and pipes shall be resiliently supported from the primary building structure using resilient hangers.

- **Separating floor between residential unit on 1st floor and retail/food/beverage on Ground floor.**
  - 300mm concrete slab

- **Party walls with office/retail in Building B**
  - 250 mm concrete wall
  - Internal dry lining

- **Party walls with retail in Building 27**
  - 400 mm brick/block cavity wall
  - Internal dry lining

These party walls/floors are expected to meet the sound insulation requirements of Approved Document E and the indoor ambient noise levels within residential units recommended by the WHO.

3.4 Zone 2. Buildings 21-26 Denmark street

The separating partitions between residential units and other uses for Buildings 21-26 Denmark Street before refurbishment are minimum 400mm brick work. As part of the refurbishment, additional dry wall linings will be added. The existing build-up before refurbishment already shows exceedance in the compliance with Approved Document E sound insulation requirements.

3.4.1 Walls:

- **21 Denmark St. residential unit – 20 Denmark St. Office 3rd floor.**

The results of the in situ tests show a sound insulation $D_{nT,w}+C_{tr}$ 53dB which implies an enhancement of ADE by 8dB (which is compliant with 4 credits under CfSH)

- **25 Denmark St. office – 26 Denmark St. residential unit 2nd floor.**

The results of the in situ tests show a sound insulation $D_{nT,w}+C_{tr}$ 52dB which implies an enhancement of ADE by 7dB (which is compliant with 3 credits under CfSH)

- **25 Denmark Str. Retail – 26 Denmark Street residential 1st floor.**

400 mm brick/block cavity wall

Internal dry lining

- **26 Denmark St. residential unit – 27 Denmark St. retail 1st floor**

400 mm brick/block cavity wall

Internal dry lining

- **26 Denmark St. residential unit – 27 Denmark St. retail 2nd floor**

The results of the in situ tests show a sound insulation $D_{nT,w}+C_{tr}$ 53dB which implies an enhancement of ADE by 8dB (which is compliant with 3 credits under CfSH)

- **26 Denmark St. residential unit – 27 Denmark St. retail 3rd floor**

The results of the in situ tests show a sound insulation $D_{nT,w}+C_{tr}$ 56dB/ $D_{nT,w}+C_{tr}$ 58dB

which implies an enhancement of ADE by 11 / 13dB (which is compliant with 4 credits under CfSH)

3.4.2 Floors:

- **Buildings 21, 23, 24 Denmark St. 3rd floor – Office on 2nd floor:**

The sound insulation performance of this existing floor has not been tested. Nevertheless, the separating floor between residential unit on 4th floor and 3rd floor for the same buildings were tested and can provide an idea of what the existing performance of the floor is.
The results of the in situ tests of the floors between 4th and 3rd levels show a sound insulation between $D_{nT,w}+C_{tr}$ 34dB and 45dB with impact noise levels within the maximum recommended by ADE. The airborne sound insulation of this floor needs to be improved. See below an example of build-up developed by the design team that is expected improve the existing sound insulation performance before refurbishment:

