



WATERSIDE PLACES

STAGE 4 ACOUSTIC DESIGN REPORT

ISLINGTON WHARF PHASE 4

11 May 2021

AEC REPORT: P3725/R02d/AGB

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1.0 INTRODUCTION

General

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by Waterside Places to review the design proposals for the new residential development at Islington Wharf, Phase 4, Manchester.
- 1.2 The proposed development is a multi-storey residential tower block consisting of 106, 1 and 2 bedroom apartments, spread across a total of 16 storeys, comprising a podium level for the first 11 floors. In addition, on the ground floor, there is a resident's foyer with the main entrance to the development, a commercial unit, bike storage and other facilities storage areas.
- 1.3 This report provides a summary of the relevant acoustic design criteria based on achieving the requirements of:
 - Manchester City Council;
 - BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*';
 - World Health Organisation (WHO) '*Guidelines for Community Noise, 1999*';
 - Approved Document E '*Resistance to the Passage of Sound*' of the Building Regulations 2010 (ADE);
 - Client's enhanced sound insulation performance requirement.
- 1.4 The results of on-site noise surveys undertaken are presented in addition to an assessment of the current proposals with regard to achieving the required acoustic criteria.
- 1.5 Acoustic terminology used throughout this report is described in brief in Appendix A.

CDM Regulations

- 1.6 Although this report may reference specific products and/or manufacturers, these are included as a suitable example only and there will normally be numerous alternative products that could be used. The final specifications for construction materials and methods would be prepared by others and any potential health and safety issues associated with the use of specific construction materials and/or methods must be confirmed based on all available information including that from the manufacturer and/or supplier.
- 1.7 Some of the risks associated with the use of materials commonly suggested for acoustic design purposes and certain construction methods could include:
 - manual handling of heavy blocks and boards;
 - handling of hazardous substances such as mineral wool, which can be an irritant and the appropriate protection should be worn during its use;
 - noise exposure of construction workers, which, although is the responsibility of the contractor, it is important that appropriate protection is provided where necessary.
- 1.8 As the proposed building is residential only, in terms of noise, there are no future operational health and safety risks that need to be highlighted to the developer or end user.

2.0 SITE DESCRIPTION

- 2.1 The proposed development is located on the junction where Great Ancoats Street meets Old Mill Street in the New Islington area of Manchester's city centre.
- 2.2 The south-western elevation of the development overlooks Great Ancoats Street which is a busy through road within the Ancoats suburb that connects Oldham Road to the north of the Manchester city centre, and the A57 to the south.
- 2.3 To the north-west of the development is Old Mill Street. Along Old Mill Street are a series of residential blocks, the New Islington Medical Practice and is where access to Bradford Road is gained.
- 2.4 The north-eastern elevation of the development is bound by Lockgate Mews, which is a small through road used to gain access to the parking areas associated with Islington Wharf Phase's 1 and 3.
- 2.5 The south-eastern elevation faces directly onto Islington Wharf Phase 1.
- 2.6 It is understood that the operator/tenant of the commercial unit is currently unknown, however, it could operate as any of the following use classes – A1, A2 or A3.

3.0 ACOUSTIC CRITERIA

Indoor Ambient Noise Levels

Background Ventilation Condition

- 3.1 Manchester City Council (MCC) has produced 'Planning & Noise – Technical Guidance', 2015 (PNTG) in relation to their requirements for noise assessments to accompany planning applications.
- 3.2 Section 3.6.1.1 of this document states "*Manchester City Council has adopted the following internal limits for residential properties:*
- *Bedroom (night-time – 23.00 – 07.00) 30dB_{L_{Aeq}} (individual noise events should not normally exceed 45dB_{L_{Amax, F}} by more than 15 times);*
 - *Living Rooms (daytime – 07.00 – 23.00) 35dB_{L_{Aeq}}.*
- 3.3 These levels are based on guidance presented in BS8233 the WHO Guidelines.
- 3.4 The above noise limits relate to the combination of external noise break-in and mechanical plant noise. The limits need to be achieved when background ventilation, as defined in Approved Document F 'Ventilation' (2010) of the Building Regulations, is being provided to habitable rooms.
- 3.5 Background (continuous whole house) ventilation is typically achieved either via a partially opened window, trickle ventilators or mechanical means. ADF states that '*The ventilation provisions will not necessarily meet cooling needs*'.

Control of Overheating Condition

- 3.6 Summer overheating in residential developments is, in most instances, normally controlled by residents opening windows to a sufficient degree. However, when windows are opened, in most instances the noise limits identified above will be exceeded to varying degrees.
- 3.7 Historically, acoustic guidance has simply stated that windows need to remain closed to achieve appropriate internal noise levels and that ventilation requirements need to be agreed with the Local Authority. As noise break-in is a planning issue and ventilation requirements a Building Control issue, consideration of acceptable internal noise levels with windows open to control overheating has slipped through the cracks. However, this issue has recently come to the attention of Local Authorities largely due to work undertaken by the Association of Noise Consultants (ANC).
- 3.8 MCC currently does not set limits to be achieved whilst the ventilation provision of residential properties is in a state to control overheating. However, based on discussions with Richard Knightley, a senior EHO with MCC, the issue should now be considered in acoustic reports relating to planning. Richard also indicated that any assessment should consider how long opening windows or other enhanced ventilation provision would need to be relied upon in the long and short term. This element needs to be considered by others.
- 3.9 To assess this issue, the main available guidance is the ANC's '*Acoustic ventilation and Overheating (AVO)*' design guide, which was published in January 2020. It is important to note that AVO is a guidance document only and does not form a statutory document.
- 3.10 Table 3.3 of AVO presents guidance for allowable noise from transportation sources whilst windows are open for the control of overheating. With reference to this document, AEC would propose that windows can be utilised in the control of overheating provided that the resultant

internal ambient noise levels are no greater than approximately $50\text{dBL}_{\text{Aeq}, 16\text{h}}$ during the daytime, and $42\text{dBL}_{\text{Aeq}, 8\text{h}}$ and $62\text{dBL}_{\text{Amax}}$ during the night-time. These internal noise levels are the upper end of the medium risk category for adverse effects as identified in AVO.

- 3.11 AVO indicates that a window partially open for the control of overheating has an outside to inside level difference of approximately 13dB for typical domestic rooms with simple façade openings equivalent to around 2% of the floor area.
- 3.12 Based on the above, it is considered acceptable to control summertime heating via opening windows where external free-field noise levels are no greater than those presented in the following Table 3.1.

Table 3.1 – Allowable External Noise Levels for Control of Overheating via Opened Windows

Location	Allowable Level, dB		
	Daytime 0700 – 2300h	Night-time 2300 – 0700h	
	$L_{\text{Aeq}, 16\text{h}}$	$L_{\text{Aeq}, 8\text{h}}$	L_{Amax}
Living Room	63	-	-
Bedroom	-	55	78

- 3.13 It should be noted that these limits are suggested only and ultimately are subject to agreement from MCC. Depending on how long windows would need to remain open for, higher or lower noise limits may be more appropriate.
- 3.14 Where mechanical means are used to assist with the control of summertime overheating, AVO states that the internal noise levels in lounges should ideally be no greater than $40\text{dBL}_{\text{Aeq}, \text{T}}$ and in bedrooms no greater than $35\text{dBL}_{\text{Aeq}, \text{T}}$. However, AVO then indicates that noise levels of 5 or 10dB higher than these values may be acceptable depending on the scenario such as occupant control, economics, space use and user needs etc.
- 3.15 Based on the above, AEC considers that noise levels of $40\text{--}45\text{dBL}_{\text{Aeq}, \text{T}}$ should be acceptable in lounges and $35\text{--}40\text{dBL}_{\text{Aeq}, \text{T}}$ should be acceptable in bedrooms during the control of overheating condition. This is subject to the agreement of the Client and it is considered that the night-time limit in bedrooms is more critical in order to avoid sleep disturbance.

Purge Condition

- 3.16 Purge ventilation is manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.
- 3.17 As purge ventilation is only used occasionally and is under complete control of the occupant, there is no acoustic requirement and it may be provided by natural means (e.g. an openable window) or by mechanical means (e.g. a fan).

Services Operational Noise

- 3.18 Noise levels due to: operation of the lifts; fluid flow through any pipework; M&E services, plant and equipment in the ground floor commercial unit. shall not exceed:
- 25dBL_{A1} in bedrooms;

- 30dB_{LA1} in living rooms;
- 35dB_{LA1} in other areas.

3.19 Noise levels due to operation of M&E services, plant and equipment associated with each apartment shall not exceed 32dB_{LAmax,F} in bedrooms and 37dB_{LAmax,F} in lounges whilst background ventilation in line with ADF requirements is being provided. There should be no noise character associated with the plant operation (e.g. clicks, hum or tones).

Atmospheric Plant Noise Emissions

3.20 MCC's document PNTG states the following in relation atmospheric noise limits for mechanical services plant:

“Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.”

Noise Associated with Ground Floor Uses

General

3.21 The ground floor will include the following spaces that could potentially have a noise impact on the residential units above:

- plantrooms;
- commercial unit (A1, A2, A3 or facility management office space);
- residential amenity;
- refuse stores.

Plantrooms

3.22 In terms of the plant rooms, 'average' dB_{Leq} noise from these areas should be controlled to no greater than NR15-20 in the rooms above assuming that the noise is continuous and broadband in nature.

Commercial Unit and Other areas

3.23 In AEC's experience, for non-music sources it would be appropriate to control maximum noise levels to no greater than NR30L_{max} in habitable rooms above these spaces during the daytime periods. Similarly, at night it is considered appropriate to control maximum noise levels in bedrooms to no greater than NR25L_{max}. Whilst noise may be just audible, it is unlikely to be deemed intrusive.

