TECHNICAL NOTE

Project	**Spencer Place North**
Subject	**Sound Insulation**
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1.0 INTRODUCTION

John Spain Associates has requested AWN Consulting to prepare an Acoustic Report in relation to the planned residential aspect of the Spencer Place North development. In particular AWN has been asked to comment on potential noise mitigation measures for separating constructions between apartments and communal spaces.

Development comprising of an alteration to permitted development Reg. Ref. DSDZ2896/18 and as amended by Reg. Ref. DSDZ4279/18 at Spencer Place North, City Block 2, Spencer Dock, Dublin 1. The proposed development seeks revisions to the permitted Block 1 and 2 to provide for an increase in the number of residential units from 349 no. to 464 no. apartment units and the change of use of the permitted aparthotel development to shared accommodation.

The proposed development will increase the height of the permitted development increasing the maximum height of Block 1 from 7 no. storeys (27.5 m) to a maximum height of 13 no. storeys (46.8m) and increasing the maximum height of Block 2 (27.5m) to 11 no. storeys (40.5m). The proposed development will also include the provision of a link bridge between Block 1 and Block 2 at 6th floor level, landscaping, the provision of communal open space, revised under croft level, provision of roof terraces and all other associates site development works to facilitate the development.

The residential amenity spaces will range in use however they are not defined in their usage at this stage. It is understood that the proposal is that these spaces may include cafes, cinemas, meeting rooms, function rooms, games rooms, lounges, gyms and more. The rooms will also be available for private functions for the residents of the apartment blocks and as such may be used for a variety of activities.

The following sections consider the sound insulation performance requirements between the aforementioned communal spaces and the apartments. Criteria are recommended to alleviate potential disturbance to residences and preliminary outline acoustic measures are discussed to aid the adoption of these criteria.

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Please note that the design goals, treatments and constructions discussed in this report are only preliminary and are intended to form the basis for various aspects of the detailed design. As such, these may be subject to change as the project progresses and as the specific uses of the communal spaces are confirmed.

The specifications provided in this report have been derived through consideration of acoustical requirements and constraints only. The structural implications of supporting such noise control measures must be checked by a suitably qualified engineer.

2.0 BUILDING REGULATION REQUIREMENTS AND BEST PRACTICE GUIDANCE

2.1 Building Regulations 2014: Part E

The sound insulation performance requirements as set out in *Part E* of the *Building Regulations 2014* are as follows:

Sound E1 Each wall and floor separating a dwelling from:

a) another dwelling or dwellings,
b) other parts of the same building, or
c) adjoining buildings,

shall be designed and constructed in such a way so as to provide reasonable resistance to sound.

See the Regulations for further definitions and clarifications.

Section 1 of *Technical Guidance Document E* provides sound performance levels required to meet the requirement of Regulation E1. Table 1 below reproduces the performance levels specified.

Separating Construction	Airborne Sound Insulation $D_{nT,w}$ (dB)	Impact Sound Insulation $L'_{nT,w}$ (dB)
Walls	53 (min)	-
Floors (including stairs with a separating function)	53 (min)	58 (max)

Table 1 Sound Performance Levels (*Building Regulations 2014 Technical Guidance Document E*)

The guidance also states that:

"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. Specialist advice may be needed to establish if a higher standard of sound insulation is required in order to achieve a reasonable resistance to sound."

It is this passage that is most relevant to the considerations within this report. Considering the adjacency of the communal areas to the residential areas it is recommended that the airborne sound insulation value between these spaces is increased to accommodate the various uses that the communal space may entail that could result in higher than typical noise emissions.

Giving consideration to the aforementioned criteria and guidance, Table 2 presents our recommended airborne sound insulation criteria for this development.

Communal Space	Airborne Sound Insulation $D_{nT,w}$ (dB)
Café / Restaurant	65 (min)
Meeting Room	60 (min)
Games Rooms, Function Rooms, Gyms	65 (min)
Circulation Spaces (reception etc.)	60 (min)

Table 2 Design Target Sound Performance Levels

In terms of impact sound insulation, the recommended design target is to provide a heightened level of protection to the residential spaces from communal areas. At this stage in the planning it is suggested that an impact sound insulation target of 46 dB $L'_{nT,w}$.

