



Azymuth Acoustics UK

Professional Acoustic Services

Acoustic Design Review

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Chorlton Baths

Manchester

On behalf of

Caddick Construction (NW) Ltd

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Contents

1.0	Introduction	4
2.0	Design / Assessment Criteria	4
2.1	British Standard 8233:2014	4
2.2	World Health Organisation Environmental Guidelines (ENG) 2018.....	4
2.3	Internal Acoustics and Sound Insulation	5
3.0	Documents Reviewed by Azymuth.....	7
4.0	External Building Envelope	8
4.1	Glazing and Ventilation Specifications	8
4.2	External Walls and Roof	9
4.3	Vibration Mitigation	10
5.0	Proposed Separating Elements	10
5.1	Separating Walls	10
5.2	Separating Floors	11
5.3	Internal Walls	11
5.4	Junction Details	12
5.5	Internal (Apartment Front) Doors.....	12
6.0	Summary.....	13
	Appendix A – Glossary of Acoustic Terms.....	14

1.0 Introduction

Azymuth Acoustics UK (henceforth Azymuth) has been contracted by Caddick Construction (NW) Ltd to review the proposed building fabric of a development consisting of 2no. apartment blocks and 50no. new dwellings in total with associated communal areas.

Azymuth has previously undertaken a Noise Impact Assessment (NIA) for the site in March 2023. In this NIA Azymuth had provided external building envelope recommendations in order to mitigate the effects of environmental noise on future residents. These recommendations are also included within this design review.

2.0 Design / Assessment Criteria

In order to assess the extent of any measures required in order to comply with suitable conditions relating to potential noise sources, Azymuth has reviewed various guidance documents and standards, these include:

- British Standard 8233:2014
- World Health Organisation Environmental Guidelines (ENG) 2018
- Approved Document E

2.1 British Standard 8233:2014

BS 8233 provides a code of practice for the sound insulation of a variety of building types affected by general environmental noise. It provides recommendations for control of noise in and around buildings and suggests appropriate internal ambient noise level criteria / limits for a variety of different situations.

The following table summarises the noise limits suggested by BS 8233 applying to residential properties:

Activity	Room	Good Design Range $L_{Aeq,T}$ (dB)	
		07:00-23:00hrs	23:00-07:00hrs
Resting	Living rooms	35	-
Dining	Dining room / area	40	-
Sleeping (daytime resting)	Bedroom (at night)	35	30
Working	Office	35 – 40	-

Table 1 - Noise Limits for Residential Properties Suggested in BS 8233

2.2 World Health Organisation Environmental Guidelines (ENG) 2018

The main purpose of the 2018 WHO guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from the following sources: transportation (road traffic, railway and aircraft), wind turbines and leisure activities.

The guidelines set out to define recommended exposure levels for environmental noise in order to protect population health. Exposure limits are average levels defined over a period of one year, measured outdoors in free field at the most exposed façade. It should be noted



that the document does not provide guideline limit values for multiple noise sources in combination.

The 2018 guidelines supersede the Community Noise Guidelines from 1999. Nevertheless, the document recommends that all CNG indoor guideline values and any values not covered by the current guidelines should remain valid. As such, the following guidance would remain appropriate:

For protection against sleep disturbance inside dwellings, night-time noise levels should not exceed 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events.

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise (interpreted as noise from all sources combined) should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas.

It should be noted that exposure levels defined in ENG and CNG are for guidance purposes as relates potential adverse health impacts and should not be interpreted as absolute limits or regulations.

2.3 Internal Acoustics and Sound Insulation

2.3.1 Building Regulations Requirement E1 – Internal Sound Insulation

Table 2 below contains the requirements for separations between dwelling houses and flats as recommended by Building Regulations Approved Document E (henceforth ADE). The table gives the minimum $D_{nt,w} + C_{tr}$ required for airborne sound and the maximum $L'_{nT,w}$ required for impact sound that Azymuth recommends the separation material achieves to meet this standard.