3.24 Any music noise from the ground floor areas to the rooms above should be controlled to ≤47dB and ≤41dB in the 63Hz and 125Hz, octave band centre frequencies (OBCF), respectively.

3.25 Noise breakout via the external envelope will also require consideration. At this stage, it is proposed to control the ambient, L_{Aeq,5min} noise levels from non-music sources, to not exceed the typical background, L_{A90,5min} noise levels -5dB, in each OBCF, external to the nearest affected residential window.

3.26 For music related sources, the L_{Aeq,5min} noise levels should be no greater than the typical background -10dB in each octave band centre frequency, external to the nearest affected residential window.

Internal Sound Insulation

ADE Requirements

- 3.27 For building control purposes, as a minimum, the sound insulation performance of separating walls and floors, must comply with the requirements of Approved Document E of the Building Regulations (ADE).
- 3.28 However, it is understood the Client requires that the sound insulation performance is at least 5dB greater than the minimum requirements of ADE for all separating walls and floors.
- 3.29 The sound insulation performance requirements are presented in Table 3.2, below. The performances presented in Table 3.2 apply to walls and floors between adjacent dwellings and dwellings and any other part of the same building.
- 3.30 To demonstrate compliance with the above for building control purposes, pre-completion testing will need to be undertaken as per the requirements of ADE.

Table 3.2 – Internal Sound Insulation Performance Requirements

<i>Airborne sound insulation ($D_{nT,w} + C_{tr}$ dB) (Minimum Values)</i>		
Construction	ADE Requirements	Client Requirements
Walls	45	50
Floors and Stairs	45	50
<i>Impact sound Insulation, L'_{nTw} dB (Maximum Values)</i>		
Construction	ADE Requirements	Client Requirements
Floors and Stairs	62	57

- 3.31 Internal walls within dwellings should have a minimum laboratory sound insulation performance of 40dBR_w. It has been assumed that the 5dB uplift does not apply to internal walls.
- 3.32 Apartment entrance doors must have good perimeter sealing to the head, jambs and threshold and a minimum mass per unit area of 25kg/m² or achieve a minimum laboratory sound insulation performance of 29dBR_w. It is assumed that there is no up-lift of the acoustic performance requirements of the front doors to apartments.
- 3.33 There are no acoustic requirements for internal doors within residential properties.

Ground Floor Uses

- 3.34 In terms of the ground floor areas, the minimum sound insulation performance from the commercial space to adjacent spaces should be 45dB D_{nT,w} (to T=1.0s).

Reverberation Time in Common Areas

- 3.35 To comply with the requirements of ADE, absorption is to be provided in corridors, staircases and hallways. As such, this can be achieved by one of the following methods:

- *Method A:* Covering a specified area with an absorber of an appropriate class that has been rated according to BS EN ISO 11654:1997.
- *Method B:* Determining the minimum amount of absorptive material using a calculation procedure in octave bands. This method is intended only for corridors, hallways and entrance halls and is not well suited to stairwells.

4.0 EXTERNAL NOISE CLIMATE

- 4.1 Two sets of attended and unattended noise level surveys have been undertaken by AEC, in 2018 and 2020. All measurements during both surveys were undertaken in general accordance with BS7445-1: 2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*'.
- 4.2 During both surveys noise levels were logged continuously at a single location on Great Ancoats Street over a 24-hour period. In addition, spot check measurements were undertaken at other locations.
- 4.3 Full details of the measurements are presented in the AEC report P3725-R1d and are not repeated in this report. However, with reference to the measured data, the daytime & night-time ambient ($dB_{LAeq,T}$) noise levels have been predicted across each façade using CadnaA®. The output models are attached as Figures A1 to A6.
- 4.4 A summary of the anticipated night-time free-field maximum noise levels affecting each façade are presented in the following Table 4.1.

Table 4.1 – Night-time Free-field Maximum Noise levels

Elevation	dBL _{Amax}	
	Level 1-10	Level 11+
South-West (Great Ancoats Street)	≤80	<70
North-West (Old Mill Street)	≤75	<70
North-East	≤69	<65
South-East	≤75	<70

5.0 EXTERNAL ENVELOPE ASSESSMENT

Residential

Background Ventilation Provision

- 5.1 Based on the measured noise levels, windows would need to remain closed in order to achieve appropriate internal noise limits of $30\text{dBL}_{\text{Aeq,T}}$ and typically $45\text{dBL}_{\text{Amax,F}}$ in bedrooms during the night-time and $35\text{dBL}_{\text{Aeq,T}}$ in living rooms during the daytime. As such, partially open windows cannot be relied on to provide background ventilation.
- 5.2 It is understood that the required background ventilation is being provided by a mechanical whole house system with atmospheric inlets and exhausts ducted to the external façade of each room and this is acceptable in terms of acoustics.
- 5.3 Opening windows will then be relied upon for purge ventilation to all apartments and where acceptable, for the control of overheating. Mechanical services are discussed further in Section 7.

Glazing Sound Insulation Requirements

- 5.1 Noise break-in calculations have been undertaken based on noise level spectrum data measured on-site, a glazed area of approximately 50% of each room façade and the proposed rooms sizes. The following drawings have been referred to.
 - IW4 RYD 00 ZZ DR A 3900-S2-P00-Bay Study 01;
 - IW4-RYD-00-00-DR-A-3000-S2-P02-Level 00 GA Plan;
 - IW4-RYD-00-01-DR-A-3001-S2-P02-Level 01 GA Plans;
 - IW4-RYD-00-ZZ-DR-A-3002-S2-P01-Level 02-06 GA Plans;
 - IW4-RYD-00-ZZ-DR-A-3007-S2-P02-Levels 07-10 GA Plans;
 - IW4-RYD-00-ZZ-DR-A-3011-S2-P02-Level 11-15 GA Plan.
- 5.2 The following Figures 5.1 and 5.2 and Tables 5.1 and 5.2 show the required glazing sound insulation performances.

Figure 5.1 – Glazing Sound Insulation requirements, levels 1 to 10



Table 5.1 – Key to Figure 5.1

Colour	Glazing Sound Insulation Performance Requirements	
	Lounges	Bedrooms
	39dBR _w & 33dBR _w + C _{tr}	--
	36dBR _w & 29dBR _w + C _{tr}	38dBR _w & 32dBR _w + C _{tr}
	36dBR _w & 29dBR _w + C _{tr}	--
	34dBR _w & 27dBR _w + C _{tr}	36dBR _w & 29dBR _w + C _{tr}

Figure 5.2 – Glazing Sound Insulation requirements, levels 11+

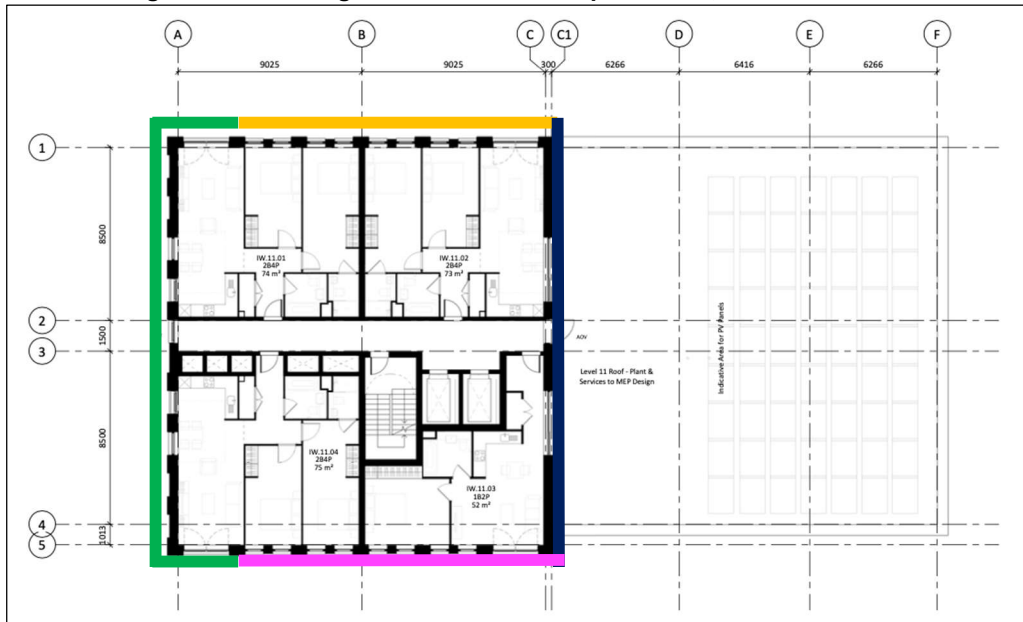


Table 5.2 – Key to Figure 5.2

Colour	Glazing Sound Insulation Performance Requirements	
	Lounges	Bedrooms
	36dBR _w / 29dBR _w + C _{tr}	--
	34dBR _w / 25dBR _w + C _{tr}	34dBR _w / 27dBR _w + C _{tr}
	31dBR _w / 25dBR _w + C _{tr}	--
	34dBR _w / 25dBR _w + C _{tr}	34dBR _w / 25dBR _w + C _{tr}

5.3 Full octave band sound insulation data for the glazing is presented in Table 5.3, below.

Table 5.3 – Octave Band Centre Frequency Sound Reduction Indexes for Glazing

Overall Sound Insulation Performance	SRI, dB @ Octave Band Centre Frequency, Hz					
	125	250	500	1k	2k	4k
39dBR _w / 33dBR _w + C _{tr}	27	29	36	41	42	52
38dBR _w / 32dBR _w + C _{tr}	26	27	34	40	38	46
36dBR _w / 29dBR _w + C _{tr}	25	22	33	40	43	44
34dBR _w / 29dBR _w + C _{tr}	21	20	31	39	37	47
31dBR _w / 25dBR _w + C _{tr}	24	20	25	35	38	35

5.4 It should be noted that the overall sound insulation performances presented above can be achieved with glazing that has slightly different octave band centre frequency values than those listed in Table 5.3, above. However, the suitability of any alternative glazing performance needs to be assessed by AEC.