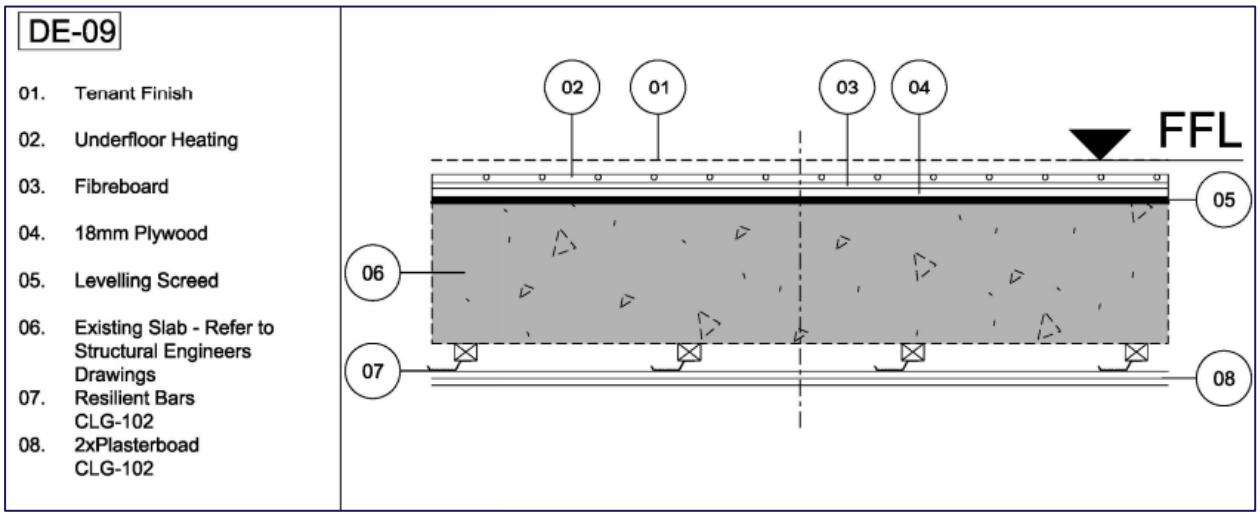

Figure 5. Example of floor build-up between 21, 23, 24 Denmark St. 3rd floor and office 2nd floor

- **Building 22 Denmark St 3rd floor – office on 2nd floor:**

The sound insulation performance of this existing floor has not been tested. Nevertheless, the separating floor between residential unit on 4th floor and 3rd floor for the same building were tested and can provide an idea of what the existing performance of the floor is.

The results of the in situ tests of the floors between 4th and 3rd levels show a sound insulation $D_{nT,w}+C_{tr}$ 34dB with an impact noise levels within the maximum recommended by ADE. The airborne sound insulation of this floor needs to be improved. See below an example of build-up developed by the design team that is expected improve the existing sound insulation performance before refurbishment:

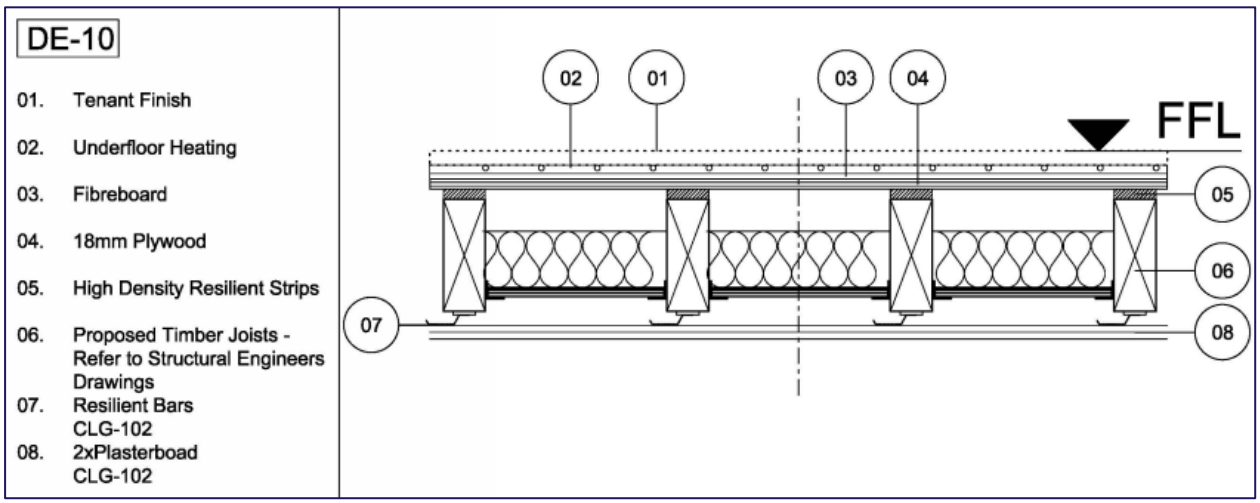

Figure 6. Example of floor build-up between 21, 23, 24 Denmark St. 3rd floor and office 2nd floor

- **Building 26 Denmark St. 1st floor – Bar on Basement:**

Two options for this floor were proposed by the design team and included in 26 Denmark St. Redevelopment Stage 3 Acoustics Report. Both options are expected to improve the existing sound insulation performance before refurbishment.

