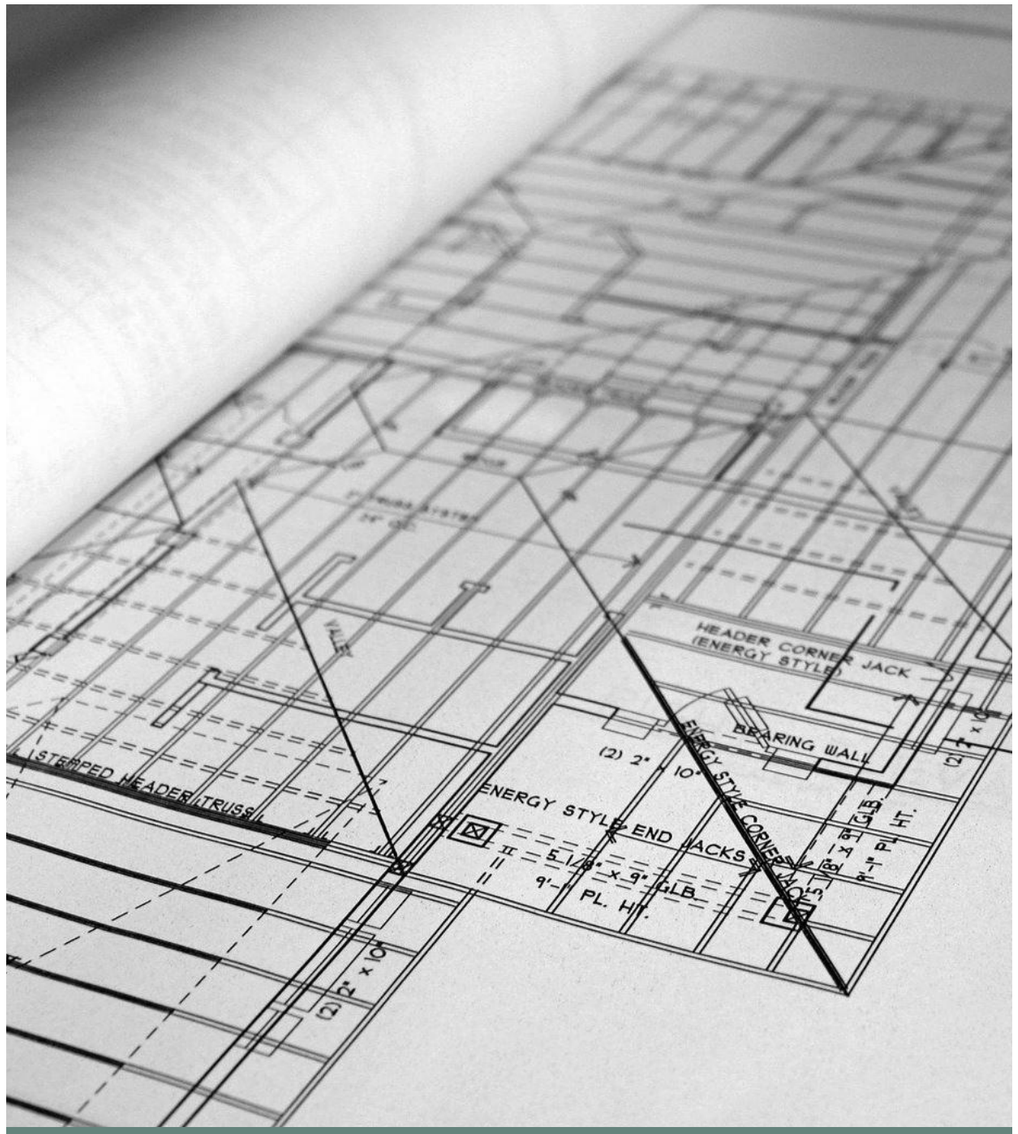
1.5.6 ACOUSTIC REPORT



Holloway Head Block C & D

RIBA Stage 4 Acoustic Design Report

Client: WinVic

Project Number: 1492021

Date: 10th August 2023

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1 INTRODUCTION

1.1 OVERVIEW

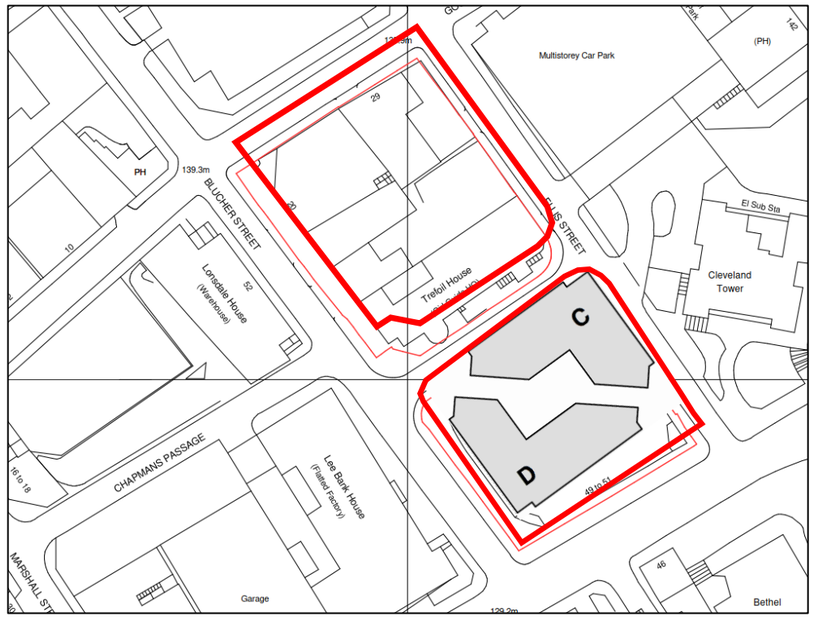
1.1.1 JPM Acoustics Ltd has been appointed by Winvic Construction Ltd to provide a RIBA Stage 4 acoustic design report for a residential development at 49-51 Holloway Head, in central Birmingham.

1.1.2 This report details relevant acoustic design criteria and guidance relating to the proposed development, and summaries the design strategies being implemented to achieve the criteria. The report uses some technical terminology where necessary and appropriate. **Appendix A** contains a glossary of relevant technical terminology to assist the reader.

1.2 DEVELOPMENT SITE

1.2.1 The development is to consist of four separate buildings split across two plots; north and south, on land bounded by Holloway Head, Ellis Street, Gough Street and Blucher Street in central Birmingham. There will be two buildings on each plot, with each pair connected at ground floor level. Block A and Block B will be located on the northern plot and Block C and Block D will be located on the southern plot. The location of both plots is shown in **Figure 1-1**. This report relates only to the design of Blocks C and D.

Figure 1-1: Site Location



1.3 SOUTHERN PLOT (BLOCK C & D) DEVELOPMENT PROPOSALS

1.3.1 The southern boundary of the southern plot is adjacent to Holloway Head, which is the only significant noise source in the vicinity of the site. The other boundaries of the plot are adjacent to relatively minor roads used by local traffic only.

1.3.2 The lower ground floor and mezzanine of the southern plot is to be predominantly used by the Girl Guides and will include a main hall, a common room, activity rooms, kitchen, offices, a three-bed apartment and associated facilities including a car park. The mezzanine will also contain a retail unit fronting onto Holloway Head.

1.3.3 The upper ground floor will consist mainly of apartments but will also have a lounge and co-working area for residents, and some small offices for staff. There will be 13 floors of residential apartments above the upper ground level.

2 DESIGN CRITERIA

2.1.1 The criteria referenced in this document have been derived with consideration to the guidance from the following:

- Building Regulations' Approved Document E: 2003 Edition (ADE) with 2004,2010, 2013 & 2015 amendments.
- National and local planning requirements.
- British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings'.
- British Standard 4142:2014+A1:2019: 'Methods for rating and assessing industrial and commercial sound'.
- The Finishes & Interiors Sector document '*A Guide to Office Acoustics'*, published in 2015.
- The Chartered Institute of Building Services Engineers (CIBSE) Guide A: *Environmental Design 2015*, including subsequent amendments.
- The British Council for Offices document *Guide to Specification*.
- Manufacturer's installation instructions.