Non-glazed elements

5.4 In terms of the non-glazed elements of the external facades, these need to achieve an acoustic performance of at least 10dB higher than the figures presented in Table 5.3.

5.5 There are 2 non-glazed elements to the external walls, these being:

- Facing Brick or Aluminium rainscreen cladding (assumed to be 3mm thick) with:
 - Cavity of around 100mm;
 - 150mm mineral wool insulation;
 - 12mm calcium silicate board (assumed around 1800kg/m³);
 - 150mm SFS filled with 140mm Rockwool insulation;
 - 2 layers of 15mm thick Soundbloc.

5.6 Based on a glazed area of approximately 50% of the façade of each room, a masonry area of approximately 30% and an aluminium cladding area of approximately 20%, calculations indicate that appropriate internal noise levels will be achieved using the above constructions.

5.7 If desired, the internal layer can be reduced to 2 layers of 12.5mm thick Soundbloc. In addition, if the plasterboard manufacturer can provide evidence that flanking noise transmission will be appropriately controlled, there may be scope to reduce to a single layer of 15mm Soundbloc. Based on achieving a sound insulation performance of ADE +5dB AEC cannot locate evidence that this will be the case.

Control of Overheating Ventilation

5.8 With reference to the predicted external noise levels presented on the attached Figures A1 to A6 and the external noise limits to allow for control of overheating using opening windows as presented in Table 3.1 above, subject to confirmation with MCC, it would appear that opening windows can be used to control overheating for windows to lounges on the rear (north east) façade. This assumes an open free area of up to around 2% of the floor area. In addition, this would apply to the majority of windows of lounges on the south east façade.

- 5.9 In terms of bedrooms, it would appear that only windows from level 11 upwards on the north east façade could be used for the control of overheating.
- 5.10 At this stage, it is understood that there are proposals to fit the whole house ventilation system with a booster fan for control of overheating purposes. This is discussed in more detail in Section 7.

Ground Floor Areas

- 5.11 In terms of the ground floor units, the minimum acoustic performance of external glazing at this stage should be $29\text{dBR}_w + C_{tr}$ (e.g. 4mm/TC/10mm glass). This would control L_{eq} noise break-out from a restaurant use (with low levels of background music or no background music) to the night-time background (L_{90}) -10dB in each octave band centre frequency.
- 5.12 Noise break-in levels should be no greater than approximately 40dBL_{Aeq} , which would be appropriate for restaurant type uses.
- 5.13 For a retail use only, it may be possible to reduce the performance requirements of the glazing. However, this would need to be developed depending on the use.
- 5.14 Internal noise limits, to be included in any tenancy agreement, are discussed below.

Continuous Curtain Walling

- 5.15 It is understood that there is continuous curtain walling between the ground floor and first floor apartments. The facades shall provide suitable elements at the horizontal acoustic junctions that maintain a sound pressure level difference across the junction of greater than $60\text{dBD}_{n,f,w}$, when measured in a laboratory in accordance with BS EN ISO 10848: 2017, normalised to 10m^2 of absorption and weighted in accordance with BS EN ISO 717-1: 2013. The sound insulation of the floor used in the test to represent the floor shall have a performance high enough to avoid influencing the results.
- 5.16 To comply with the above flanking noise transmission performance requirement it is likely one or more of split mullions, inserts, capping and mass layers will be required.

Roof

- 5.17 It is understood that the roof at podium and tower level will be concrete, which will comply with requirements in terms of rainfall and noise break-in and potential structure borne noise from plant (assuming correct installation as discussed below).

6.0 INTERNAL CONSTRUCTION ASSESSMENT

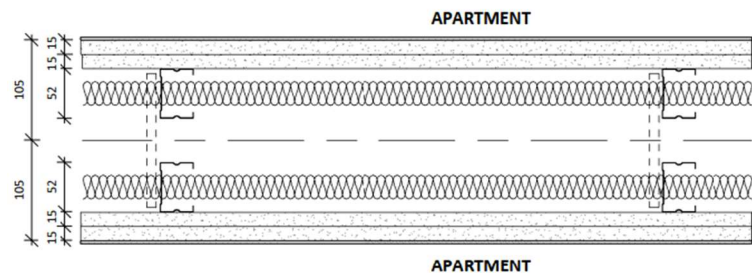
General

- 6.1 In all instances, the discussions below relating to on-site sound insulation performances assume appropriate detailing and a good standard of construction on-site.
- 6.2 The assessment presented below has been undertaken with reference to the Level 01 Setting Out Plan in the Ryder drawing no. RYD-00-01-DR-A-3101 rev P02, to confirm the location of each wall. It is assumed that other habitable area setting out plans are equivalent to this in terms of partition location.

Residential Separating Party Walls

- 6.3 To achieve the client's minimum on-site acoustic performance requirement of $50\text{dB}_{\text{D}_{\text{NT},\text{W}}+\text{C}_{\text{tr}}}$, a partition that has a minimum laboratory measured sound insulation performance $56\text{dB}_{\text{R}_{\text{W}}+\text{C}_{\text{tr}}}$ and approximately $64\text{dB}_{\text{R}_{\text{W}}}$ should be selected.
- 6.4 With reference to the Ryder drawings the following wall is proposed between apartments.

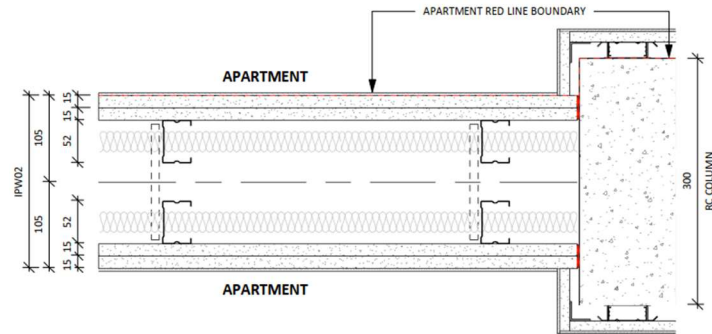
IPW02 - Apartment to Apartment



2x15mm - Gyproc Soundbloc - NBS: K10/XXX
50mm - Twin rows of C Studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - braced with 70mm Flat Fixing Plate at max 1500mm centres between each pair of twin studs NBS: K10/455A
50mm - Cavity to be filled with Insulation Partition Roll - To be installed as a two rows of 25mm (one per stud frame) - NBS: K10/494A
2x15mm - Gyproc Soundbloc - NBS: K10/XXX

- 6.5 The BG White Book indicates that this construction would achieve a performance of approximately $63\text{dB}_{\text{R}_{\text{W}}}$ and $56\text{dB}_{\text{R}_{\text{W}}+\text{C}_{\text{tr}}}$ (System ref: A216009S). Subject to confirmation with British Gypsum, at this stage, if there is a requirement to brace the twin metal frames, an acoustic brace should be used.
- 6.6 Provided that acoustic braces are used, the above wall should achieve the Clients requirements of $\text{ADE} +5\text{dB}$ i.e. $50\text{dB}_{\text{D}_{\text{NT},\text{W}}+\text{C}_{\text{tr}}}$.
- 6.7 Socket boxes should be fitted with a putty pad as a minimum and should not be located back to back (they should be located in the adjacent studwork bay as a minimum). Where only a minimum separation can only be provided, a putty pad will not suffice and a heavier-weight socket box (e.g. SRS Robust Detail socket box) must be used.

6.8 IPW02 - Apartment to Apartment.



2x15mm - Gyproc Soundbloc - NBS: K10/XXX

50mm - Twin rows of C Studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - braced with 70mm Flat Fixing Plate at max 1500mm centres between each pair of twin studs - NBS: K10/455A

50mm - Cavity to be filled with Insulation Partition Roll -

To be installed as a two rows of 25mm (one per stud frame) - NBS: K10/494A

2x15mm - Gyproc Soundbloc - NBS: K10/XXX

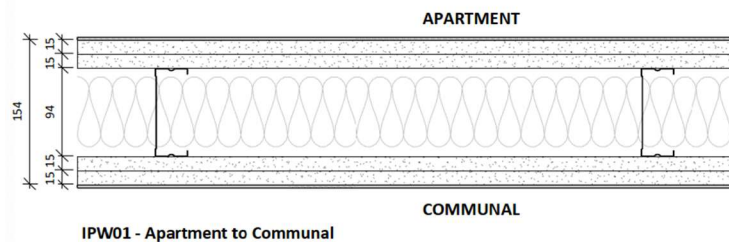
6.9 The above column detail is appropriate. It is assumed that where the party wall lining abuts the column, a mastic seal will be provided. If desirable, for a 300mm wide column, a dot and dabbed plasterboard finish could be used.