3.0 AIRBORNE SOUND INSULATION

The following sections provide recommended outline sound insulation specifications that may be considered to mitigate noise transfer from the various communal spaces that are located adjacent to apartments. Note that at this stage these recommendations are indicative and will likely be further adjusted at the detailed design stage.

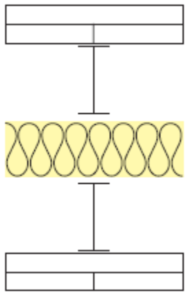
The level of noise transfer between spaces within a building is not only determined by the sound insulation performance of the intervening structure but also the level of noise produced in the "source" room (i.e. the communal spaces in this instance). The term "sound proofing" is an often used albeit somewhat misleading phrase, since the level of sound insulation specified between spaces is typically designed to adequately contain only the expected level of noise. If the level of noise increases above that assumed by the acoustic designer then the "sound proofing" performance is considered to be inadequate since more noise will be transferred than intended. For example, an office partition construction that is adequate for containing general office noise may not offer sufficient sound insulation performance if it is used as the internal wall construction of a plant room and may under the latter circumstances, be considered to offer inadequate sound insulation or "sound proofing". It is therefore clear that the sound insulation afforded by the structure must be matched to the level of noise that has to be contained. In this respect it must be acknowledged that specification of partitions alone may not be sufficient in controlling noise from the adjacent communal spaces and that noise limits may be imposed within communal spaces where noise levels are expected to be elevated. This may be particularly important if amplified sound is required in any communal spaces (i.e. cinema use).

3.1 Walls

To achieve the airborne sound insulation performance for walls it is expected that twin wall plasterboard constructions will be required. The following two examples provide upgraded constructions to meet the aforementioned recommended criteria.

3.1.1 <u>65 dB $D_{nT,w}$</u>

To meet the **65 dB $D_{nT,w}$** airborne separation it is recommended that the separating constructions be upgraded to the following:



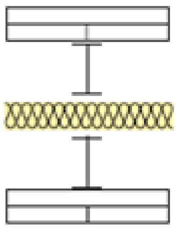
2x15mm SoundBloc board fixed to the outside faces of two Gypframe 60 I 50 ‘I’ Stud frameworks with studs at 600mm centres. 100mm Isover APR 1200 in the cavity (cavity width 190mm). (Gypsum System Ref: A216013)

The estimated in-situ performance of this partition is the order of 65 dB $D_{nT,w}$ assuming high levels of workmanship and detailing.

Alternative constructions offering equivalent or better in-situ performance would also be considered acceptable.

3.1.2 <u>60 dB $D_{nT,w}$</u>

To meet the **60 dB $D_{nT,w}$** airborne separation it is recommended that the separating constructions be upgraded to the following:



Two layers of 15mm SoundBloc board fixed to the outside faces of two Gypframe 48 I 50‘I’Stud frameworks with studs at 600mm centres. 50mm Isover APR 1200 in the cavity (cavity width 140mm).

The estimated in-situ performance of this partition is the order of 60 dB $D_{nT,w}$ assuming high levels of workmanship and detailing.

Alternative constructions offering equivalent or better in-situ performance would also be considered acceptable.

3.2 Ceiling Linings

Irrespective of the ultimate usage of the communal spaces (aside from in special cases detailed in sections 5.1 and 5.2) we recommend that a suspended ceiling be installed below the structural slab in each of the spaces under consideration. The following specification is suitable:

metal frame suspension system to give a minimum 300mm deep void below the underside of the concrete slab – 100mm mineral wool quilt ($\geq$18kg/m^3) on the rear of the plasterboard – 2x12.5mm SoundBloc plasterboard

In order to preserve the sound insulation performance of this acoustic suspended ceiling, there should be no penetrations of the plasterboard in order to suspend services and/or fittings. It will therefore be necessary to bring fixings through the plasterboard directly below the suspension points. A threaded drop rod is fixed to the roof structure at one end and to the acoustic suspended ceiling at the other, passing through a C-section channel clip that supports the metal frame of the suspended ceiling. The drop rod is then brought through the plasterboard, thereby providing a mechanism by which services/fittings or a secondary support grid (e.g. Unistrut) may be hung below the acoustic ceiling. This arrangement is shown on Figure 1.