- **Proposed floor build-up 1:**

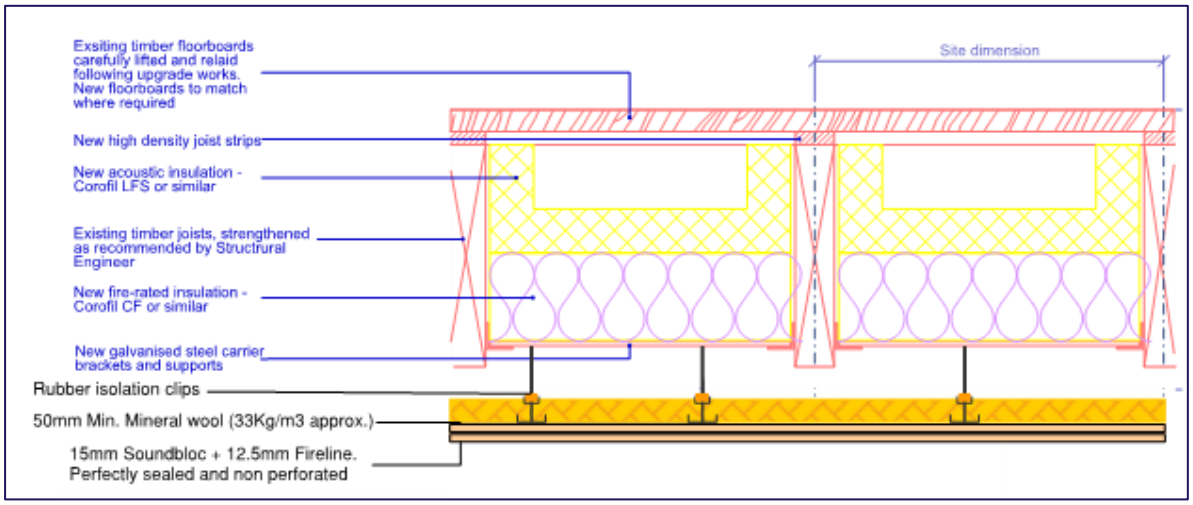

Figure 7. Proposed separating floor build-up between residential unit – drinking establishment. Option 1

- **Proposed floor build-up 2:**

The existing 30mm timber floor will be improved by adding 2x10mm cement board (1200Kg/m^3 min.).

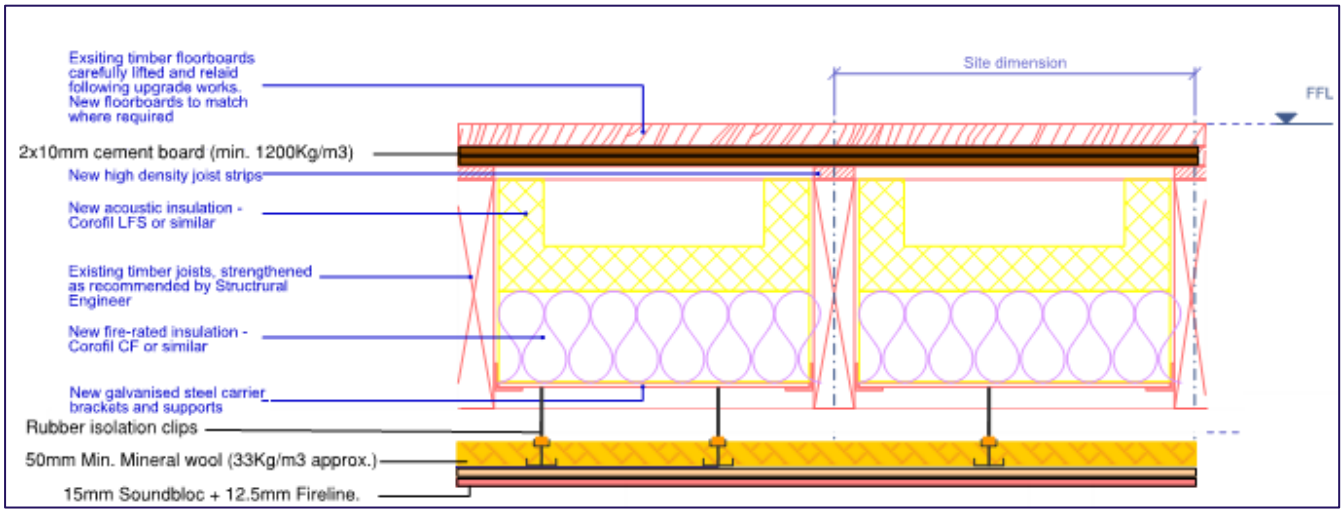

Figure 8. Proposed separating floor build-up between residential unit – drinking establishment. Option 2