6.10 The junction between the column and external wall is subject to review by AEC.

Walls to Corridors and Stairwells

6.11 With reference to the Ryder drawings the following wall is proposed between apartments and corridors.

IPW01 – Apartment to Communal



2x15mm - Gyproc Soundbloc - NBS: K10/XXX

92mm - C Studs (0.70 gauge) at 600mm centres (400mm centres if tiled) - NBS: K10/455A

75mm - Acoustic Partition Roll - NBS: K10/494A

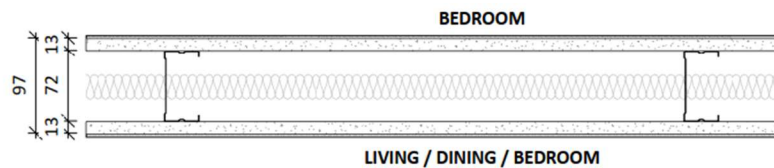
2x15mm - Gyproc Soundbloc - NBS: K10/XXX

6.12 With reference to the BG White Book the above construction achieves 56dBR_w (System ref: A206234).

- 6.13 Although this partition would not meet the client's requirements of ADE +5dB and potentially may not comply with normal ADE requirements, in all instances there is a door in this partition to habitable spaces.
- 6.14 The composite SRI of the door and partition combined is around 37dB with the door being the weakness. Calculations show that there would be no benefit whatsoever in increasing the sound insulation performance of this partition.
- 6.15 As only noise from voices is anticipated in corridors the wall is also considered appropriate to bathrooms. Hence, the partition is considered appropriate in terms of acoustics.
- 6.16 It is noted that the apartments walls to stairwells will consist of a 250mm wide concrete shear wall. These walls do not require a finish for acoustic reasons. In principle a dot and dabbed plasterboard finish could be used on these walls. However, ideally, one of the sides should ideally be fixed via metal furrings with mineral wool in the cavity formed.

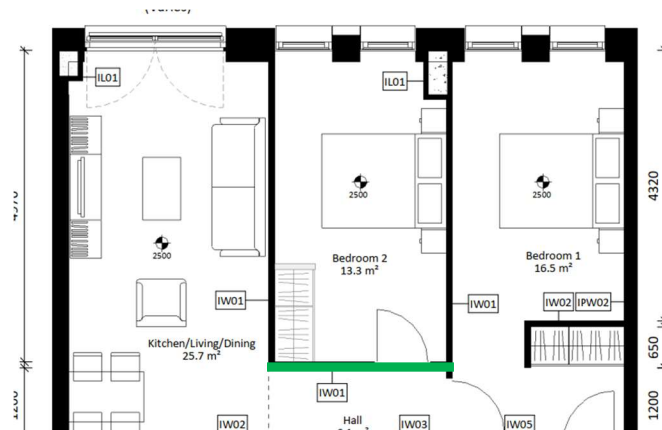
Residential Internal Walls

- 6.17 Various constructions are detailed in the Ryder Internal partition type drawing and all of these will achieve the minimum ADE requirements of 40dB_{Rw}. These are presented below.
- 6.18 *IW01 - Sound Reducing Internal Apartment Wall*

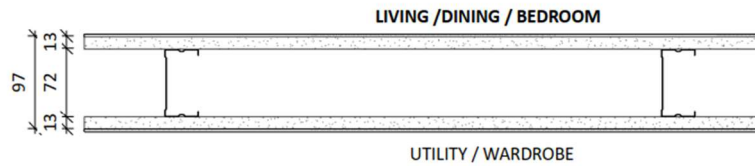


12.5mm - Standard Wallboard - NBS: K10/XXX
70mm - C studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - NBS: K10/455A
25mm - Acoustic Partition Roll - NBS: K10/494A
12.5mm - Standard Wallboard - NBS: K10/XXX

- 6.19 BG White Book – 42dB_{Rw} (System ref: A206045). Where this wall contains a door, consideration could be given to omitting the mineral wool. E.g. the wall marked green below.



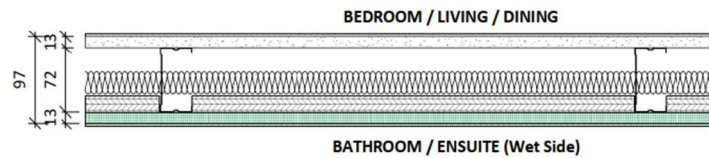
6.20 IW02 - Standard Internal Apartment Wall



- 12.5mm** - Standard Wallboard - NBS: K10/
- 70mm** - C studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - NBS: K10/455A
- 12.5mm** - Standard Wallboard - NBS: K10/

6.21 BG White Book – 36dBR_w (System ref: A206013). Where this wall forms a utility cupboard with an MVHR unit that will operate on boost to control overheating it will be necessary to infill the cavity with mineral wool and upgrade the plasterboard.

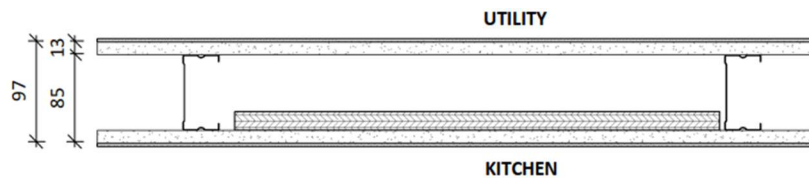
6.22 IW03 - Internal Apartment Walls



- 12.5mm** - Standard Wallboard - NBS: K10/
- 70mm** - C studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - NBS: K10/455A
- 25mm** - Acoustic Partition Roll - NBS: K10/494A
- 18mm** - Install Plywood patressing on metal angles as required between studs
- 12.5mm** - Moisture Panel - NBS: K10/

6.23 BG White Book – 42dBR_w. (equivalent partition). The wall is appropriate in terms of acoustics. Where the wall contains a door the mineral wool can be omitted.

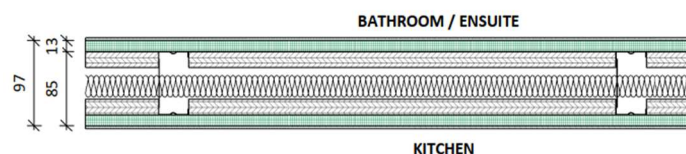
6.24 IW04 - Internal Apartment Walls



- 12.5mm** - Standard Wallboard - NBS: K10/
- 70mm** - C studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - NBS: K10/455A
- 18mm** - Install Plywood patressing on metal angles as required between studs within the partition framing for all apartment wall mounting zones and kitchens fixings (refer to M&E drawings for setting out of patressings zones on all apartmentments)
- 12.5mm** - Standard Wallboard - Use Moisture Panel in high humidity environments - NBS: K10/

6.25 Where this wall forms a utility cupboard with an MVHR unit that will operate on boost to control overheating it may be necessary to infill the cavity with mineral wool and upgrade the plasterboard.

6.26 IW05 - Internal Apartment Walls



12.5mm - Moisture Panel - NBS: K10/
70mm - C studs (0.55 gauge) at 600mm centres (400mm centres if tiled) - NBS: K10/455A
25mm - Acoustic Partition Roll - NBS: K10/494A
18mm - Install Plywood patressing on metal angles as required between studs within the partition framing for all apartment wall mounting zones and kitchens fixings (refer to M&E drawings for setting out of patressings zones on all apartmemnts)
12.5mm - Moisture Panel in high humidity environments - NBS: K10/401A

- 6.27 BG White Book – 42dBR_w (equivalent partition). Appropriate in terms of acoustics. Where this wall contains a door, consideration could be given to omitting the mineral wool.
- 6.28 Internal walls can be constructed to and sealed to the underside of the plasterboard ceilings in the residential areas. In addition, these internal walls do not need to break the inner leaf of external walls or corridor walls.

Internal Linings – Metal Stud

- 6.29 *IL01 - Internal Wall Linings to Dwellings (SVP / Boxings)* - 2 x 12.5mm standard wall board with 25mm pipe wrap on SVP. This is appropriate to box out SVP in utility cupboard. Can consider an alternative where it is used to line out concrete columns. The SVP should not be rigidly coupled to a wall or lining to a habitable room.
- 6.30 *IL02 - Internal Wall Linings to Bathrooms (SVP / Boxings)* - 12.5mm standard wall board and 12.5mm moisture panel with 25mm pipe wrap on SVP. This is appropriate to box out SVP in. Can consider an alternative lining where it is used to line out concrete columns. The SVP should not be rigidly coupled to a wall or lining to a habitable room.
- 6.31 *IL05 - Internal Linings to dwellings (Kitchens)*. This is understood to be a sacrificial lining to kitchens and, as such has no acoustic requirements.

Internal Linings – Adhesive

- 6.32 *IL06 - Internal Wall Liner to Blockwork and Concrete Walls* - Concrete wall linings in communal spaces and has no acoustic requirement.

Lift Shaft Walls

- 6.33 In accordance with BS8233, noise levels from lifts within nearby living accommodation should not exceed 25dBL_{Amax, F} in bedrooms and 30dBL_{Amax, F} in living rooms. Furthermore, BS8233 states that '*Lift operation noise during any part of the lift cycle, including announcements, and with any occupancy level should not normally exceed 55dBL_{Amax, F} when measured in the lift lobby*'.
- 6.34 With reference to the Ryder Drawings, *IL03 & 04 - Internal Linings of Lift and Stair Wall to Dwelling*, consists of 15mm thick plasterboard or moisture board on independent I studs with mineral wool in cavity.
- 6.35 This lining is required in all locations where the lift shaft backs onto a habitable room. An alternative lining can be considered where stair cores back onto non-habitable rooms (e.g. bathrooms).
- 6.36 The lining is not required to staircase walls.

Doors

- 6.37 In accordance with ADE, it is a requirement that to '*ensure that any door has good perimeter sealing (including the threshold where practical) and a minimum mass per unit area of 25kg/m² or a minimum sound reduction index of at least 29dBR_w*'.
- 6.38 There is no acoustic requirement for internal doors within apartments.