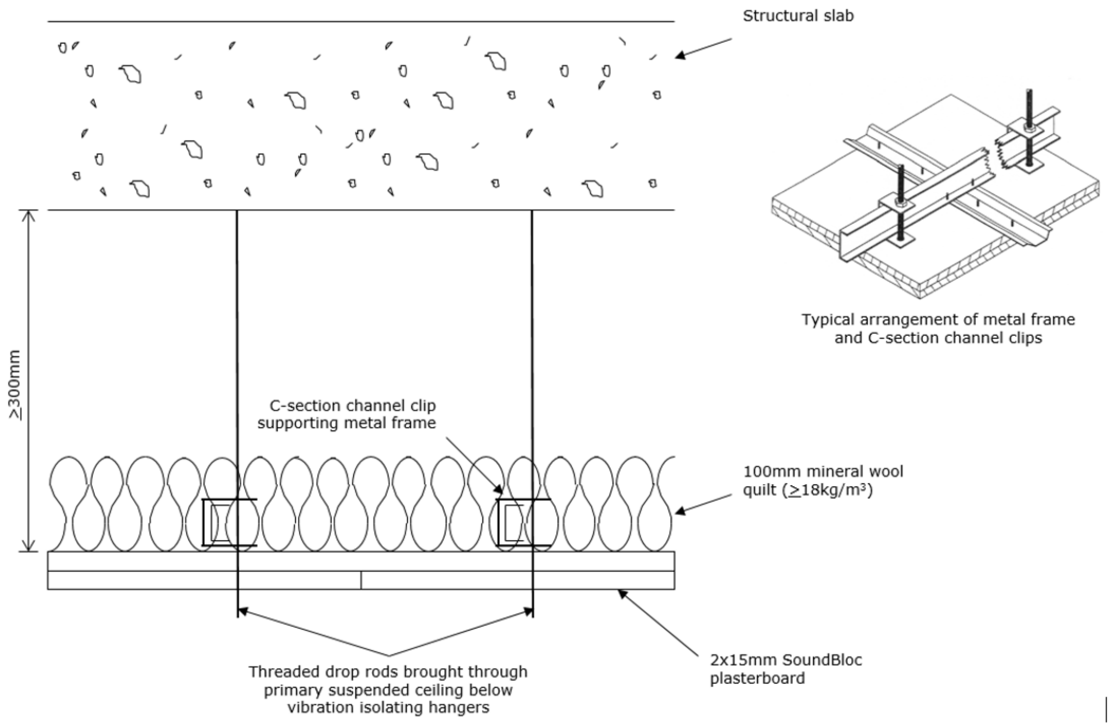


Figure 1 Upgraded Ceilling Construction

The estimated in-situ performance of this floor/ceiling is the order of 65 dB $D_{nT,w}$ assuming high levels of workmanship, detailing and a concrete slab construction offering a minimum mass per unit area of 365kg/m^2.

Alternative constructions offering equivalent or better in-situ performance would also be considered acceptable.

4.0 IMPACT SOUND INSULATION

As discussed previously, the communal areas are not yet defined in usage. It is therefore recommended that, where communal spaces are located above residential spaces, a higher specification of resilient layer is installed. In these instances it is recommended that a resilient layer of at least 29 dB ΔL_w is installed as opposed to the typical value of 17 dB ΔL_w presented in Technical Guidance Document E of the Building Regulations. Again, this is a preliminary design goal that may be redefined at the detailed design stage when further details of the usage of each communal space is known. As specified in section 2, the composite performance of the partition should be designed to meet an impact sound insulation performance of 46 dB $L'_{nT,w}$ and it may be possible at the detailed design stage to achieve this target with a lower performing resilient layer.