Separating surface	Minimum $D_{nT,w} + C_{tr}$ (dB)	Maximum Impact Level $L'_{nT,w}$ (dB)
Wall	45	N/A
Floor	45	62

Table 2 – ADE airborne and impact sound insulation requirements for separating walls and floors.

Below in Table 3 is the minimum laboratory airborne sound insulation values for internal walls and floors in dwelling houses and flats.

Separating surface	Minimum R_w (dB)
Wall (internal wall)	40
Floor (internal floor)	40

Table 3 – ADE Airborne sound insulation for internal walls in dwelling flats and houses.



2.3.2 Client Requirements – 5dB Uplift on Building Regulations

Client requirements state that all separating walls and floors should have a 5dB uplift on buildings regulations. The table gives the minimum $D_{nT,w} + C_{tr}$ (on-site measurement) and the maximum $L'_{nT,w}$ required for impact sound required for airborne sound with a 5dB improvement.

Separating surface	Minimum $D_{nT,w} + C_{tr}$ (dB)	Maximum Impact Level $L'_{nT,w}$ (dB)
Wall	50	N/A
Floor	50	57

Table 4 – ADE airborne and impact sound insulation requirements for separating walls and floors with +5dB uplift.

Table 3 is the minimum laboratory airborne sound insulation values for internal walls and floors in dwelling houses and flats with +5dB uplift.

Separating surface	Minimum R_w (dB)
Wall (internal wall)	45
Floor (internal floor)	45

Table 5 – ADE Airborne sound insulation for internal walls in dwelling flats and houses with +5dB uplift.

Approved Document also states that any door should have “good perimeter sealing and a minimum mass per unit area of 25kg/m² or a minimum sound reduction index of 29 dB R_w ”.

2.3.3 Building Regulations Requirement E3 – Reverberation in Common Areas

Requirement E3 of Building Regulations states that:

“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.”

To achieve compliance with this requirement, targets are laid out in Section 7 of Building Regulations Approved Document E. In section 7, targets for the amount of additional absorption that should be used in corridors, hallways, stairwells and entrance halls that give direct access to flats can be determined via two different methods.

In section 7 corridors or hallways are defined as:

“A space for which the ratio of the longest to the shortest floor dimension is greater than three.”

Entrance halls are defined as:

“A space for which the ratio for which the longest to the shortest floor dimension is three or less.”

In Method A, a specified area is covered with absorbent material of a specific class.

In entrance halls, corridors or hallways an area equal to or greater than the floor area must be covered with a Class C absorber or better.

For stairwells or stair enclosure, the combined area of:

- The stair treads
- The upper surface of the intermediate landings,
- The upper surface of the landings (excluding the ground floor)

- The ceiling area

is calculated. An area equal to this must be covered with a Class D absorber, or an area equal to 50% of this area must be covered in Class C or better.

In Method B, an amount of absorbent area is required per cubic metre of volume. This absorption area is calculated in octave bands from 250 to 4000Hz inclusive.

The targets below reference total absorption area. This is defined as:

“The hypothetical area of a totally absorbing surface, which if it were the only absorbing element in the space would give the same reverberation time as the space under consideration.”

For entrance halls that give access to flats, a minimum of 0.2m² of total absorption area per cubic metre of volume is required.

For corridors or hallways that give access to flats, a minimum of 0.25m² of total absorption area per cubic metre of volume is required.

The additional material required to meet the target in method B should be distributed over the available surfaces.

Method B is not suitable for stairwells or stair enclosures.