2.1.2 Summaries of ADE and relevant British Standards are included in the following sections.

2.2 APPROVED DOCUMENT E (ADE)

2.2.1 Approved Document E "*Resistance to the passage of sound*" (ADE) of the Building Regulations 2010 sets out the Office of the Deputy Prime Minister's (ODPM) requirements for acoustic conditions within residential developments.

2.2.2 ADE sets out three Requirements: E1, E2 and E3. Requirements E1 and E2 relate to airborne and impact sound insulation performances for separating and internal walls. Requirement E3 relates to the control of reverberant noise. Requirements E1, E2 and E3 are summarised below.

Requirement E1

> *"E1. Dwelling-houses, flats and rooms for residential purposes shall be designated and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings."*

2.2.3 ADE goes on to state that:

> *"In the Secretary of State's view the normal way of satisfying Requirement E1 will be to build separating walls, separating floors, and stairs that have a separating function, together with the associated flanking construction, in such a way that they achieve the sound insulation values for dwelling-houses and flats set out in Table 1a"*

2.2.4 **Table 2-1** summarises the minimum airborne sound insulation performance requirements to be achieved by separating walls, floors and stairs across the proposed development, taken from Table 1a of ADE.

Table 2-1 - Airborne Sound Insulation Performance Requirements to be Achieved by Separating Walls and Floors

Separating Element	Performance Standards for Separating Walls, Separating Floors and Stairs that have a Separating Function	
	Airborne Sound Insulation $D_{nT,w} + C_{tr}$	Impact Sound Insulation $L'_{nT,w}$
Walls	45 dB (minimum)	-
Floors and Stairs	45 dB (minimum)	62 dB (maximum)

2.2.5 Compliance with the performance requirements detailed in **Table 2-1** will need to be demonstrated to the Building Control Officer (BCO) through a series of on-site pre-completion impact and airborne sound insulation tests. The schedule of testing will need to be pre-agreed with the BCO. Should non-compliances be identified, remedial works and retesting will be required until compliance is demonstrated.

2.2.6 It should be noted that separating walls and floors are defined as "[a] *wall* [or floor] *that separates adjoining dwelling-houses, flats or rooms for residential purposes*". A corridor wall is therefore not a separating wall. However, it is important to ensure that flanking via a corridor wall is controlled so as not to undermine the sound insulation performance of a separating wall.

Requirement E2

2.2.7 Requirement E2 states that internal walls and floors within individual dwellings should be designed and constructed in such a way that they provide reasonable resistance to sound. In order to satisfy this requirement, walls within individual rooms for residential purposes should provide an airborne laboratory sound insulation performance of not less than 40 dB R_w.

2.2.8 Requirement E2 does not apply to internal walls which contain a door or internal walls which separate an en-suite toilet from an associated bedroom.

Requirement E3

2.2.9 Requirement E3 relates to the control of reverberant noise in common areas and is as follows:

> *"E3. 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."*

2.2.10 ADE clarifies that Requirement E3 applies to corridors, stairways, hallways and entrance halls which give access to the flat or room for residential purposes.

2.2.11 Section 7 of ADE outlines two methods for demonstrating compliance with Regulation E3: Method A and Method B.

- Method A - Cover a specified area with an absorber of an appropriate class that has been rated in accordance with BS EN ISO 11654:1997: *Acoustics*. *Sound absorbers for use in buildings*. *Rating of sound absorbers*.
- Method B - Determine the minimum amount of absorptive material using a calculation procedure in octave bands.

2.3 BS 8233:2014: GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS (BS 8233)

2.3.1 BS 8233 provides guidance for the control of noise in and around buildings. The guidance provided within the Standard is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.

2.3.2 The Standard includes recommended internal and external noise level criteria for steady external noise sources such as road traffic. It is stated that it is desirable that internal ambient noise levels do not exceed the levels set out in **Table 2-2**.

Table 2-2 – Internal Desirable Guideline Values from BS 8233

Activity	Location	Period	
		07:00 to 23:00 Hours, i.e. Daytime	23:00 to 07:00 Hours, i.e. Night-time
Resting	Living Room	35 dB $L_{Aeq,16\ Hour}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\ Hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\ Hour}$	30 dB $L_{Aeq,8\ Hour}$

2.4 BRITISH STANDARD 4142: 2014+A1:2019 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND (BS 4142)

2.4.1 This British Standard describes methods for rating and assessing the following:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

2.4.2 The method uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.4.3 In accordance with the assessment methodology, the specific sound level ($L_{Aeq,T}$) of the noise source being assessed is measured or predicted at a receptor location. A rating level ($L_{Ar,Tr}$) is then derived by adding a correction or penalty to the specific sound level for characteristic features, such as tonal qualities and/or distinct impulses, which make the source distinguishable against the residual noise climate. The British Standard effectively compares the difference between the rating level and the typical background sound level ($L_{A90,T}$) in the absence of the noise source being assessed.

2.4.4 It is advised that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) when the noise source in question is likely to operate or is proposed to operate in the future.

2.4.5 Comparing the rating level with the background sound level, BS 4142 states:

> *"Typically, the greater this difference, the greater the magnitude of impact.*
>
> *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

2.5 NOISE RELATED PLANNING CONDITIONS

2.5.1 The following noise related planning conditions are imposed on the development:

Planning Condition 11

2.5.2 Planning Condition 11 states the following:

"No phase of development shall take place until for that phase of development a scheme of noise insulation between the residential and commercial premises has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved details prior to the occupation of the building and thereafter maintained. Reason: In order to secure the satisfactory development of the application site and safeguard the amenities of occupiers of premises/dwellings in the vicinity in accordance with Paragraphs 3.8 and 3.10 of the Birmingham UDP 2005 and the NPPF."

2.5.3 The only 'commercial' spaces which are adjacent to the residential areas within Blocks C and d are the Girl Guide areas and single shop unit at the mezzanine level, and the lettings office and co-working space at Upper ground floor level, all of which are directly underneath residential dwellings.

2.5.4 This assessment therefore considers noise transfer from these spaces to residential areas.

Planning Condition 24

2.5.5 The wording of Planning Condition 24 is as follows:

"Prior to occupation of the development, glazing and ventilation to habitable rooms shall be installed as specified in section 3.1 of Cascade noise assessment report Project No: CC1154 (July 2015) and thereafter retained and maintained."

2.5.6 Planning Condition 24 therefore relates to the recommended glazing and ventilation performances from the previous report, which are repeated in Section 4 of this report.

3 ENVIRONMENTAL NOISE SURVEY

3.1.1 This assessment is based on the baseline noise data captured during a survey undertaken at the planning application stage of the development, details of which are documented in Cascade Consulting's report (Ref: CC1154) noise report. A summary of the noise survey and results is summarised below.

3.2 SURVEY SUMMARY

3.2.1 Noise levels were measured next to each of the roads surrounding the proposed plots. As part of the assessment it was intended to carry out a 24-hour measurement in the existing building facing Holloway Head, however, due to safety and security concerns this was not possible. Instead, attended measurements were carried out over a 24-hour period (16th – 17th May 2014), taking sample measurements of road traffic on each of the surrounding roads. Consultation in 2015 confirmed that the 2014 data was considered to be valid and representative of baseline noise levels at the time of the application in June 2015. Noise levels were measured at five locations as described below and labelled in **Figure 3-1**.

1. Ellis Street, a façade noise measurement taken outside the multi-storey car park on Ellis Street, representative of the noise levels affecting the eastern site boundary of the north plot.

2. Brownsea Drive, a façade noise measurement taken outside the office building on the northern plot, representative of the noise levels affecting the centre of the development.

3. Gough Street, a façade noise measurement on the pavement of Gough Street, relevant for noise levels affecting the northern plot, including noise from the Craven Arms.

4. Blucher Street, a façade noise measurement on the pavement of Blucher Street adjacent to the north-western boundary of the south plot, relevant for noise levels affecting the southern plot.

5. Holloway Head, a façade noise measurement on the pavement of Holloway Head taken outside the site hoardings adjacent to the southern site boundary.

3.2.2 Noise levels were measured for 20-minute periods on a rotational basis, at each of the five locations over daytime and night-time periods. Six measurements were carried out during the daytime period and four measurements during the night-time period. **Table 3-1** details the noise measurement equipment used for the noise survey.