4 Consideration of noise levels in offices, retail and food/beverage units

The party floors and walls build-ups presented in this document are expected to meet the indoor ambient noise levels recommended by the WHO in the residential units for the following maximum indoor ambient noise levels within the non-residential adjoining spaces:

Room	NR	Equivalent L_{Aeq} (dBA)
Restaurant	NR70	75
Retail spaces	NR 55	60
Bar	NR 70	75
Plant rooms	NR 70	75
Offices	NR 50	55

5 Summary

This document provides evidence for the discharge of Planning Condition 20. This condition requires to control the sound insulation between residential units and any other use of the development.

The existing sound insulation performance of part of the construction elements subject to compliance with this condition have been tested previous to refurbishment. The results of the in situ test show compliance with the minimum acoustic requirements for the party walls. The sound insulation performance of part of the separating floors needs to be improved. Examples of suitable floor build-ups to comply with Condition 20 have been developed by the design team. These will allow to meet the indoor ambient noise levels requirements within residential units for the expected indoor ambient noise levels in the adjoining non residential spaces.

Appendix A Sound insulation requirements of internal partitions for historic buildings residential refurbishment

The refurbished residential elements of the scheme that are undertaken in historic buildings will be assessed under the BREEAM Refurbishment 2012 Scheme (CN10 of HEA02).

This building is the following in Zone 2:

- 26 Denmark Street Grade II listed building

For attached dwellings within Historic Buildings, as defined by Approved Document E , the following credit requirements apply:

- *Pre-completion testing should be carried out before and after refurbishment by a Suitably Qualified Acoustician to determine whether the sound insulation values for historic buildings have been met as found in the table below:*

Credits	Airborne sound insulation values	Impact sound insulation values
1	No worse than values determined pre-refurbishment	
2	3 dB higher than before refurbishment	3 dB lower than before refurbishment
3	5 dB higher than before refurbishment	5 dB lower than before refurbishment
4	8 dB higher than before refurbishment	8 dB lower than before refurbishment

Table 0-1. Historic building residential refurbishment credits (BREEAM CN10)

The development includes some residential units (refurbishment of the 1st, 2nd, 3rd floors at 26 Denmark Street) within a Grade II listed building.

Approved Document of the Building Regulations is quite clear about buildings such as this:

"In the case of some historic buildings undergoing a material change of use it may not be practical to improve the sound insulation to the standards set out in Table 1a and Table 1b [of Approved Document E – summarised in Panel 1 below]. *The need to conserve the special characteristics of such historic buildings needs to be recognised* [reference BS 7913 – the principals of the conservation of historic buildings, 1998] *and in such work the aim should be to improve sound insulation to the extent that it is practically possible, always provided that the work does not prejudice the character of the historic building, or increase the risk of long term deterioration to the fabric or fittings. In arriving at an appropriate balance between historic building conservation and improving sound insulation it would be appropriate to take into account the advice of the local authoritiy's conservation officer. In such cases it will be reasonable to improve the sound insulation as much as is practical and to affix a notice showing the sound insulation value(s) obtained by testing in accordance with Regulation 41 or 20(1) and (5) in a conspicuous place inside the building".*

It is important to establish if the proposals considered here amount to refurbishment of existing residential provision **or** material change of use. Specifically, it is important to establish if the number of dwellings will change or whether spaces will be returning to their original residential use. If the latter, only a subset of the requirements of Approved Document E of the Building Regulations (Panel 1) would apply which are:

- that any new internal wall should have a laboratory acoustic rating of R_W 40 dB.

It is assumed that there are no proposals for new compartment walls or new floors. Because it is assumed there is no material change in use, sound insulation testing is not expected nor is the notice of performance.