Floors

- 6.39 It is understood that the floors will be a solid 225mm RC slab with an overall mass per unit area in excess of 500kg/m² and a plasterboard ceiling suspended underneath. This construction will achieve the airborne sound insulation performance of 50dBD_{nT,w}+C_{tr} required by the client, assuming all flanking transmission paths are appropriately controlled.
- 6.40 Based on the above minimum floor construction, to achieve the required impact sound insulation performance of 57dBL'_{nT,w}, as per the client's enhanced performance requirement, the floors should have a finish that provides a reduction in impact sound insulation of around 17dBΔL_w. This performance would be readily achieved with a carpet and underlay however, building control should be consulted as it may be necessary to adhere a resilient layer to the concrete (such as 2.5mm rubber crumb sheeting) to comply with ADE.
- 6.41 For areas with hard surface floor finishes (e.g. laminate, vinyl or ceramic tile) an underlay would be required.

Stairwell Construction

- 6.42 To control impact noise transferring to bedrooms, stairs should not be rigidly connected to walls forming the bedrooms.

Walls Between Ground Floor Areas

- 6.43 Assuming blockwork is used around the commercial unit, provided that this is at least 140mm thick blockwork with a density of around 1800kg/m³ an on-site performance of 45dBD_{nT,w} should be achieved to adjacent areas.

Sound Insulation Between Ground Floor Spaces and Apartments

Plantrooms

- 6.44 Based on the proposed 225mm thick concrete slab between the plant rooms and apartments, provided that noise levels are controlled to no greater than NR70-75 in the plant room (which is a realistic limit for the majority of plant areas) noise in the habitable rooms above would be limited to NR15-20 and as such, comply with the suggested limit.

Commercial Unit and Amenity Areas

- 6.45 In AEC's experience, it would be appropriate to control maximum noise levels to no greater than NR30L_{max} in the rooms above during the daytime periods, which would mean that noise may be

just audible but not intrusive. Similarly, at night, it would seem to be appropriate to control maximum noise levels in bedrooms to no greater than NR25 L_{max} .

- 6.46 Based on the proposed 225mm thick concrete slab between the ground floor units and apartments, the maximum allowable internal noise levels in the ground floor units (assuming that flanking noise transmission by the external envelope is controlled) would be as presented in Table 6.1, below.

Table 6.1 – Maximum Allowable Noise Levels in the Ground Floor Units

Overall Level	Noise Level, dB L_{AFmax} @ Octave Band Centre Frequency, Hz						
	63	125	250	500	1000	2000	4000
90dB $L_{Amax, F}$	83	80	80	80	83	83	83

- 6.47 The above noise levels would allow for operation of a range of uses including a busy city centre café / restaurant into the late evening without further mitigation measures.
- 6.48 For potential bar or fitness operation or for uses in the night-time (2300h onwards), the floor would need to be upgraded in terms of acoustics. This could be achieved using a plasterboard mass barrier ceiling in the commercial unit, however, consideration of flanking noise transmission paths would also be required. This can be developed when the proposed tenant is known. However, the basic structure does not limit potential uses in the commercial unit.
- 6.49 The above noise limits would also allow for operation of a potential resident's gym playing low level background music. As part of operation of a potential gym, any free-weights areas would require an appropriate matting system and a gym management clause should be to instruct all users to avoid dropping of free-weights altogether and certainly not from a height above knee height.
- 6.50 It is highly improbable that the above noise limits would be exceeded in the refuse areas. As such, in terms of acoustics, there would be no requirement to underdraw the slab.

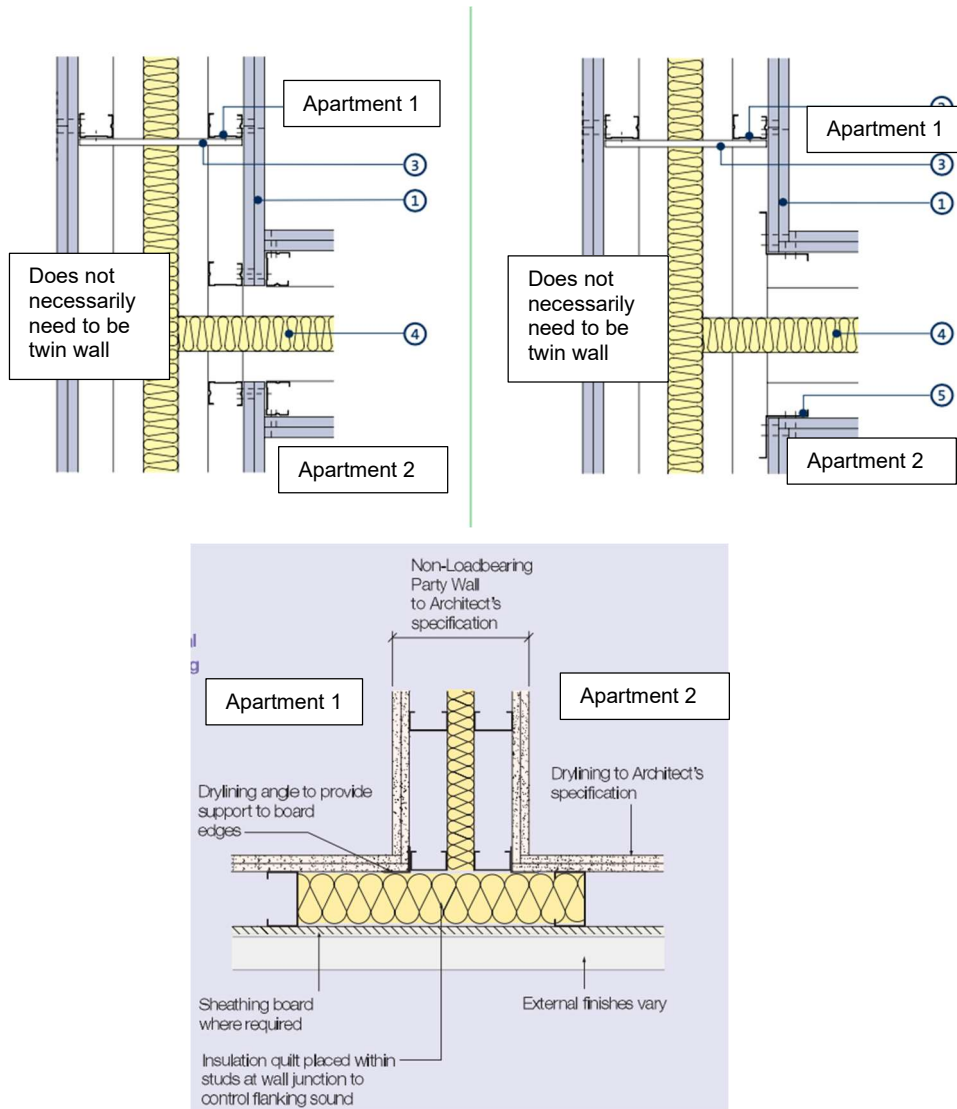
Junction Details

- 6.51 In order to achieve an appropriate level of sound insulation between apartments, the separating wall must break any internal linings of external walls, corridor walls and ceilings.

Walls

- 6.52 In principle junction details for separating party walls are presented in Figure 6.1 below.

Figure 6.1 – Examples of in principle Junction Details



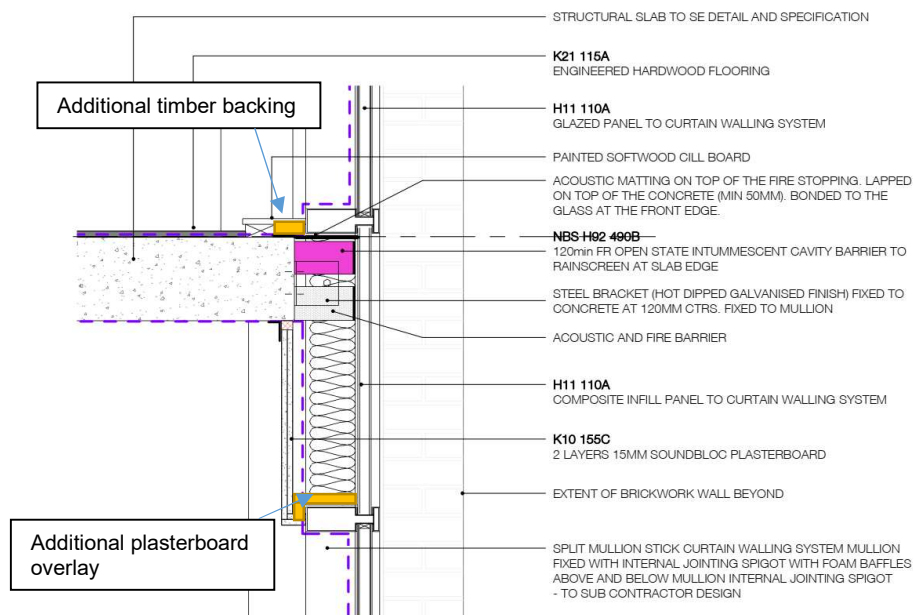
- 6.53 Deflection head details must be correctly specified and constructed and the plasterboard forming the wall must overlap the core board by at least 10-15mm, where a deflection head detail is located above (and hence protected by) a plasterboard MF ceiling.
- 6.54 It is important that there are no gaps under the partition; even hairline gaps formed by small imperfections in a concrete floor can significantly reduce the performance of the partition. As such, where floors are not completely level and free of debris, it may be necessary to install C channels on a line of mastic before fixing to the floor.

Slab Edge Detail

- 6.55 Slab edge details are identified on the Ryder drawing no IW4-RYD-00-ZZ-DR-A-4101 rev, P04. All details as shown for the upper floors are appropriate although the sealing of the window frames and window cills to the slab will be a critical element.

- 6.56 In terms of the curtain walling detail between the ground floor and first floor apartments, an additional batten should be provided to add more mass to the cill and the bottom mullion should be overlaid with a later of 15mm thick Soundbloc (simply adhered using mastic) as identified in Figure 6.2 below.