Figure 3-1 – Measurement Locations

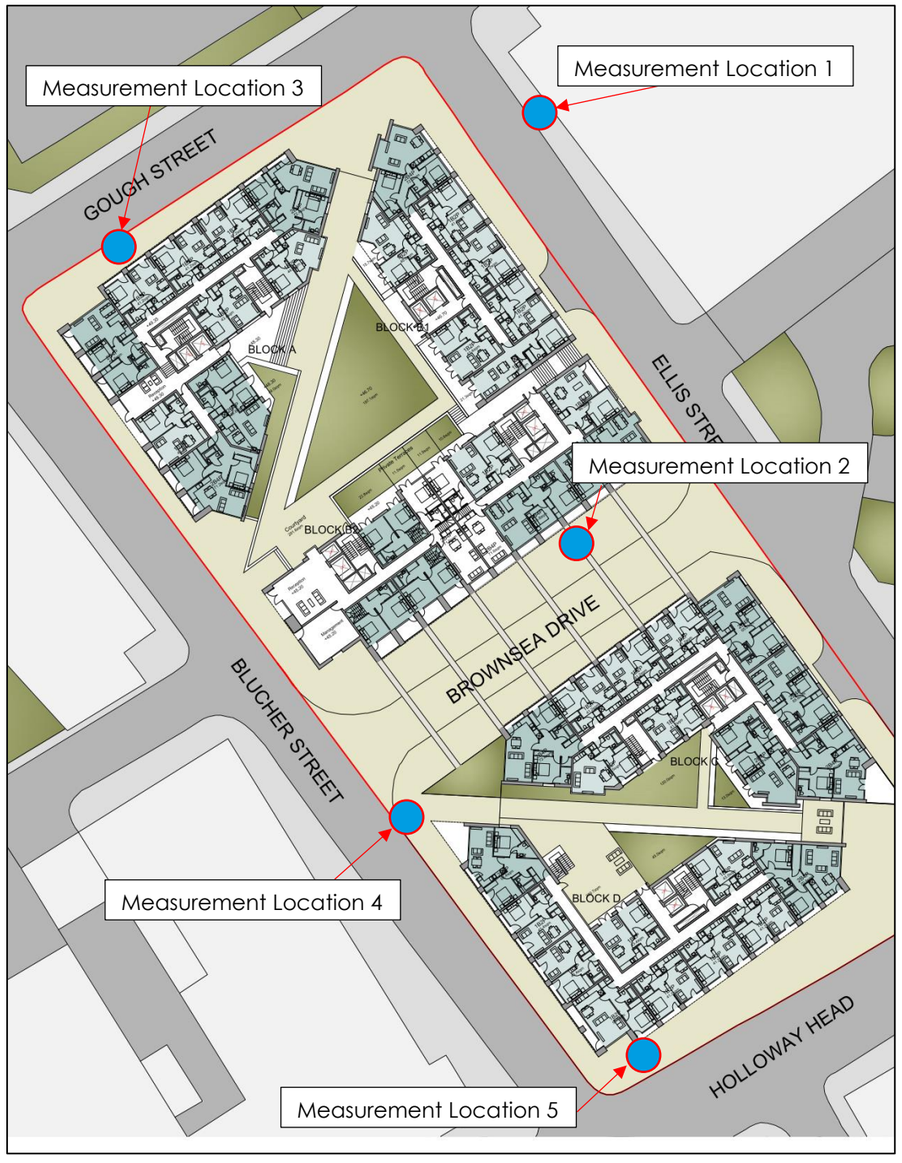


Table 3-1 – Equipment Details

Equipment	Make & Model	Serial Number
Sound Level Meter	Norsonic 118	31501
Microphone	Norsonic 1225	52234
Pre-Amplifier	Norsonic 1206	30539
Calibrator	Norsonic 1251	31057

3.2.3 At all measurement positions, the dominant noise source was road traffic, mainly cars and light goods vehicles. There was occasional noise from overflying helicopters at levels similar to that of passing cars. There was also occasional noise from emergency vehicle sirens and passers-by.

3.3 NOISE SURVEY RESULTS

3.3.1 The results of the noise survey results are presented in **Table 3-2**.

Table 3-2 – Measured Sound Pressure Levels, 20-minute Measurements, dB

Position	Time	Measured Sound Pressure Level (dB)			
		$L_{Aeq,20mins}$	L_{AFmax}	$L_{A10,20mins}$	$L_{A90,20mins}$
1	07:46	56.0	73.5	57.0	52.0
	10:01	56.6	73.9	58.6	52.4
	12:06	57.0	72.7	59.8	52.3
	14:10	58.6	74.9	61.9	52.4
	16:16	57.9	77.2	61.4	52.0
	19:07	55.6	72.6	58.4	51.5
	21:04	53.4	61.7	54.5	51.8
	23:05	51.1	69.8	54.5	48.6
	10:01	50.6	64.2	52.4	47.7
	02:59	50.4	67.5	51.3	47.9
	04:58	52.1	70.8	56.0	49.6
2	08:16	54.8	63.7	57.1	52.1
	10:29	55.5	71.2	57.2	52.5
	12:30	59.5	80.1	59.3	52.8
	14:33	58.3	72.4	61.1	53.0
	16:36	58.6	75.1	61.7	52.9
	19:26	55.2	67.8	56.9	52.1
	21:29	58.0	88.5	57.4	50.1
	23:29	51.9	73.9	54.1	48.2
	01:27	49.4	64.8	53.9	47.8
	03:24	50.4	66.6	52.0	46.0
	05:22	53.6	68.1	54.8	50.4
3	08:44	55.8	68.7	58.5	51.7
	10:55	56.8	71.4	58.8	51.8
	12:54	55.0	67.3	56.8	52.4
	14:57	56.8	67.0	58.9	53.9
	17:04	56.9	69.5	59.6	53.7
	19:51	56.4	71.0	58.9	52.3
	21:54	55.5	72.9	58.1	50.6
	23:52	50.6	70.0	53.4	47.8
	01:50	48.3	60.7	51.7	47.5
	03:47	49.2	61.8	52.0	48.3
	05:46	52.9	71.1	55.2	50.2
4	09:09	55.0	69.1	56.2	52.2
	11:18	54.8	67.4	56.3	52.5
	13:21	55.9	66.8	58.0	53.1
	15:26	56.8	67.0	58.9	53.9
	17:30	57.3	67.8	57.9	52.8
	20:15	54.2	67.2	55.5	51.7
	22:18	53.7	68.9	55.8	50.0
	00:15	51.2	66.4	54.3	48.1
	02:14	48.7	65.3	51.9	45.8
	04:10	49.9	62.9	51.5	48.0
	06:09	52.6	61.8	54.0	49.9
5	09:34	67.6	89.1	69.1	60.8
	11:43	68.5	85.7	71.8	62.2
	13:43	67.0	77.2	69.8	60.6
	15:48	66.2	76.7	68.8	60.5
	17:56	68.3	81.0	70.4	62.3
	20:39	65.4	79.6	68.2	59.7
	22:41	63.6	80.1	66.2	56.7
	00:38	61.9	74.1	64.9	53.7
	02:37	60.2	71.2	62.9	51.2
	04:34	62.5	80.6	65.9	50.5
	06:33	65.8	82.0	68.3	56.9

4 External Building Fabric

4.1.1 Planning Condition 24 references the glazing and ventilation specifications from Section 3.1 of the planning stage noise report, which are based on the highest measured noise levels at each measurement location. The specifications for the overall sound reduction required from the facades of Block C and Block D, as detailed in Table 5 of the planning report, are shown in **Table 4-1** below.

Table 4-1: Sound Insulation Performance Requirements from Previous Report, dB

Block	Façade	Street	Daytime L_{Aeq}	Night-time L_{Aeq}	Required Level Difference	
					Day	Night
C	Northeast	Ellis Street	59	52	24	22
C	Northwest	Brownsea Drive	60	54	25	24
D	Southwest	Blucher Street	57	53	22	23
D	Southeast	Holloway Head	69	66	34	36

4.1.2 As the values in **Table 4-1** are based on maximum measured L_{Aeq} levels during the daytime and night-time, the stated level difference performances are considered to be robust and suitable.

4.1.3 Based on information provided by the design team it is understood that the external wall construction is proposed to be as follows (outside to inside):

- Brick slip system
- Rockwool Rainscreen Duo Slab
- 12mm Secolite board
- 150mm SFS cavity filled with RWA45 insulation.
- 1 layer of 15mm Dense plasterboard (e.g., Duraline or Fireline)

4.1.4 The above construction is predicted to achieve a sound insulation performance of circa 47 dB $R_w + C_{tr}$. As the sound insulation performance of the wall is more than 10 dB above the required performance for the glazing units, noise break-in through the wall will not be the limiting factor, and the wall construction therefore has an acceptable performance.