3.0 Documents Reviewed by Azymuth

Azymuth have reviewed the following document while issuing acoustic design advice for the development:

- CHOBABUTZZXXDR04200Proposed GA Site Plan
- CHOBABUTZZ00DR04210Proposed Ground Floor - GA Plan
- CHOBABUTZZ01DR04211Proposed First Floor - GA Plan
- CHOBABUTZZXXDR09201Wall Types Schedule
- CHOBABUTZZXXDR22201Int Walls - Section Details - Sheet 1
- CHOBABUTZZXXDR21200External Walls to Upper Floor Junction Details - Sheet 1
- CHOBABUTZZXXDR23240Ground Floor Details - Sheet 1
- CHOBABUTZZ00DR45200Proposed Reflected Ceiling Plan - Ground Floor
- CHOBABUTZZZZDR45201Proposed Reflected Ceiling Plan - Floors 1 to 3
- CHOBABUTZZ04DR45202Proposed Reflected Ceiling Plan - Floor 4



4.0 External Building Envelope

Azymuth had previously undertaken a noise impact assessment for the site in March 2023 with the following mitigation measures being specified.

4.1 Glazing and Ventilation Specifications

The tables below outline the glazing and ventilation specifications Azymuth have recommended the development.

Location (Habitable Spaces)	Glazing Specification	Appropriate Glazing Types
Manchester Road and Metrolink Elevations	Any building regulations approved min. 42dB R_w and 36dB R_w+C_{tr}	Acoustic glazing e.g 8mm/16mm argon/8.8mm Pilkington Optiphon TM double glazed units
Internal Facing Elevations	Any building regulations approved min. 35dB R_w and 29dB R_w+C_{tr}	8mm/12mm/6mm good quality double glazed units

Table 4 – Recommended glazing specification

NB where patio doors / large areas of glazing are proposed then additional care will be required in specifying door / window frames and opening elements with high quality acoustic seals (including threshold seals) in order to maintain the overall performance of the acoustic glazing.

Location (Habitable Spaces)	Ventilation Specification	Appropriate Ventilation Types
All dwellings	System 4 - MVHR	No trickle vents. Any air inlets/outlets for MVHR should be appropriately attenuated.