Figure 6.2 – Alterations to Curtain Walling Detail



Reverberation Time in Common Areas

- 6.57 Assuming corridors are carpeted, additional absorption (normally at soffit level) would be required to strictly comply with the requirements of ADE. However, building control may accept a reduction in the absorption.
- 6.58 In terms of the stairwells these should be fitted with a class D absorber over an area equivalent to the stair treads and landings. However, it is understood that there is normally a desire to omit this and this would need to be agreed with Building Control.

7.0 MECHANICAL SERVICES DESIGN

Internal Requirements

- 7.1 It is understood that all apartments will be served by whole house heat recovery (MVHR) units. In addition, some apartments will be fitted with an acoustic purge fan, which will assist with achieving the flow rates necessary to control overheating (in conjunction with the MVHR unit potentially operating up to 100% duty). Purge ventilation is provided to all apartments by means of openable windows.
- 7.2 The internal noise limits for mechanical plant are presented in Table 7.1 below. As discussed, the initial aim for bedrooms should be no greater than 35dB(A) when the plant is operating to control overheating.

Table 7.1 – Plant Noise Limits in Residential

Ventilation Condition	Room	Noise Limit	
		dB(A)	NR
Background	Bedroom	28	23
	Lounge	33	28
Control of Overheating	Bedroom	35-40	30-35
	Lounge	40-45	35-40

- 7.3 To achieve the suggested internal noise level limits, it is highly likely that in line attenuation will be required to the room side of the mechanical plant. Depending on the final selections and operation speeds, a manufacturers acoustic solution pack for the MVHR units may suffice. Furthermore, room side attenuation will be likely required to the purge fan. Final confirmation of silencers is required.
- 7.4 Where purge fans are located above a ceiling, the fans may need to be lagged using a dense barrier mat and any access hatches must have an acoustic rating of around 30dBR_w and a minimum overall mass per unit are of around 12.5kg/m³.
- 7.5 Based on a fully ducted mechanical services system with ductwork above ceilings and inlet and discharge grilles on the façade, silencers will not be required to the atmospheric inlet and discharge elements to control noise break-in.
- 7.6 It is essential that the MVHR units are fixed from a bracket via the soffit and that they do not touch the plasterboard perimeter walls which can act as a sounding board.
- 7.7 Subject to confirmation all cupboard walls containing the units should have a minimum acoustic rating of 45dBR_w and to all cupboard doors are solid core timber with acoustic seals (rubber compression seals) to the head, jambs, meeting stiles and threshold, noise break-out via the cupboard would be appropriately controlled to habitable areas. This will be confirmed when full noise details of the system are known.
- 7.8 To control airflow generated noise in ductwork systems to bedrooms, the maximum duct velocities are presented in Table 7.2, below.

Table 7.2 – Maximum Ductwork Airflow Velocities

Noise Level, dB(A)	Velocity, m/s		
	Main Duct	Branch Duct	Final Runout
28 (NR23)	5.0	4.5	2.5
33 (NR28)	6.5	5.5	3.25

7.9 Noise levels due to: operation of the lifts; fluid flow through any pipework; M&E services, plant and equipment in the ground floor commercial unit. shall not exceed:

- 25dBL_{A1} in bedrooms;
- 30dBL_{A1} in living rooms;
- 35dBL_{A1} in other areas.

7.10 Noise levels due to operation of M&E services, plant and equipment associated with each apartment shall not exceed 32dBL_{Amax,F} in bedrooms and 37dBL_{Amax,F} in lounges whilst background ventilation in line with ADF requirements is being provided. There should be no noise character associated with the plant operation (e.g. clicks, hum or tones).

7.11 In addition to the control of airborne noise, structure-borne noise also needs to be controlled by effectively isolating plant from the supporting concrete slab, as follows:

- Air handling plant should be installed such that it is supported 150-200mm above the floor slab;
- The support arrangement of air handling plant should include neoprene pads or similar, achieving a minimum static deflection of, nominally, 2mm under applied load;
- The fans and motor assemblies inside air handling plant should be supported off open spring isolation mounts achieving nominally 25mm minimum static deflection under applied load;
- Connecting ductwork should be effectively isolated from air handling units, using flexible connections with a minimum operating length of 150mm;
- The supporting systems of large pump sets, where applicable, should include open spring isolation mounts achieving at least 25mm minimum static deflection under applied load. The system would need to be installed on an inertia base;
- Connecting pipe work to any large pump sets should be isolated from the supporting structure by vibration isolators achieving at least 10mm static deflection under applied load.

7.12 Any service penetrations through partition walls will need to be resiliently sealed.

Atmospheric Plant Noise Emissions

7.13 Atmospheric plant noise should be controlled to the limits presented in Table 7.3, below, which are free-field and are approximately 5dB below the lowest measured background noise.

7.14 The noise limits assume that there is no acoustic character associated with the mechanical services plant (e.g. tonality or intermittency). Furthermore, they relate to the total combined noise level from all plant associated with the building.

7.15 Once further details relating to plant location and operation for the commercial unit, a noise limit can be determined to be included in any commercial unit tenancy agreement.

Table 7.3 – Plant Noise Level Limits (At nearest residential window)

Period	Plant Noise Limit, dBL _{Aeq,T}
Daytime (0700h to 2300h)	50
Night-time (2300h to 0700h)	40

- 7.16 In terms of emergency plant, at this stage, a limit of 10dB higher than those presented in Table 7.3 should be appropriate assuming that it operates for no longer than 2 hours per month and that this occurs during normal office hours.
- 7.17 It is understood that the generator could be in the car park and this is likely to require a solid acoustic barrier to all sides of the compound (min 10kg/m² e.g. a close boarded timber fence). Furthermore, an acoustic louvered lid may be required depending on the location and generator selected.

Figure A1 – Anticipated Free-field Daytime ($L_{Aeq,16hr}$) Noise Levels affecting the NW & SW Facades

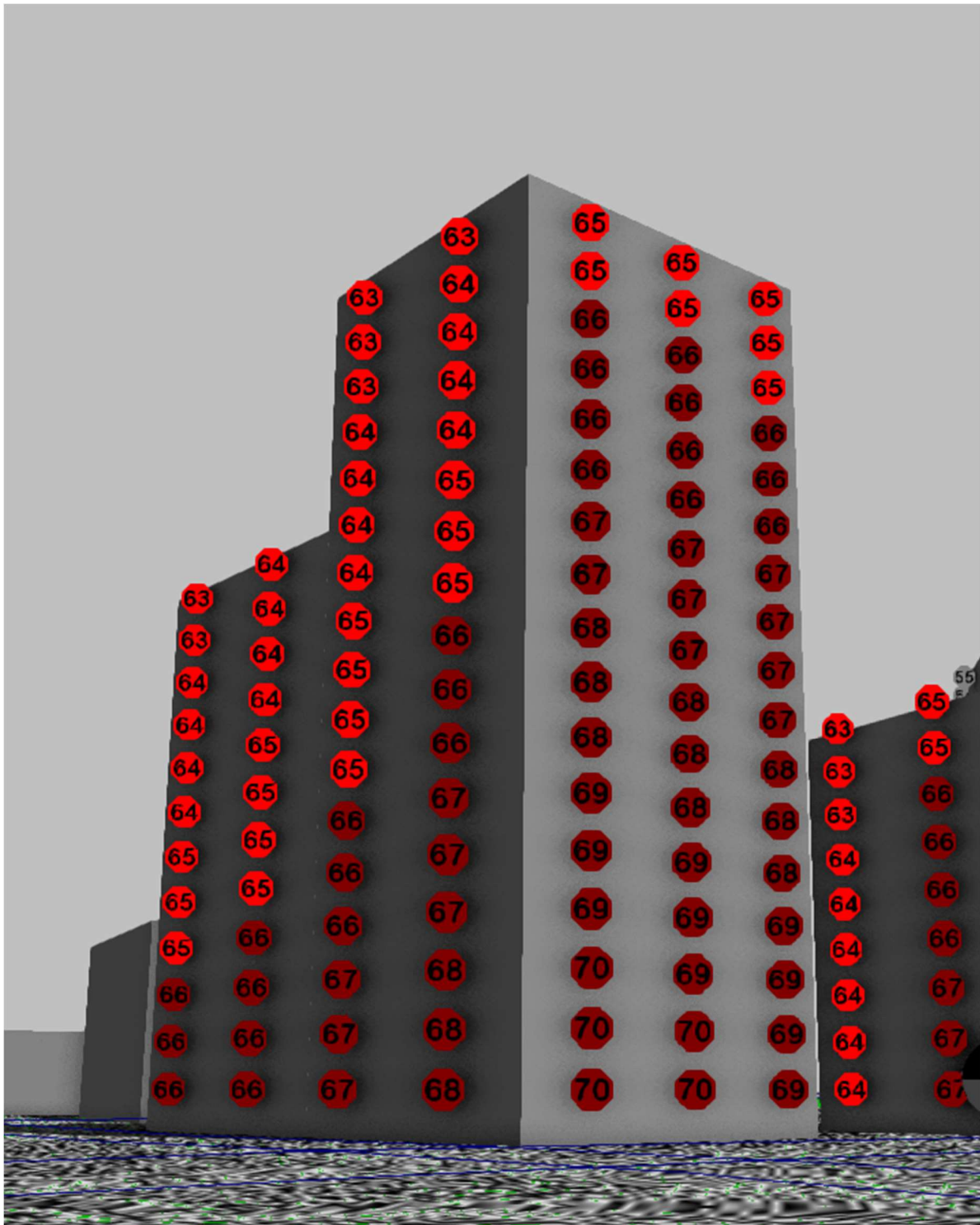


Figure A2 – Anticipated Free-field Daytime ($L_{Aeq,16hr}$) Noise Levels affecting the SE & SW Facades