4.1.5 It is proposed to use mechanical ventilation and heat (MVHR) units throughout the building, and as such ventilation openings will also afford a level of sound insulation more than 10 dB above that of the glazing. The glazed façade elements will therefore be the limiting factor in the level of sound insulation afforded by the overall façades.

4.1.6 There are three different types of glazing proposed to be used within the facades, the performance specifications for which have been provided by the supplier. The configuration, acoustic performance ratings and area of use, for each of the three systems is summarised below:

- North, East and West Facades:
  6mm glass / 14mm air gap / 8.8mm glass – 28 dB R_w+C_{tr}
- Southern Façade (Living Rooms):
- 6 mm glass / 22 mm air gap / 8.8 mm acoustic glass – 31 dB R_w+C_{tr}
- Southern Façade (Bedrooms):
- 6 mm glass / 22 mm air gap / 8.8 mm acoustic glass – 36 dB R_w+C_{tr}

4.1.7 Detailed noise break-in calculations have been undertaken to confirm that the proposed glazing units can achieve the required level difference, and consequently allow the internal noise levels with windows closed to be met. The calculation have been undertaken based on the rigorous method provided in Section G.2 of BS 8233:2014, and have been based on a road traffic noise spectrum corrected to match the A-weighted levels from the final rows of **Table 4-1.** A reverberation time of 0.5 seconds was assumed in each frequency band and room and glazing dimensions for bedrooms and lounge spaces were based on the current scheme layout, and were as follows:

Lounge spaces
- Room height: 2.35 m;
- Room width: 3.8 m;
- Room depth: 6.0 m; and
- Façade glazed area: 5.8 m^2

Bedrooms
- Room height: 2.35 m;
- Room width: 3.4 m;
- Room depth: 3.8 m; and
- Façade glazed area: 5.8 m^2

4.1.8 The results of the above predictions confirm that the performance of glazing units in combination with that of the façade meet the performance requirements in **Table 4-1**, and the internal noise level criteria from BS 8233 are predicted to be achieved. The glazing selections are therefore considered suitable for use and the requirements of Planning Condition 24 are achieved.

4.2 CURTAIN WALLING

4.2.1 Whilst for the majority of the building the façade is an SFS external wall system with punched in windows, it is understood that on a small section of Block D's northern façade there is a section of curtain wall which spans across party floor lines to the full height of the building. If there are any other locations where curtain walling spans party floor/walls JPM should be notified.

4.2.2 Where curtain walling spans across party floor (or wall) lines, the system shall incorporate suitable elements against which the party floor can be sealed to control sound flanking. The flanking transmission of the system should be proven (via testing) to provide a minimum weighted normalised flanking level difference of 53 dB $D_{nf,w} + C_{tr}$ when tested in a laboratory in general accordance with BS EN ISO 10848-2 and rated in accordance with BS EN ISO 717-1.

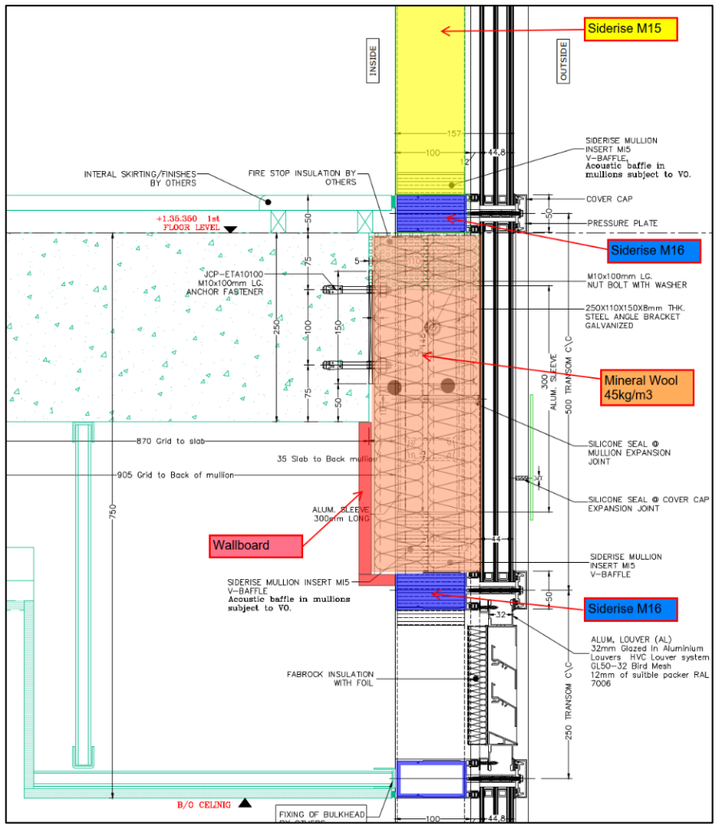
4.2.3 After having reviewed the curtain wall proposals, and tests undertaken on what is understood to be the same system, it is evident that the system will not achieve the minimum performance standard without mitigation measures being introduced. Based on the test data provided by the system supplier, it is recommended that the system at Holloway Head is as close as possible to that tested in report 28957 (Sample No. A7491-10).

4.2.4 Although the scenario at Holloway Head is slightly different to the A7491-10 test scenario due to three transoms and a ceiling cavity (as opposed to two transoms and no ceiling), the enhancements noted in **Figure 4-1** would be expected to be comparable to that in the test and would therefore meet the required D_{nfw} performance.

4.2.5 It would only be necessary for two of the three transoms to be infilled. One should be the top transom, and the gap between this and the other filled transom should then be fully filled with insulation. For the purposes of **Figure 4-1** it has been presumed the most efficient way of doing this would be to seal off the void between the top and middle transoms and fill this cavity with insulation (as shown), and include Siderise M16 infills in the middle transom.

4.2.6 Whilst a similar result could be achieved with the top and bottom transoms filled instead, there would then be a larger void to fill with mineral wool between the soffit and the ceiling. Either option would, however, achieve a satisfactory acoustic performance.

Figure 4-1: Recommended Updates to Curtain Wall Details



5 INTERNAL SOUND INSULATION

5.1 SEPERATING WALLS

5.1.1 Marked-up drawings showing the minimum airborne sound insulation performance requirements for the residential areas of Block C and Block D are included in **Appendix B**. The first-floor plan is largely repeated for the 2nd to 12th floors and it is therefore considered to also be representative of the floors above.

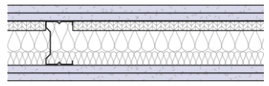
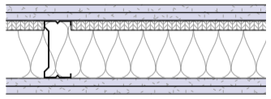
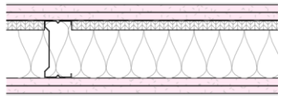
5.1.2 There are two performance parameters referenced in the sound insulation mark-ups in **Appendix B**: $D_{nT,w} + C_{tr}$ and $R_w + C_{tr}$. For reference, $D_{nT,w} + C_{tr}$ relates to the sound insulation performance to be achieved on-site and is the parameter referenced in ADE. The $R_w + C_{tr}$ parameter is a laboratory tested value and is typically higher than the on-site $D_{nT,w} + C_{tr}$ performance for the same construction.

5.1.3 The difference between the laboratory and on-site performances is typically due to the imperfect conditions which occur on-site compared to those in a laboratory where there are no penetrations, flanking details, or workmanship issues. To avoid confusion, it is the $R_w + C_{tr}$ parameter only that should be included on specifications submitted to, and received by, tenderers.

5.1.4 It is considered necessary in the case of the Holloway Head development to allow for at least a 7 dB difference between the lab tested and on-site performance, and therefore any proposed party wall construction should be rated as a minimum of 52 dB R_w+C_{tr} in order to achieve an on-site performance of 45 dB $D_{nT,w} + C_{tr}$.

5.1.5 Partition constructions for the project have been developed by Corstorphine & Wright and British Gypsum. The principle partition types, together with the respective acoustic performance ratings, are shown in **Table 5-1**.