Table 5 – Recommended ventilation specification

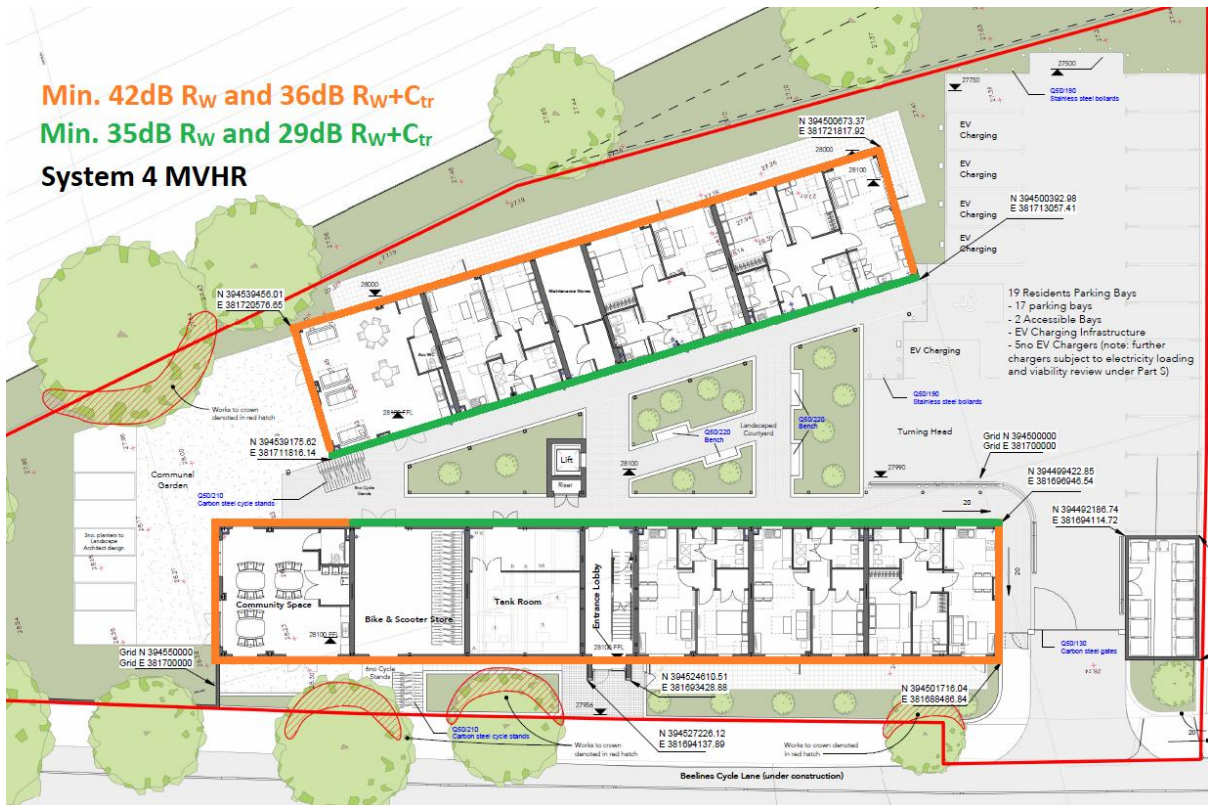


Figure 1 – Recommended mitigation specifications

4.2 External Walls and Roof

In the original NIA Azymuth specified the following minimum acoustic requirements for the external walls and roofs to both apartment blocks to mitigate the effects of external noise within the development:

- External Walls: min. 50dB R_w .
- Roof: min. 40dB R_w

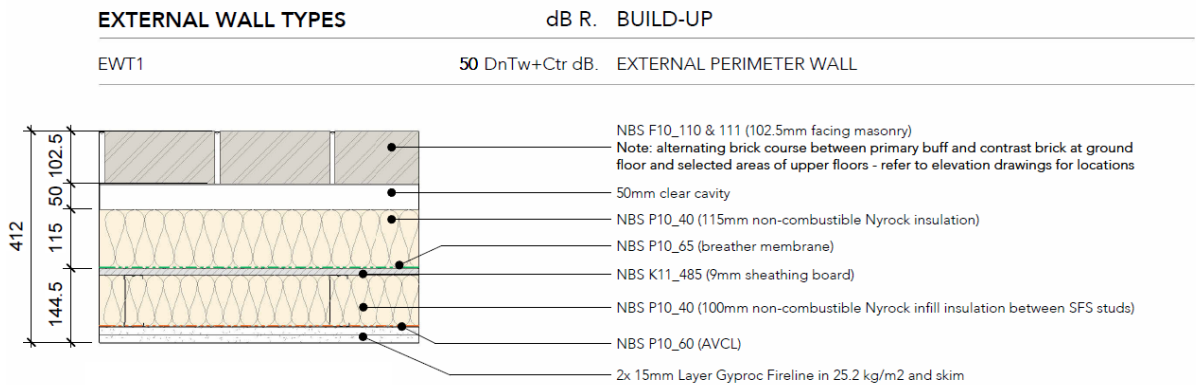


Figure 2 – Proposed external wall construction

Azymuth anticipates that this external wall construction shall significantly exceed the target of min. 50dB R_w .

4.3 Vibration Mitigation

The vibration levels require little to no mitigation. As per the drawings received, the proposed apartment building will be set back from the site boundary, reducing the vibration dose value and bringing the dwellings themselves into the low probability zone. Despite this, Azymuth recommends both the proposed ground and first floors are constructed on concrete slabs (eg. in-situ concrete or beam and block construction) to reduce vibration.

5.0 Proposed Separating Elements

The following internal wall and floor types are currently being proposed for the development. The client has expressed that all separating walls and floors should have an acoustic rating of Building Regulations +5dB.

5.1 Separating Walls

All walls separating dwellings should have a minimum airborne sound insulation of 50dB $D_{nTw}+C_{tr}$ (designed to ~58dB R_w+C_{tr}) as per ADE.