In terms of impact sound insulation it is recommended that any potential gym area is not located directly above residential apartments to reduce the potential of impact noise transfer through the structure.

5.0 PARTICULAR CASES

The following advice applies to gymnasium and cinema rooms.

5.1 Gym Areas

The following recommendations have been prepared in relation to any potential proposed gym areas.

In terms of a gym consideration needs to be given to the issue of airborne noise transfer (e.g. aerobics classes with music) and impact noise (e.g. dropping of weights). As discussed previously there may be a further requirement to impose a noise limit within the gym area despite the recommendation of the below specifications.

5.1.1 <u>Typical Measures</u>

Ceiling Treatment

The following typical ceiling treatment may be considered in relation to gym areas:

> *2 layers of 12.5mm SoundBloc on vibration isolation hangers to form 150mm cavity (approx.) between the rear of the plasterboard and the underside of the concrete slab. 50mm Rockwool insulation (≥12kg/m³) placed in the cavity.*

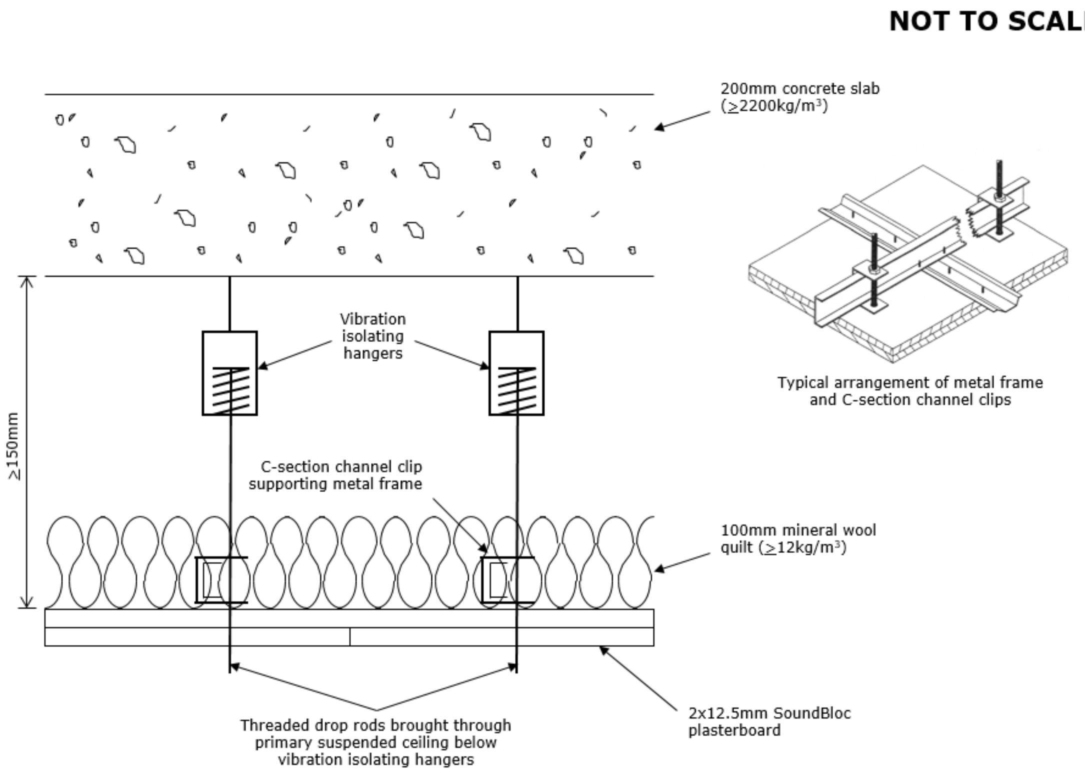


Figure 2 Typical Suspended Ceiling for Gym

The concrete slab construction shall offer a minimum mass per unit area of 365kg/m^2.