There are BREEAM implications to the refurbishment of these residential units. This does require sound insulation before and after refurbishment.

Notwithstanding this, it is assumed here that the general development philosophy set out in the except from Approved Document E will be followed; one of improving sound insulation to the extent that is practically possible providing that the work does not prejudice the character of the building.

Compliance with the acoustic standards in Approved Document E of the Building Regulations is therefore not directly applicable to refurbishments such as this. Grade II listed building, Nevertheless, they provide a reference point for the acoustics design and are therefore set out below for completeness.

Panel 1: Approved Document E:

Acoustic performance standards for **separating** walls, floors and stairs (when they have a separating function)

- $D_{nT,w}$ +C_{tr} = 45 dB (airborne sound insulation) or 42 dB for cases where there is material change of use
- $L_{nT,w}$ = 62 dB (impact noise criteria) or 64 dB for cases where the is material change of use

Laboratory values for new internal walls between a bedroom or water closet and other rooms and also floors **within** dwelling-houses and flats and rooms for residential purposes constructed to

- Rw = 40 dB

The requirement for internal walls and floors **does not apply** to

- An internal wall which contains a door
- An internal wall which separates an en-suite toilet from the associated bedroom
- Existing walls and floors in a building which is subject to material change of use

Pre-completion acoustic testing is required to demonstrate compliance with the design criteria and any required remedial works must be carried out prior to handover and completion. Alternatively *Robust Details* can be used in place of pre-completion testing.

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

BREEAM credits for acoustics are being targeted for the development as a whole. The requirements for this are set out in Panel 2.

Panel 2: BREEAM credits for acoustics:

HEA 5 (up to 4 credits available depending on function of the space) relating to

- Indoor noise levels meeting 'good' standards in BS8233 and other guidance and impact noise levels being controlled
- All acoustically sensitive areas such as rooms designed for speech and music comply with the requirements for reverberation time in BS8233 (table 8), BB93 and other guidance.

HEA02 for Domestic Refurbishment – up to 4 credits depending on the level of sound insulation achieved.

POL05 (1 credit available)

- Noise impact assessment carried out in accordance with BS7445: 2003 and the noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (07:00 hr to 23:00 hr) and +3dB at night (23:00 hr to 07:00 hr) compared to the background noise level.

In order to gain these credits, pre-completion acoustic testing is required to demonstrate compliance with the design criteria and any required remedial works must be carried out prior to handover and completion.

Code for Sustainable Homes credits for acoustics will be used as a guidance for assessing the internal sound insulation of separating floors for the residential components of the development. The requirements for this are set out in Panel 3.

Panel 3: Code for sustainable homes credits for acoustics:

1 credit level

Acoustic performance standards for **separating** walls, floors and stairs (when they have a separating function) exceed the requirements of Approved document E by **3 dB**

- $D_{nT,w}$ +C_{tr} = 48 dB (airborne sound insulation)
- $L_{nT,w}$ = 59 dB (impact noise criteria)

3 credit level

Acoustic performance standards for **separating** walls, floors and stairs (when they have a separating function) exceed the requirements of Approved document E by **5 dB**

- $D_{nT,w}$ +C_{tr} = 50 dB (airborne sound insulation)
- $L_{nT,w}$ = 57 dB (impact noise criteria)

4 credit level

Acoustic performance standards for **separating** walls, floors and stairs (when they have a separating function) exceed the requirements of Approved document E by **8 dB**

- $D_{nT,w}$ +C_{tr} = 53 dB (airborne sound insulation)
- $L_{nT,w}$ = 54 dB (impact noise criteria)

In order to gain these credits, pre-completion acoustic testing is required on every group or sub-group of dwellings to demonstrate compliance with the design criteria and any required remedial works must be carried out prior to handover and completion.

The relationship between in-situ sound insulation ($D_{nT,w}$) and the sound insulation rating measured in a laboratory (R_w) and quoted by manufacturers of wall products is taken to be: $R_w=D_{nt,w}+C_{tr}+7+5$

- Assuming the C_{tr} correction is -7 dB (worst case)
- $R_w= D_{nT,w}+5$ for masonry