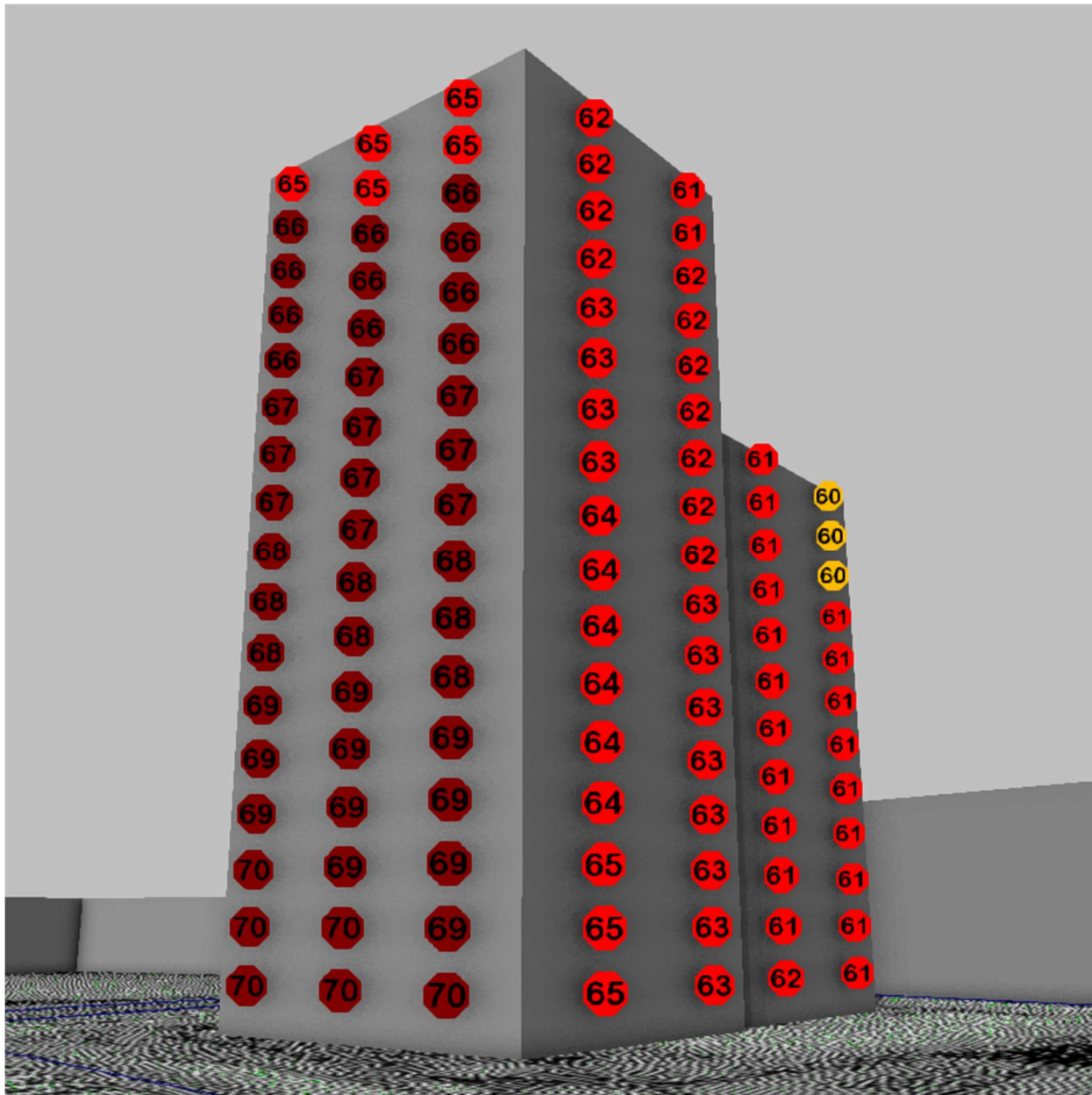


Figure A3 – Anticipated Free-field Daytime ($L_{Aeq,16hr}$) Noise Levels affecting the NE & NW Facades

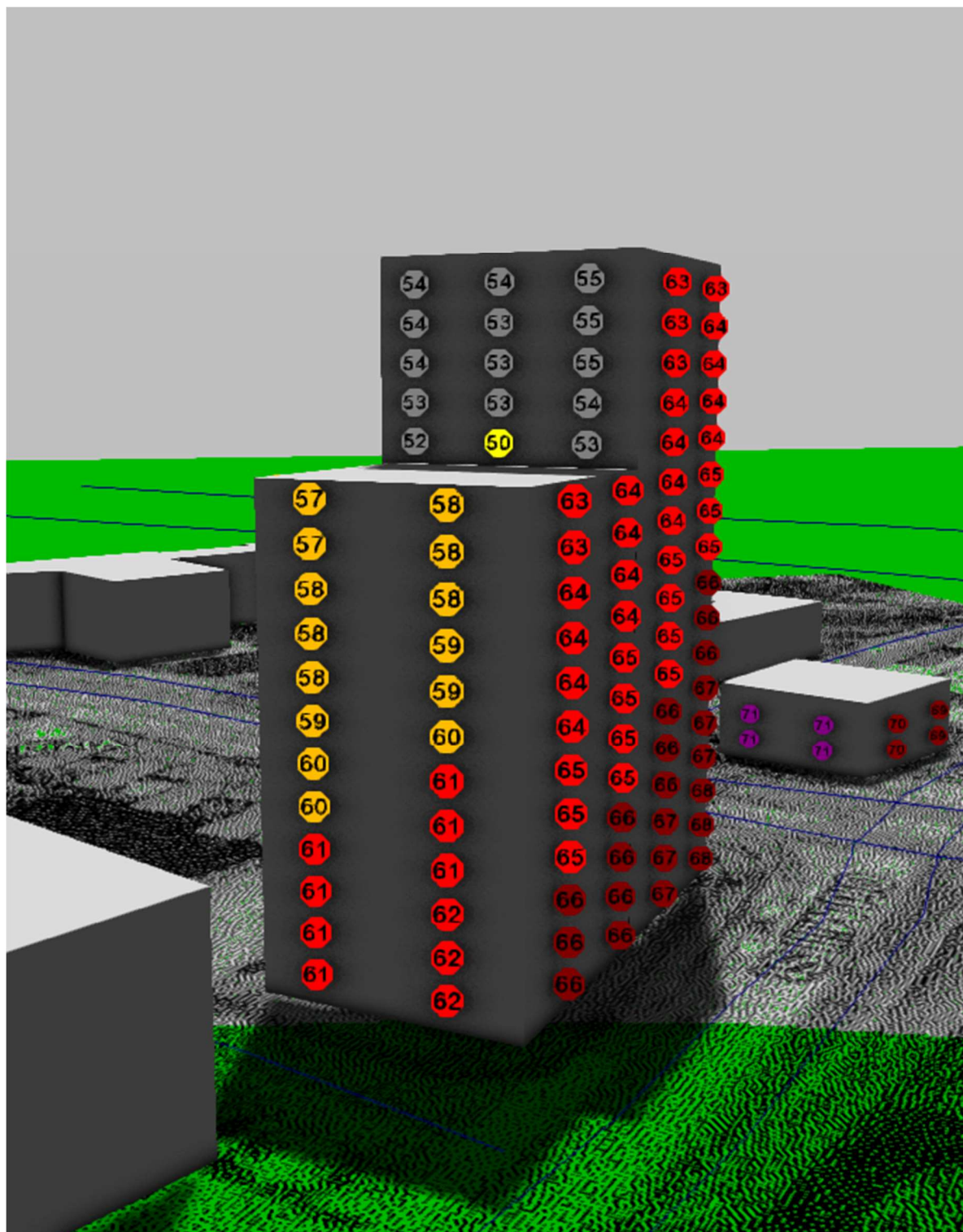


Figure A5 – Anticipated Free-field Night-time ($L_{Aeq,8hr}$) Noise Levels affecting SW & SE Facades