Wall Linings

It is also recommended that any structural walls within a gym adjoining a residential dwelling are independently lined to prevent sound transmission through the building. As an example the following build up or similar may be installed:

> *2x12.5mm SoundBloc plasterboard – I-section metal stud erected independent of separating walls to give a minimum cavity depth of 75mm – 50mm mineral wool quilt (>12kg/m^3) in cavity (nominal overall depth of lining 100mm)*

NOT TO SCALE

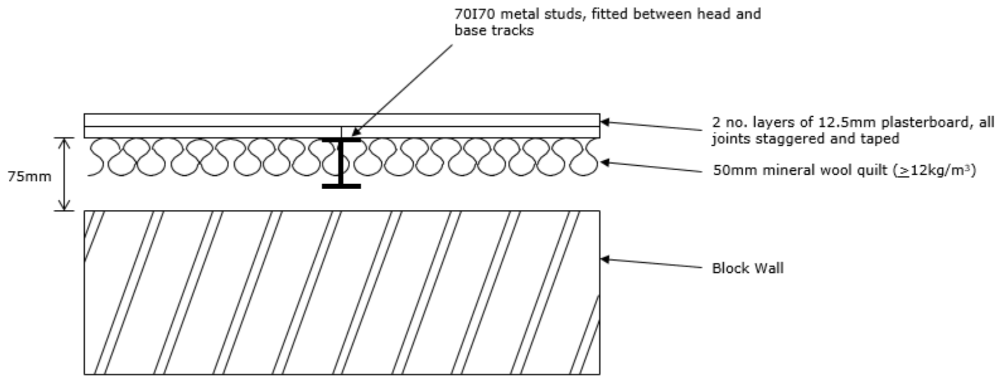


Figure 3 Recommended Independent Wall Lining

Vibration Isolation

Finally, it is also recommended that a suitable vibration isolated floor is installed in any gym area adjoining a residential dwelling to avoid structureborne transfer to the apartments. Due to the complexities of vibration transfer within a building, it is largely not possible to predict the level of building response to vibration excitation without conducting specific site testing. Buildings of a similar construction can respond significantly differently depending on small changes in the structural make up.

The most common forms of vibration isolation used for gym floors within sensitive buildings tend to comprise one or a combination of the following:

- Acoustic Floating Floor, or;
- Resilient Mat Build up Floor.

An isolated floor, commonly called a "floating floor", is used to minimize impact and airborne sound transmissions through the floor/ceiling structure.

Floating floor composite constructions consist of a built-up floor (e.g., concrete slab, wood, etc.) supported by a resilient mount placed on top of the base concrete slab (i.e. non-isolated floor).

Floating floor systems must be decoupled at all edges from walls and other non-isolated building components. Creating airspace and resiliently decoupling the mass of the isolated floor from the non-isolated structure will disrupt noise transmission into the floor/ceiling structure. There are a range of different options for resilient mounts including springs, rubber pads or a combination of both, depending on the level of isolation required.

Example Floating Floor

A concrete floating floor with spring mounts provides the highest level of impact and airborne isolation whereas a timber floating floor on rubber/foam underlay for example provides the least.