The proposed party wall construction is believed to be as follows; 2x15mm SoundBloc plasterboard with 2.5mm skim either side of 2x70mm Gyframe 'C' studs (with steel bracing), cavity fully filled with Isover APR to partition thickness 330mm.

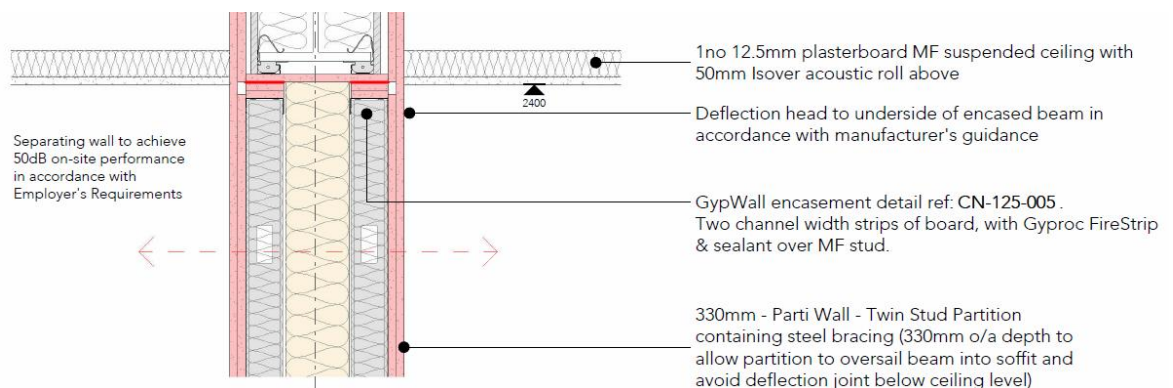


Figure 3 – Proposed party wall construction

Azymuth anticipates that this construction shall achieve a minimum rating of 52dB $D_{nTw}+C_{tr}$ (laboratory equivalent ~60dB R_w+C_{tr}).

5.2 Separating Floors

All floors separating dwellings should have a minimum airborne sound insulation of 50dB $D_{nTw}+C_{tr}$ (designed to ~58dB R_w+C_{tr}) and a maximum impact sound insulation of 62dB L'_{nTw} as per ADE.

5.2.1 Airborne Sound Insulation

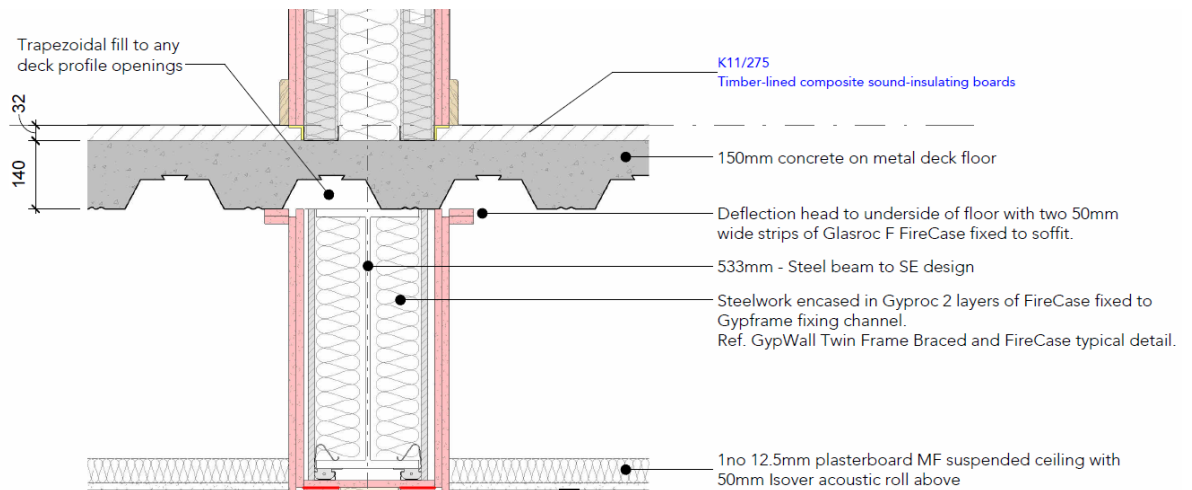


Figure 4 – Proposed separating floor construction

The proposed party floor construction is believed to be as follows; timber-lined composite sound insulating boards on 150mm concrete on metal deck, ~550mm cavity with 50mm Isover APR and 1x12.5mm plasterboard below.