Table 5-1 *– Summary of Main Wall Constructions*

Wall Type	Detail	Specification	Sound Insulation Performance
IW-01		• 2 x layers of Gyproc Soundbloc 12.5mm board each side of partition • Gypframe 70 AS 50 Acoustuds at 600mm centres • 25mm Isover Acoustic Partition Roll (APR 1200) in the cavity • Nominal construction width 122mm	58 dB R_w
IW-02		• 2 x layers of Gyproc Soundbloc 12.5mm board each side of partition • Gypfraem 92 AS 50 Acoustuds at 600mm centres • 100mm Isover modular roll in cavity • Nominal construction width 144mm	54 dB $R_w + C_{tr}$
IW-02a		• 2 x layers of Gyproc Fireline 12.5mm board each side of partition • Gypfraem 92 AS 50 Acoustuds at 600mm centres • 100mm Isover modular roll in cavity • Nominal construction width 144mm	54 dB $R_w + C_{tr}$
IW-03		• 1 x layer if Gypron SoundBloc 12.5mm each side of partition • Gypframe 70 S 50 'C' Studs at 600mm centres • Nominal construction width 97mm	40 dB Rw

5.2 RESIDENTIAL PARTY WALLS

5.2.1 Residential party walls between dwellings are proposed to be formed by the IW02 and IW02a dry wall construction. The sound insulation performance of this partition type is at least 45 dB $R_w + C_{tr}$, and is therefore considered capable of achieving the required on-site performance, subject to suitable workmanship and junction detailing.

5.3 PARTY WALLS BETWEEN DWELLINGS AND CORRIDORS

5.3.1 The sound insulation performance requirement of party walls between dwellings and circulation spaces (stairwells and corridors) is the same as that required between dwellings. The current scheme design includes IW01 wall constructions between apartments and corridors, which are capable of achieving the required on-site performance of 45 dB $D_{nT,w}$ + $C_{tr,}$ subject to suitable workmanship and junction detailing.

5.4 INTERNAL WALLS WITHIN DWELLINGS

5.4.1 Partitions within apartments which separate bedrooms and bathrooms from other rooms, and do not contain a door, need to be selected or designed to achieve 40 dB R_w.

5.4.2 It is understood that current proposals for internal walls typically comprise the IW03 wall type, which will provide a minimum laboratory performance of 40 dB R_w and will therefore be compliant with the requirements of ADE.

5.5 ENTRANCE DOORS TO APARTMENTS

5.5.1 Entrance doors to apartments should meet at least one of the following criteria:

- Install doors which have been tested in a laboratory and have been shown to achieve an acoustic rating of at least 29 dB R_w; or
- Install doors with a minimum mass per unit area of 25 kg/m^2, fitted with perimeter seals, including at the threshold where practicable.

5.5.2 The proposed entrance doors to be installed are Integra EnduroHD doors which meet the minimum mass per area criteria.

5.5.3 Doors should also be fitted with appropriate closers to minimise 'banging'.

5.6 PARTITIONS IN NON-RESIDENTIAL AREAS

5.6.1 ADE does not contain any mandatory requirements for the minimum sound insulation performance of partitions which are not directly related to residential dwellings. Performances for these partitions (which form the majority of the lower ground, mezzanine and upper ground floors) are therefore recommended based on relevant British Standards and industry best practice, and are shown in **Appendix B**.

5.6.2 Proposals for these partitions have been reviewed by JPM throughout the design process to ensure that they are suitable.

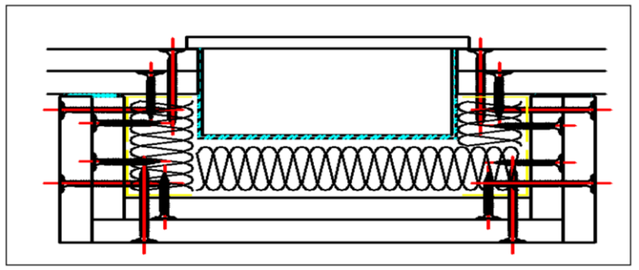
5.7 BUILDING SERVICES PENETRATIONS

5.7.1 There must be no building services pipe or duct penetrations through the separating walls between apartments and other spaces. Pipe and ductwork penetrations are permitted through internal walls and riser walls.

5.7.2 Vertical pipes or ducts should be located within the allocated service risers and must not otherwise penetrate the floor construction. Should there be any instances where this is not practical and a pipe or duct is required to penetrate the floor slab, the pipe or duct must lagged with 25 mm thick mineral fibre for the full length and then installed within an enclosure with a minimum mass per unit area of 15 kg/m^2. This mass per unit area could be provided using 2 x 12.5 mm thick wallboard. Where fire stopping is required, this should be flexible and should prevent rigid contact between the pipe and the floor.

5.7.3 Electrical sockets and switches should be avoided in separating partitions, as far as practical. Where recessed sockets are proposed they should not be mounted in a 'back to back' formation, without acoustic protection, and care should be taken to ensure a minimum of 600 mm spacing between sockets located either side of a partition. A typical baffle detail is shown in **Figure 5-1**.

Figure 5-1 - Typical Baffle Box Detail for Plasterboard Partitions



5.7.4 Regarding baffle boxes on the back of sockets and switches the following advice would apply:

- Sockets are to be boxed in with two layers of plasterboard, equivalent in density to the main partition lining.
- Socket baffle boxes should not be located within the same stud bay. Staggering between adjacent stud bays is acceptable.

- The baffle box should be fully sealed on all sides, including top and bottom. Holes in the box for cables should not be over-sized, and should be fully sealed. A further detail showing this should be subject to JPM's review.
- The baffle box should extend 150 mm above and below the socket.

5.8 JUNCTION DETAILING

5.8.1 Partition junction details must be designed carefully so as to not compromise the acoustic performance of the partitions. This is particularly important for party walls and in the following situations:

- At junction with corridor walls. The internal linings of corridor walls should be discontinuous between horizontally adjacent spaces to control flanking sound transmission.
- Party walls must not be built off a floating floor. They should extend down to the structural slab with the floating floor isolated on either side with resilient perimeter strips.
- Where party walls (or floors) abut external cladding, the internal lining of the external wall should overlap the junction full height on both sides of the wall. Linings to the external wall should not, under any circumstances, run continuously between rooms.
- Where two layers of board are fixed to studs, they should be installed with staggered joints which should be wet plastered to form an airtight seal.
- In instances where party walls are interrupted by structural columns it should be ensured that the resilient element of the party wall frame is maintained as the partition passes the column (e.g. by using resilient bar on which to fix the boards to the columns), and the internal lining of the party wall should continue as far as possible to the column.

5.8.2 Partition details shown in the Siniat Project Pack (Rev D dated 10/03/2020) have not changed significantly since having been reviewed and generally found to be acceptable. Recommendations for changes have been made where appropriate to ensure that the final details are acceptable.

5.8.3 JPM Acoustics will be pleased to review any further specific junction details as and when they become available during the ongoing design and construction phase of the project.

5.9 SEPARATING FLOORS

5.9.1 Separating floors between vertically adjacent apartments are required to achieve a minimum airborne sound insulation performance of 45 dB $D_{nT,w}$ + C_{tr} and a maximum impact sound insulation performance of 62 dB $L_{nT,w}$.

5.9.2 In addition to the above requirements, it should be noted that the proposed floor construction will be continuous between horizontally adjacent apartments above and below the partition construction. This will create a potential sound flanking path between apartments which will need to be controlled. Therefore in addition to considering the sound insulation performance achieved between vertically adjacent apartments provided by the separating floor construction, it is also necessary to consider flanking sound insulation performance provided by the concrete floor construction between horizontally adjacent apartments. Where the concrete floor construction is continuous above and below party wall constructions, it is recommended (in accordance with Approved Document E) that the concrete floor provided a mass per unit area of 365 kg/m^2 in order to control sound flanking.

5.9.3 The floor constructions throughout the development are understood to comprise 250mm insitu concrete slabs underdrawn with plasterboard (12.5mm SoundBloc board)ceilings.

5.9.4 Based upon the proposed slab thickness of 250mm, and assuming a normal density concrete (2,400 kg/m^3), the floor slab should be capable of meeting the recommended minimum mass per unit area to control flanking sound transmission, and combined with the proposed ceiling with cavity depth of at least 150mm, the proposed overall construction should also be capable of meeting the party floor airborne sound insulation impact sound insulation performance and requirements.