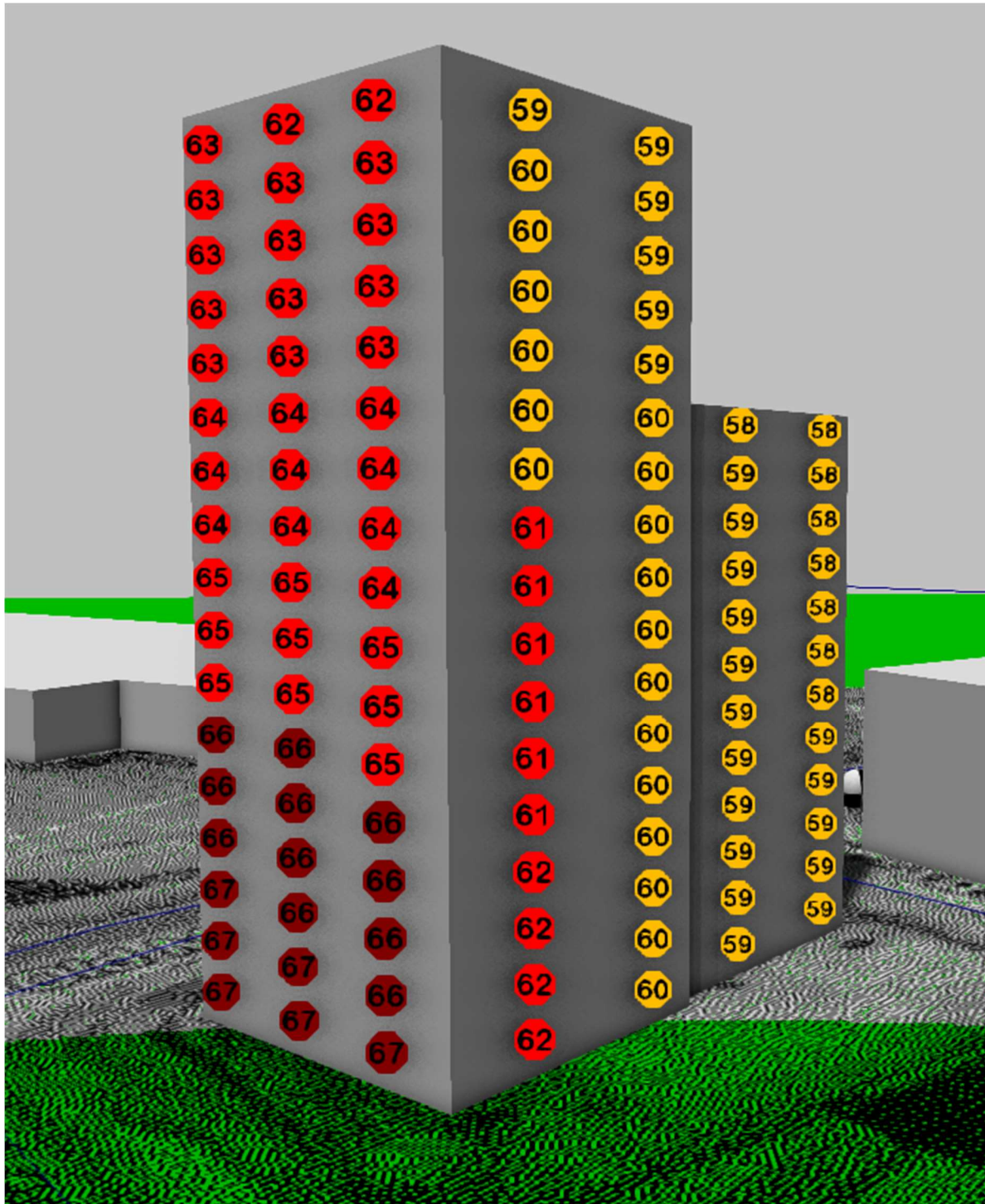
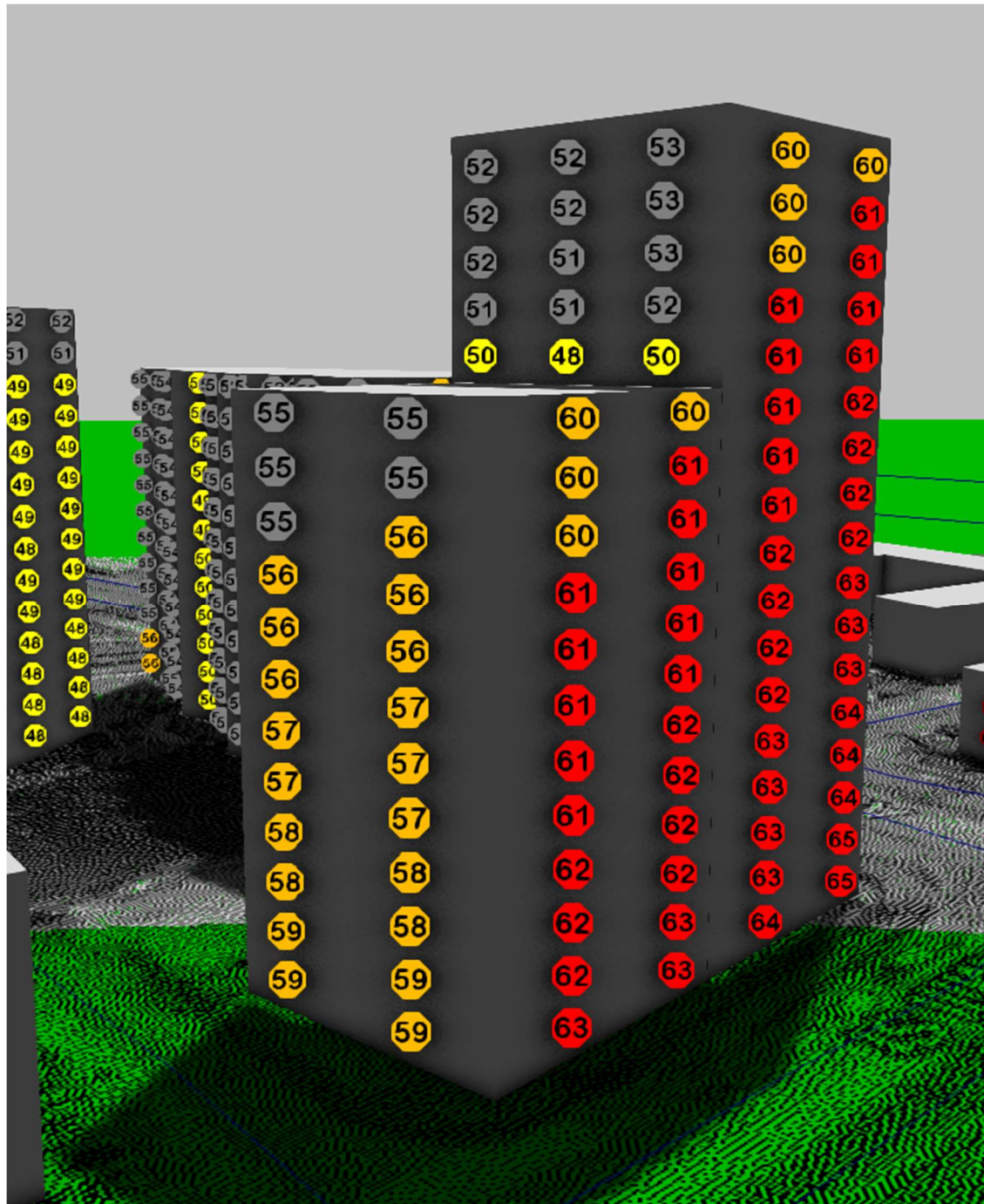


Figure A6 – Anticipated Free-field Night-time ($L_{Aeq,8hr}$) Noise Levels affecting NE & SW Facades



APPENDIX A - Acoustic Terminology in Brief

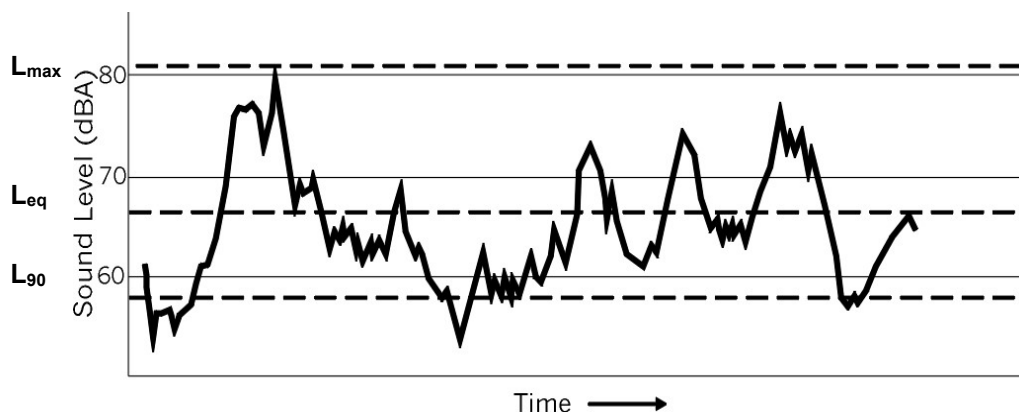
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most noise is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The dBA weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be preceded by a dB descriptor in the report e.g. $L_{Aeq,T}$ could be written $dBL_{Aeq,T}$



Example of Sound Level Varying With Time

- | | |
|-------------|---|
| $L_{Aeq,T}$ | The equivalent continuous (A-weighted) sound level. It may be thought of as the "average" sound level over a given time, T. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the "ambient" noise level. |
| L_{A1} | The (A-weighted) sound level exceeded for 1% of a measurement period. It is the value generally used to indicate a 'typical' maximum noise level. |
| $L_{A10,T}$ | The (A-weighted) sound level exceeded for 10% of a measurement period. It is the value often used to describe traffic noise. |
| L_{A90} | The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise. |
| L_{Amax} | The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited. |

Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
Façade Level	This refers to the sound level measured outside, at 1m from a hard reflecting surface, typically 3dB greater than the free-field level.

Other Acoustic Units

NRC	Noise Reduction Coefficient – a single figure number sometimes used to describe the performance of sound absorbing materials based on a combination of its absorption coefficient at various frequencies.
NR	Noise Rating – a graphical method for assigning a single number rating to a noise spectrum and is often use to specify noise level limits for mechanical services.
R_w	Single number rating used to describe the <u>laboratory</u> airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
D_w	Single number rating used to describe the on-site airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
D_{nT,w}	Single number rating used to describe the on-site airborne sound insulation performance properties of a material or building element over a range of frequencies, typically 100-3150Hz, which is calculated in terms of a standardized reverberation time of 0.5 seconds.
D_{nT,w}+C_{tr}	As above only the resultant figure is adjusted by a spectrum adaptation term in relation to the low frequency sound insulation performance.
L'_{nT w}	Single number rating used to describe the on-site impact sound insulation performance properties of a floor over a range of frequencies, typically 100-3150Hz, which is calculated in terms of a standardized reverberation time of 0.5 seconds.
RT	The RT (Reverberation Time) of a space is defined as the time it takes for the sound pressure level to reduce by 60dB. It is not always possible to measure the full 60dB decay, so the first 20dB decay (T ₂₀) or 30dB decay (T ₃₀) is used to approximate the reverberation time (T ₆₀)