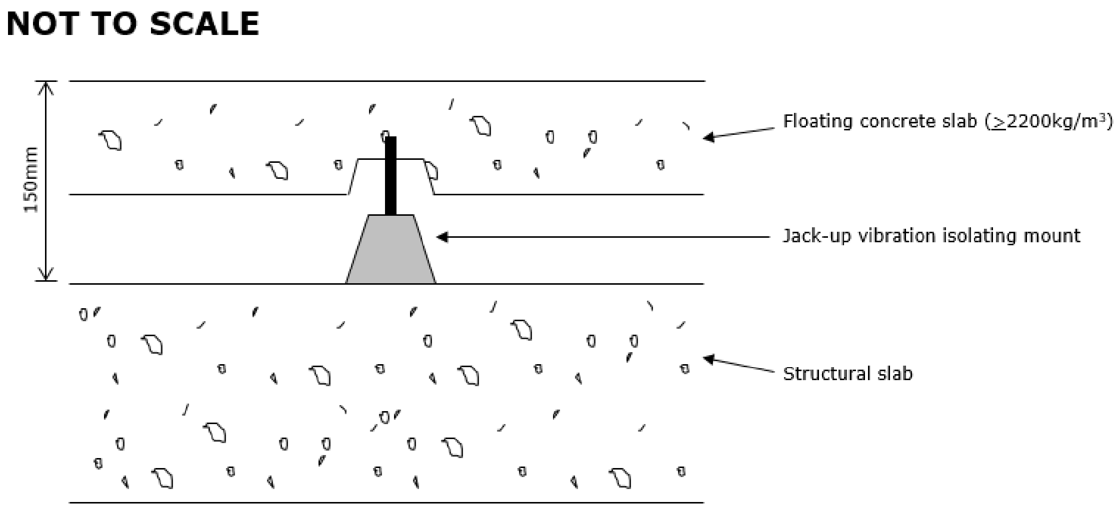


Figure 4 Floating Floor Build Up

The exact construction of a floating floor would require detailed consideration at the design stage.

Resilient Mat Build Up

In recent years, there has been considerable development in terms of the flexible solutions to gym vibration isolation given the requirement for retrospective solutions, flexible floor designs due to lease holds and other engineering design constraints.

Alternative options to floating floors include the use of resilient floor mats which can be installed in different configurations to achieve varying levels of vibration isolation. Depending on the configuration chosen, this system can, in certain circumstances, provide an equivalent level of vibration isolation compared to a structural floating floor.

Impact Absorbers

The use of impact (shock) absorbers to exercise equipment/machines is an effective means of incorporating vibration isolation at source to reduce the level of impact incident on the separating floor itself.

The use of impact absorbers installed between the weight base and the frame are recommended for resistance machines which can be used either in isolation or in conjunction with a resilient floor covering, depending on the level of vibration isolation required.

Figure 5 Resilient Mat Build up Within Free Weights Area

Figure 6 Impact Absorbers to Resistance Equipment

5.2 Cinema Room

If a cinema room is proposed then particular care should be given to the sound insulation performance of the surrounding partitions. In certain instances (i.e. depending on the noise level to be generated in a cinema), the following typical mitigation measures may be required. The typical details outlined below may be relaxed in instances where lower noise levels are anticipated or where proprietary noise limiting devices are installed and calibrated to an approved limit value.

5.2.1 Typical Measures

Suspended Ceiling

A mass barrier plasterboard suspended ceiling may be considered for installation below the concrete slab, specification as follows:

metal frame suspension system incorporating proprietary vibration isolating hangers to give a minimum 300mm deep void below the underside of the slab – 100mm mineral wool quilt (>12kg/m^3) on the rear of the plasterboard – 2x15mm SoundBloc plasterboard

In order to preserve the sound insulation performance of this high performance acoustic suspended ceiling, there must be no untreated penetrations of the plasterboard in order to hang services, the architectural suspended ceiling and any other fittings. It will therefore be necessary to bring fixings through the plasterboard directly below the vibration isolated suspension points.

It is important to note that the vibration isolators must be capable of taking the combined load of the acoustic suspended ceiling and everything below it (e.g. ductwork, lights, architectural ceiling). We recommend a spring hanger with a natural frequency no higher than 5Hz. The concrete slab construction shall offer a minimum mass per unit area of 365kg/m^2.