Azymuth anticipates that this current construction shall achieve a minimum rating of 50dB $D_{nTw}+C_{tr}$ (~58dB R_w+C_{tr}). To ensure that targets are met Azymuth would recommend using 2x15mm layers of SoundBloc plasterboard for the suspended ceiling.

5.2.2 Impact Sound Insulation of Floors

Azymuth understands that the 'timber-lined composite sound-insulating boards' are JCW Acoustic Decks (32mm) the inclusion of these boards within the overall floor construction shall ensure compliance with the impact sound insulation target of maximum 57dB L'_{nTw} .

5.3 Internal Walls

Internal walls within dwellings in the apartment blocks should have a minimum sound insulation performance of 45dB R_w .

The proposed internal wall construction is as follows:



Figure 5 – Proposed internal wall type

Azymuth anticipates that this internal wall construction shall 48dB R_w and as such would achieve the target of min. 45dB R_w .

5.4 Junction Details

Where there are junction details similar to those in Figure 6 it is important to ensure that plasterboard junctions are staggered as to prevent flanking noise transmission.

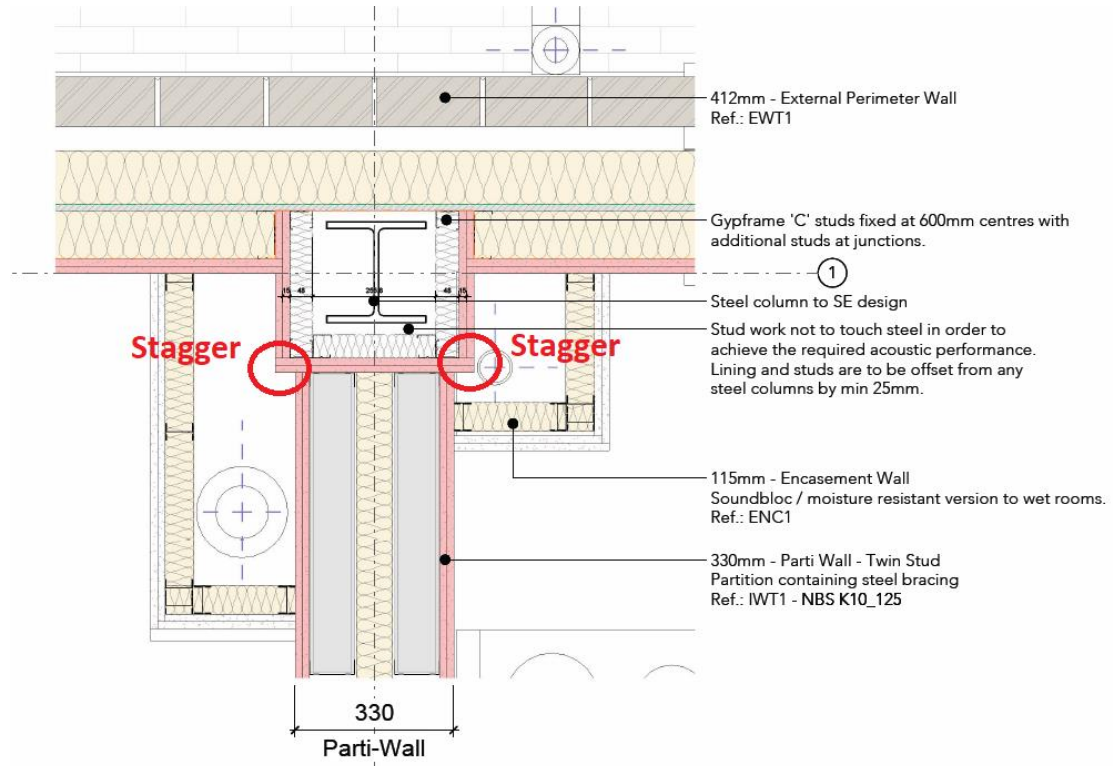


Figure 6 – Example staggered junction details

5.5 Internal (Apartment Front) Doors

The minimum recommended sound insulation values for the majority of proposed internal doors is R_w 32dB.

These R_w 32dB doors may be standard FD30 fire doors with neoprene seals and drop threshold seals. The required R_w values for doors as stated above are composite values i.e. should include glazed vision panels if these are proposed.

6.0 Summary

Azymuth have undertaken an acoustic design review of the proposed development at the former Chorlton Baths site, Manchester.

The client has requested that all targets that relate to sound insulation should have a 5dB uplift on Building Regulations, as such Azymuth have provided recommendations as to how best achieve these targets.

Azymuth had previously conducted a Noise Impact Assessment (NIA) of the site in March 2023. The recommendations included in this original NIA, as relates to the external building envelope, have been included in Section 4.0.

Azymuth have reviewed the proposed external wall types which shall significantly exceed the previously specified target ratings for external walls contained within the NIA.

Azymuth have reviewed the proposed internal wall types and anticipate that they shall achieve all relevant targets.

Azymuth have reviewed the propose separating floor construction and have recommended the inclusion of 2x15mm layers of SoundBloc plasterboard to the ceiling to ensure that the client's requirements shall be achieved.