5.9.5 It is recommended however that the impact sound insulation performance of the floors (as built) is tested at the earliest available opportunity to verify that the floor construction is capable of meeting the impact sound insulation performance without a resilient floor covering. This is especially important for the apartments in which there is a section of curtain walling.

5.9.6 Notwithstanding the above, downlighters installed in the plasterboard ceilings in habitable spaces should be at centres of not less than 0.75 m and should have openings no greater than 100 mm diameter or 100x100 mm. There should be no more than one downlighter per 2 m^2 of the total ceiling area in each room. If a greater number of downlighters are required, acoustically rated downlighter coverings or hoods are likely to be required.

5.9.7 It should be noted that electrical cables can give off heat when in use and special precautions may be required when they are covered by thermally insulating materials (see BRE RE 262, Thermal Insulation: avoiding risks, Section 2.4).

5.10 NON-DOMESTIC SPACES TO RESIDENTIAL APARTMENTS

5.10.1 The level of sound insulation required by elements that separate residential dwellings from non-domestic use areas require further consideration and enhancement where noise levels are expected to be higher than those in a typical residential dwelling.

5.10.2 For the girl guides apartment the sound insulation of the 'base' floor construction alone (plasterboard ceiling, 250mm concrete slab) is expected to be sufficient.

5.10.3 The separating floor between the girl guides Activity Room and dwellings above, and between the Main Hall and dwellings above, is proposed to comprise a 250 mm concrete slab underdrawn by a mineral fibre ceiling with a Soundblocker 16 backing system. Calculations suggest that the proposed separating floor construction is capable of facilitating a noise level of 88 dB(A) in the Main Hall or Activity Room while not exceeding the desirable guideline values from BS 8233 in apartments above. It is therefore recommended that any amplified music systems installed within the Mian Hall or Activity Room includes a noise limiter to ensure noise levels in the spaces do not exceed 88 dB $L_{Aeq,5mins}$.

5.10.4 For the separating floor between the ground level commercial spaces and apartments above, the "standard" separating floor construction (i.e. 250 mm concrete slab with plasterboard ceiling below) is predicted to be sufficient, provided the use classes of the space is either A1, A2, A5, D1 or B1.

5.10.5 Where the use of the commercial space is to be A3 or A4 (Food & Drink and Drinking Establishments) a suspended mass barrier ceiling comprising two layers of dense plasterboard with insulation in the cavity, may be required to the entire ceiling area of the commercial space, mounted to the soffit to the soffit on acoustically resilient hangers.

6 CONTROL OF REVERBERANT NOISE

6.1 SOUND ABSORPTION

6.1.1 Requirement E3 of the Building Regulations relates to the provision of sound absorption within common areas which provide direct access to dwellings and is aimed at minimising the potential for disturbance to residents from reverberant noise build-up in common areas.

6.1.2 The underlying principle of Requirement E3 is to provide sound absorbent finishes so that the reverberant noise level in common areas is reduced. This includes all corridors, hallways, stairwells and entrance lobbies which provide direct access to any dwelling. The requirements of E3 do not apply to corridors or hallways within dwellings, and do not apply to stairwells which do not provide direct access to apartments.

6.1.3 Based upon the proposed Holloway Head development floor plans, Requirement E3 would apply to the communal corridors to all residential floors, as shown in green in **Figure 6-1** and **Figure 6-2**.

Figure 6-1: Upper Ground Level Areas where Requirement E3 applies.

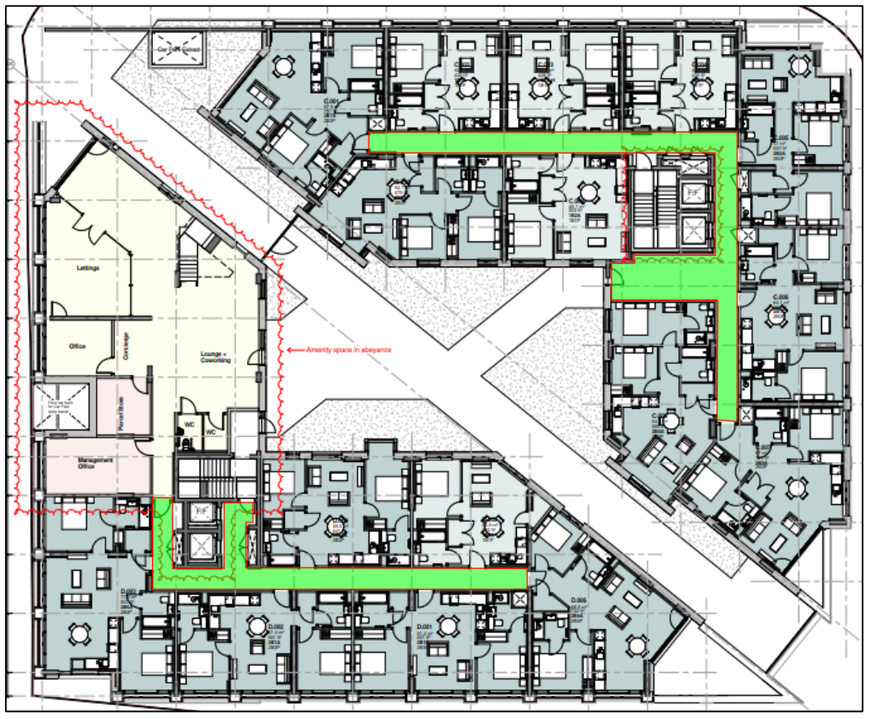
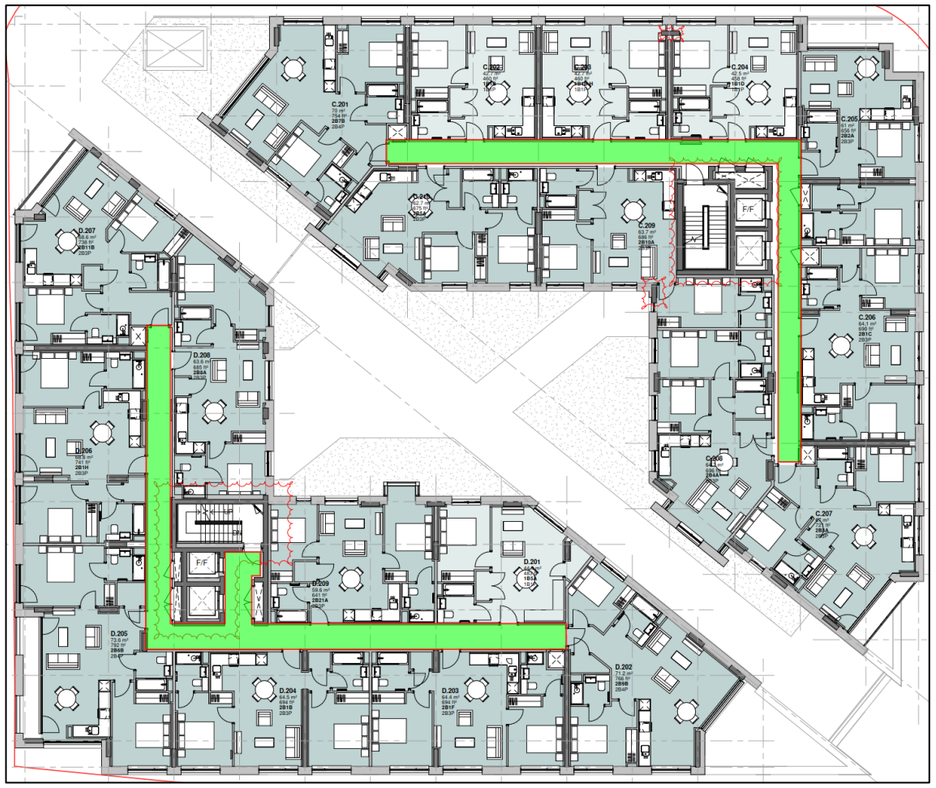


Figure 6-2: First Floor Level (and levels above) Areas where Requirement E3 applies



6.1.4 Within ADE, there are two methods by which compliance with E3 can be achieved - Method A or Method B, both of which are described below:

Method A

6.1.5 Method A provides a minimum surface area of wall/ceiling to be treated with sound absorption. For entrance halls, corridors and hallways, an area equal to or greater than the floor area should be covered with a Class C performing absorber (or better).