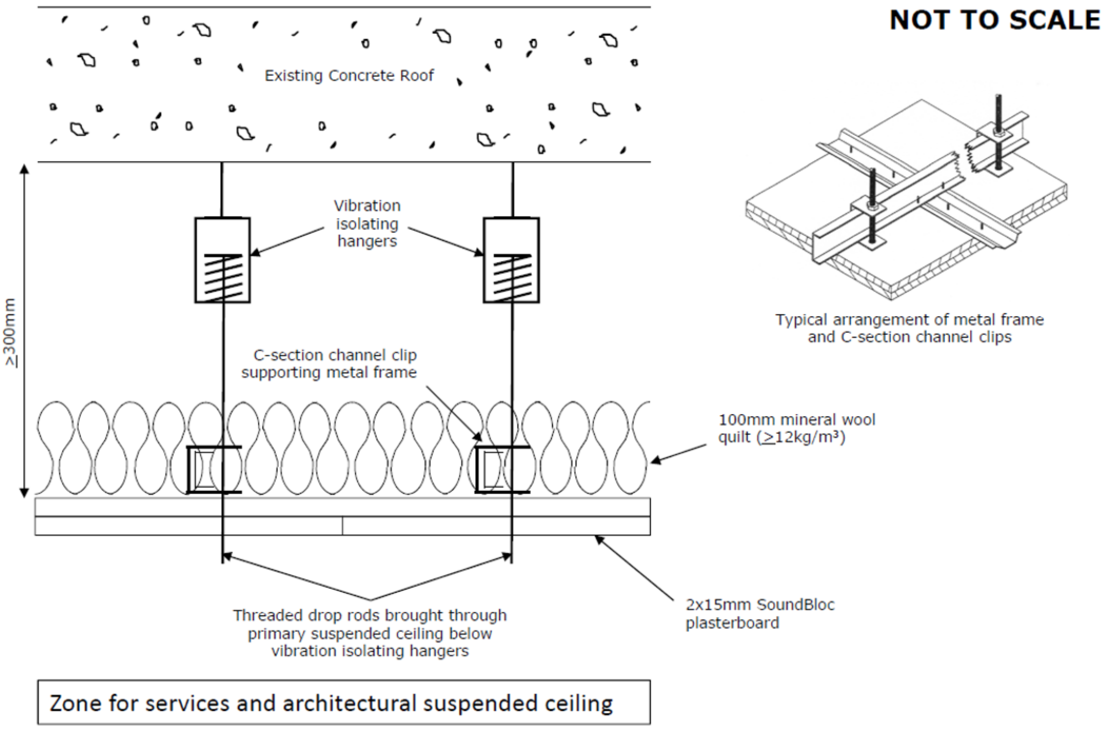


Figure 7 Typical Cinema Ceiling

Wall Linings

It is also recommended that any structural walls within any potential cinema room are independently lined to prevent sound transmission through the building. As an example the following build up or similar may be installed:

> *2x12.5mm SoundBloc plasterboard – I-section metal stud erected independent of separating walls to give a minimum cavity depth of 75mm – 50mm mineral wool quilt (>12kg/m^3) in cavity (nominal overall depth of lining 100mm)*

NOT TO SCALE

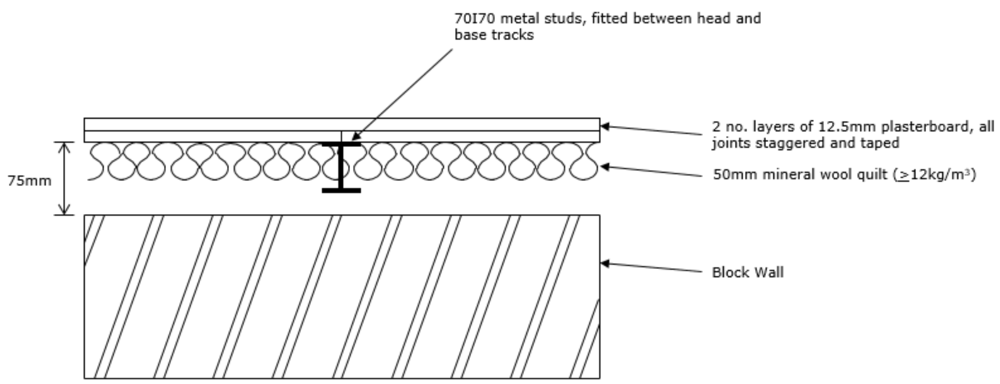


Figure 8 Recommended Independent Wall Lining

Floating Floor

An acoustic floating floor may also be required for installation onto the existing floor slab within the cinema, an example specification is as follows:

> *sandwich layer comprising 18mm T&G, 2x15mm SoundBloc plasterboard and 18mm T&G – vibration isolated battening system (such as CDM-LAT) to provide a minimum 100mm cavity – 50mm mineral wool quilt (≥12kg/m^3) in the cavity*

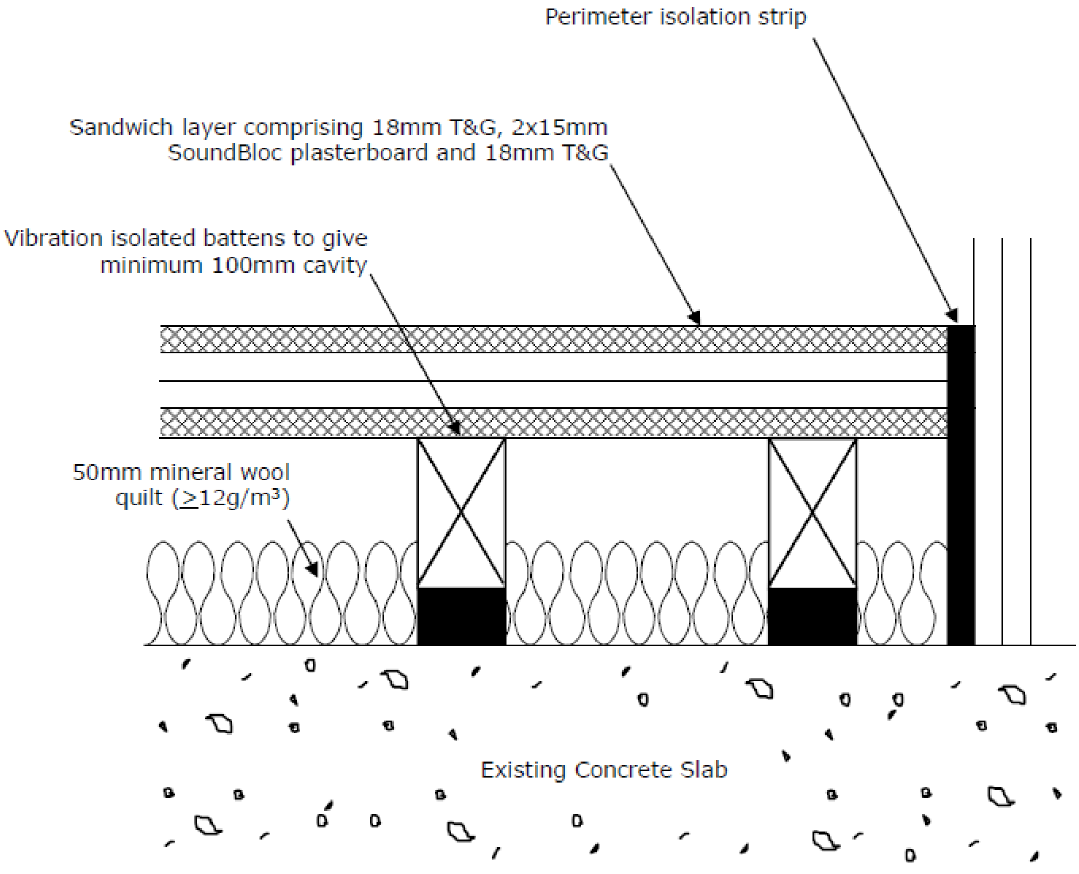


Figure 9 Floating Floor Detail

Note that *in-situ* performance of this system will be dictated primarily by the cavity depth and specification of the vibration isolating mounts. The cavity should be as large as possible (with 100mm being the minimum) and the vibration isolating mounts should be selected so as to provide the lowest possible natural frequency.

6.0 CONCLUSION

AWN Consulting has been asked to comment on transfer of noise from communal spaces to residential apartments within the Spencer Dock North development. Preliminary advice has been given in terms of both recommended noise criteria and examples of typical mitigation measures, however there is the potential for the advice to be altered or progressed at the detailed design stage when further details and building uses are known.