The inclusion of the JCW Acoustic Decking shall also ensure that the impact sound insulation targets shall be met.

Extra care should be taken around junctions, ensuring that any plasterboard junctions are staggered to prevent any flanking noise (Section 5.4).

If the recommendations included within this report are to be adhered to then the uplift on sound insulation targets shall be achieved.

Appendix A – Glossary of Acoustic Terms

Decibel (dB)

This is the unit used to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro Pascal to 100 Pascal).

dB (A)

This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. A-weighting) to compensate for the sensitivity of the human ear to sound of different frequencies. The A-weighting curve is implemented in sound level meters using an electronic filter that approximately corresponds to the frequency response of the ear.

Octave Band Noise Level

The human ear is sensitive to sound over a range of frequencies between approximately 20Hz to 20kHz. The ear is also generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum can be divided into frequency bands. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it.

L_{Aeq}

This is the equivalent steady sound level in dB (A) containing the same acoustic energy as the actual fluctuating sound level over a given time period.

Reverberation Time (RT or sometimes T_{30} or T_{60})

This is the time taken for the reverberant sound energy in an enclosure to decay one millionth of its equilibrium value, i.e. by 60dB, after the source has been switched off, is known as the reverberation time. The reverberation time is frequency dependent and it is customary to measure its value in octave or one-third octave bands. Reverberation occurs when sound waves are repeatedly reflected from each surface of the room.

Sound Reduction Index (SRI)

Difference measured between the amount of energy flowing towards the wall in the source room and the total amount of energy entering the receiving room (usual range 100 - 3150Hz for one third octave band values). The SRI varies with frequency and is measured in a laboratory in either octave or one-third octave bands.

$SRI = L_1 - L_2 + 10 \log (S/A)$, where:

L_1 = Noise level in the source room

L_2 = Noise levels in the receiving room

S = Surface area of test specimen

A = Equivalent acoustic absorption area in the receiving room

Weighted Sound Reduction Index (R_w)

This is a weighted single figure descriptor of the sound insulation performance of a partition measured under laboratory conditions. The procedure used to quantify the R_w is to compare the sound reduction index (SRI) in each of the one-third octave bands from 100Hz to 3150Hz against a set of standard reference curves.