6.1.6 For stairwells, the combined surface area of the stair treads, the upper surface of the landings (excluding ground floor), and the ceiling area of the top floor should be calculated. Either of the following methods would comply with the ADE E3 Method A requirements, providing the absorptive material is evenly distributed between all floors:

- Cover an area equal to the calculated area with a Class D performing sound absorber;
- Alternatively, cover an area equal to 50% of the calculated area with a Class C performing sound absorber.

Method B

6.1.7 Method B takes into account the existing absorption in the room. It can provide flexibility in the amount of absorption needed within the space to comply with ADE E3.

6.1.8 To assess the extent of absorption required, octave band calculations (250 Hz to 4kHz) are required based on the proposed finishes, to show the following absorption areas are provided:

- For entrance halls provide ≥ 0.20 m^2 of absorption area for every cubic metre;
- For corridors/hallways provide ≥ 0.25 m^2 of absorption area for every cubic metre.

6.1.9 The additional absorptive material that is required should be evenly distributed throughout the space.

6.1.10 The design proposals for Holloway Head Block C and Block D, as illustrated in drawings P21043-CW-BD-XX-DR-A-4707 & P21043-CW-BD-XX-DR-A-4706) comprises a lay-in grid ceiling using Zenita Dune Evo tiles for most of the corridor areas, with plasterboard ceilings in the areas immediately surrounding the cores.

6.1.11 These proposals provide absorption totalling >0.25m^2 of absorption per cubic meter, which is distributed evenly enough to meet the requirements of Method B.

Non-residential Areas

6.1.12 There are no statutory requirements for reverberation times in the ancillary non-residential spaces, and at Stage 3, there was no reverberation time criteria specified for non-residential spaces. As such, it is assumed this is not a project requirement.

6.1.13 Notwithstanding, whilst in certain areas sound absorbent finishes may not be required, they may still be advisable to control reverberant noise build up and promote a comfortable environment to suit its intended use.

6.1.14 It is recommended that reverberant noise build-up in the Girl Guides' Main Hall and Activity Rooms is controlled to an extent in order to both limit the potential for noise break out and also to provide more comfortable acoustic conditions for users.

6.1.15 It is recommended that a Class A acoustic absorptive finishes, or equivalent, are installed to an area equal to that of the ceiling. This could for example be provided by a mixture of ceiling tiles and/or wall panels.

7 BUILDING SERVICES NOISE

7.1.1 There are no statutory noise level limits for building services plant in residential spaces. The proposed criteria presented in this section are therefore based on relevant guidance documents, British Standards, industry best practice and experience on similar projects.

7.2 INTERNAL NOISE LEVEL LIMITS

7.2.1 Proposed internal noise level limits for building services plant (e.g. MVHR) are presented in **Table 7-1**. Noise level limits should consider duct-borne noise and casing radiated noise from the MVHR unit, where applicable. The building services engineer should design the system to ensure the noise level limits are not exceeded.

Table 7-1 - Proposed Building Services Noise Level Limits in Sensitive Spaces

Location	Proposed Criteria	
	Noise Rating Level (NR)	dB(A)
Bedrooms	25 (35[1])	30 (40[1])
Living / Dining Rooms	30	35
Bathrooms	40	45
Kitchens	40 (50[1])	45 (55[1])
Foyer / Reception	40	45
Circulation Spaces (Communal Corridors)	40	45
Open Plan Coworking Space	40	45
Retail Unit	40	45
[1]*Criteria under boost setting (e.g. for purge ventilation when cooking)*		

7.3 PROPOSED WHOLE HOUSE VENTILATION SYSTEMS

7.3.1 The MVHR system currently proposed in each apartment is a Nuaire MRXBOX-ECO, which will typically be operated in 'trickle' mode but which will also have 'Boost' mode for additional ventilation to be used at the discretion of the occupier,

7.3.2 The units will operate at different duties depending on the size of each respective apartment and will therefore produce different levels of noise in different apartments. The sound power data for the MVHR units operating at the worst case duties in one, two and three bedrooms apartments has been obtained from Nuaire and are presented in **Table 7-2**.

Table 7-2 – MVHR Supply and Exhaust Duct Sound Power Levels

Location	Mode	Duty	Sound Power Level, dB							
			63	125	250	500	1k	2k	4k	8k
1 Bed Apartment	Trickle	46%	38	34	31	31	22	16	16	16
	Boost	53%	50	56	55	57	51	49	38	27
2 Bed Apartment	Trickle	56%	46	49	48	49	42	37	27	19
	Boost	66%	54	62	61	63	58	56	46	37
3 Bed Apartment	Trickle	51%	49	55	54	56	50	48	36	25
	Boost	58%	52	58	57	59	53	52	41	31

7.3.3 Using the data shown in **Table 7-2** and the proposed duct layout drawings (Drawing number E378-TNA-XX-XX-DR-M-31xx series) for each respective apartment type, calculations have been undertaken to predict the noise levels likely to arise in the rooms supplied by the MVHRs.

7.3.4 The results of the calculations indicate that the proposed criteria shown in **Table 7-1** will be achieved in both modes by at least 3 dB without the need for additional attenuation.

7.3.5 Noise break-out from the units themselves should be adequately controlled due to being installed in a utility cupboard in the dwelling's hallway. It is imperative that MVHRs are not installed in bedrooms or other habitable rooms.

7.4 SERVICES RISERS AND PIPEWORK

7.4.1 Pipes (e.g. SVPs) and ducts (excluding gas pipes) are required to be enclosed (full height) where they penetrate a floor separating habitable rooms. For Building Regulations' compliance, the pipe should be separated from the habitable room with 2 No. layers of board (total min. 15 kg/m^2) and 25 mm mineral wool. Access to pipes will be via destructive means only.

7.4.2 The design proposals for the project are understood to comprise a single layer of 15mm Duraline board with 2mm plaster skim. The density of this build is 16.5 kg/m^2 (>15 kg/m^2) and is therefore considered acceptable, although it is recommend that regular checks take place to ensure that skim is not applied at a depth significantly less than 2mm.

7.4.3 It should be noted that the above will not ensure inaudibility in habitable rooms. If there is an aspiration for noise from pipes to approach inaudibility in habitable areas, JPM Acoustics will advise further on possible additional treatments (e.g. acoustic HDPE soil pipes etc.).

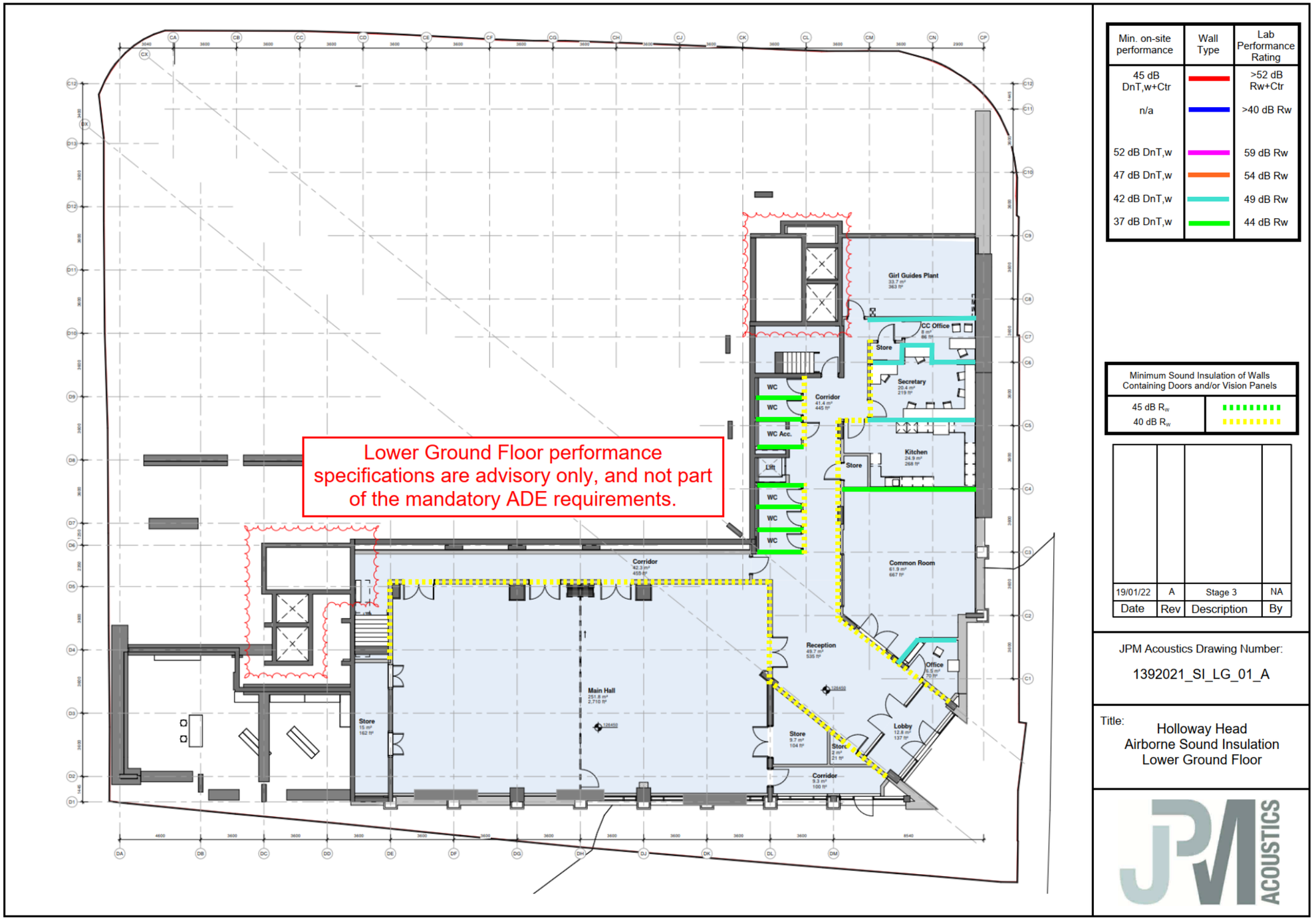
7.4.4 Pipework within risers shall be supported in a manner which precludes the transmission of structure-borne noise to walls and floors. This could be achieved by:

- Supporting pipework off masonry elements (e.g. via Unistrut off slabs if required) so that pipes are fully independent of lightweight walls with a minimum 10 mm clearance.
- Using oversized brackets containing neoprene inserts.
- Incorporating acoustic dampeners where pipework is suspended from floor slabs.
- Using rubber lined pipe brackets.

APPENDIX A: TECHNICAL GLOSSARY

Term	Descriptions
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20 µPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds S1 and S2 is given by 20 log10 (S1 / S2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m.
Façade	At a distance of 1 m in front of a large sound reflecting object such as a building façade.
Fast/Slow Time Weighting	Averaging times used in sound level metres.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.

APPENDIX B: ACOUSTIC SOUND INSULATION MARK-UP DRAWINGS



Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr		>52 dB Rw+Ctr
n/a		>40 dB Rw
52 dB DnT,w		59 dB Rw
47 dB DnT,w		54 dB Rw
42 dB DnT,w		49 dB Rw
37 dB DnT,w		44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	
40 dB R_w	

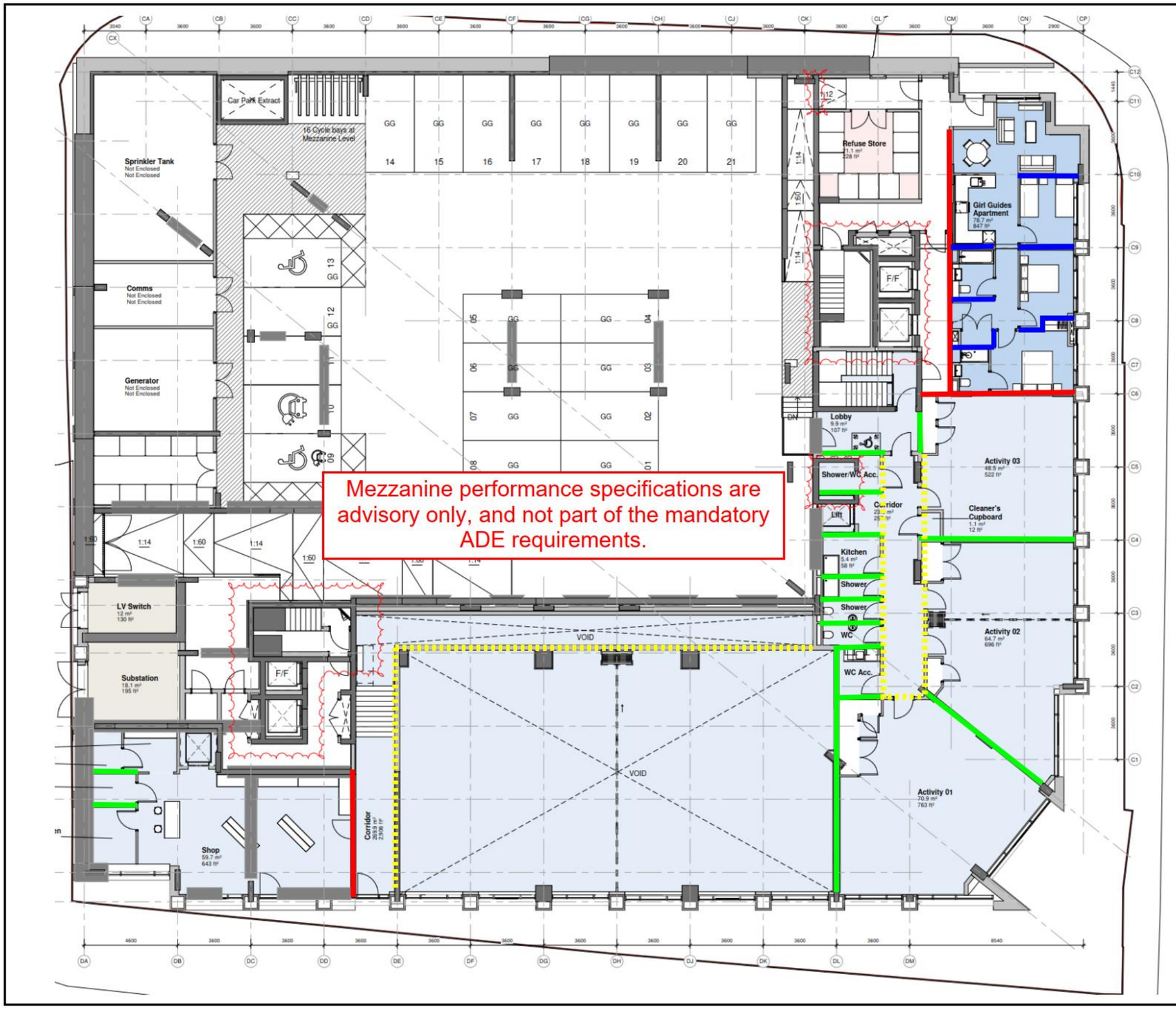
Date	Rev	Description	By
19/01/22	A	Stage 3	NA

JPM Acoustics Drawing Number:

1392021_SI_LG_01_A

Title:

Holloway Head
Airborne Sound Insulation
Lower Ground Floor



Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr		>52 dB Rw+Ctr
n/a		>40 dB Rw
52 dB DnT,w		59 dB Rw
47 dB DnT,w		54 dB Rw
42 dB DnT,w		49 dB Rw
37 dB DnT,w		44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	
40 dB R_w	

19/01/22	A	Stage 3	NA
Date	Rev	Description	By

JPM Acoustics Drawing Number:

1392021_SI_MEZ_01_A

Title:

Holloway Head
Airborne Sound Insulation
Mezzanine Level

Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr		>52 dB Rw+Ctr
n/a		>40 dB Rw
52 dB DnT,w		59 dB Rw
47 dB DnT,w		54 dB Rw
42 dB DnT,w		49 dB Rw
37 dB DnT,w		44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	
40 dB R_w	

19/01/22	A	Stage 3	NA
Date	Rev	Description	By

JPM Acoustics Drawing Number:

1392021_SI_UG_01_A

Title:

Holloway Head
Airborne Sound Insulation

Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr		>52 dB Rw+Ctr
n/a		>40 dB Rw
52 dB DnT,w		59 dB Rw
47 dB DnT,w		54 dB Rw
42 dB DnT,w		49 dB Rw
37 dB DnT,w		44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	
40 dB R_w	

Date	Rev	Description	By
19/01/22	A	Stage 3	NA

JPM Acoustics Drawing Number:

1392021_SI_1F_01_A

Title:

Holloway Head
Airborne Sound Insulation