



HTM-08-01 Acoustic Assessment

Site Address: The Langley Building, Southmoor Road, Roundthorn
Industrial Estate, Wythenshawe, Manchester, M23 9QZ

Client Name: MHA Architects

Project Reference: NP-010558



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<i>Delivering sustainable development by promoting good health and well-being through effective management of noise.</i>		

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare an acoustic assessment for an extension to the existing Medicines Evaluations Unit ('the proposed development') at The Langley Building, Southmoor Road, Roundthorn Industrial Estate, Wythenshawe, Manchester, M23 9QZ ('the site').

It is understood that the Client is intending to submit a planning application to the Local Planning Authority, Manchester City Council.

The aim of the report is to assess the suitability of the site for the proposed usage and provide acoustic design advice to ensure that appropriate internal acoustic conditions can be achieved. The aim is also to positively influence the acoustic design of the scheme, providing minimum specifications for sound insulation and reverberation times.

Additionally, a fixed plant limit level has been defined and a construction noise impact assessment has been undertaken to protect any existing noise sensitive receptors ('NSRs') during both the construction and operational phases of the development.

An environmental survey was undertaken in January 2024 to ascertain existing ambient and background sound levels at the site. The results of the noise survey have been used to inform the assessment.

The assessment is completed considering information and drawings provided by the client and has been conducted in accordance with the relevant performance standards, legislation policy and guidance.

This report is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Standards & Guidance

The following performance standards and guidance have been considered to ensure good acoustic design in the assessment:

- BS8233 – Guidance on Sound Insulation and Noise Reduction for Buildings (2014)
- Health Technical Memorandum (HTM) 08-01: Acoustics (2013)
- Building Bulletin 93 (BB93) – Acoustic Design of Schools: Performance Standards (2015)
- British Standard BS5228:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites'
- British Standard BS4142:2014+A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'
- National Planning Policy Framework (2023)
- Noise Policy Statement for England (2010)
- ProPG: 'Planning and Noise 2017' (including supplementary documents 1 & 2)

Health Technical Memorandum 08-01: Acoustics (2013)

This document provides guidance to assist with the acoustic design of buildings/rooms of medical use. It sets out minimum performance standards for the acoustics of medical buildings and describes the normal means of demonstrating compliance with the criteria. In particular, the document addresses the following acoustic criteria:

- Internal ambient noise levels (IANL)
- Noise from mechanical services
- Sound Insulation
- Reverberation times

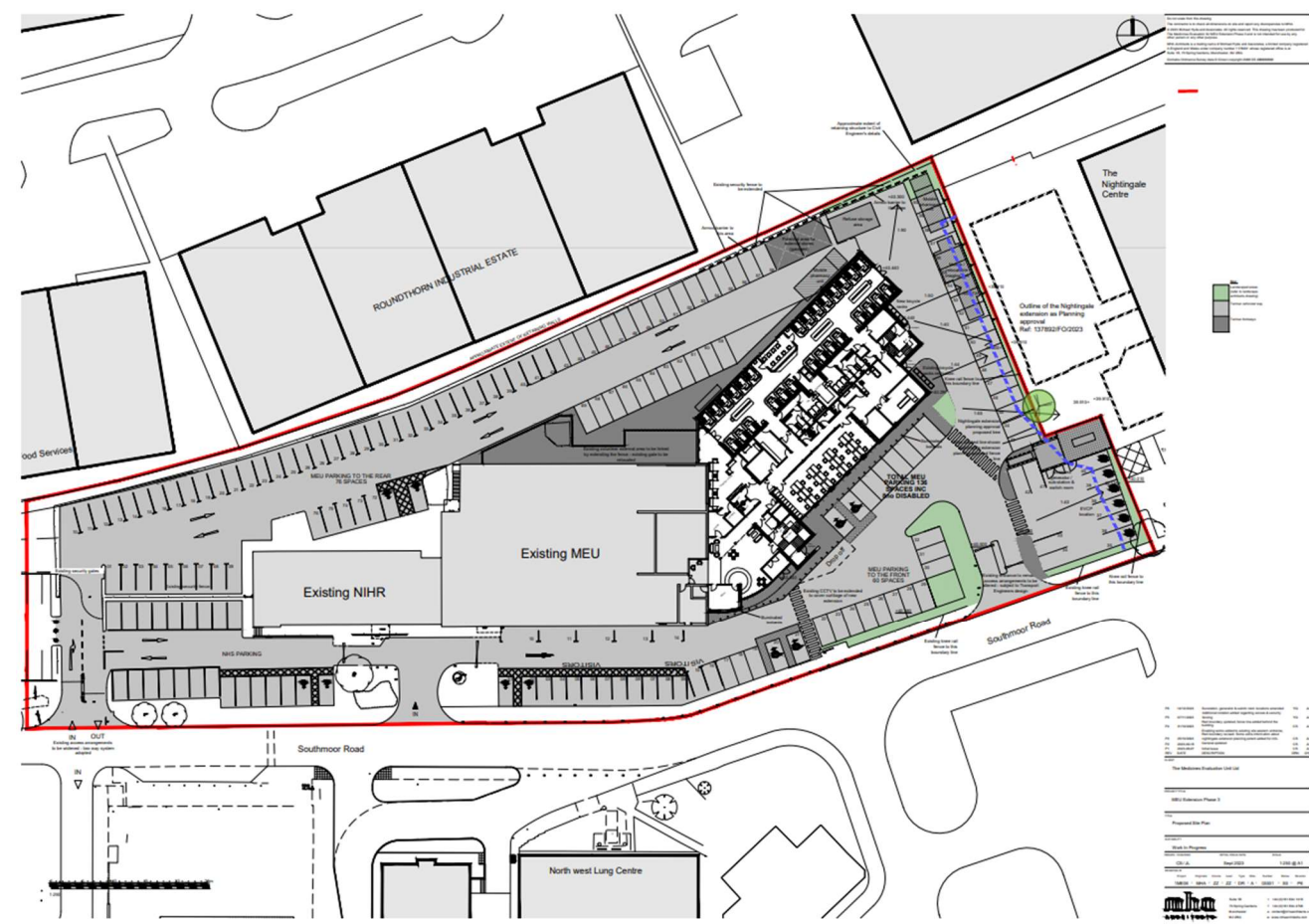
Whilst HTM 08-01 is specifically designed for buildings of medical use, some of the room classifications within the proposed development are outside the scope of this standard. In these cases, advice has instead been taken from the other sources.

Proposal Brief

The proposed three-storey extension to the existing Medicines Evaluations Unit ('MEU') shall significantly extend the capacity of the current MEU, with the extension including new inpatient ward accommodation, patient welfare facilities, a CT scanning suite, a cleanroom aseptic pharmacy suite, lab spaces, office spaces, seminar space and meeting rooms. The building will primarily be used to deliver clinical trials using cohorts of 'health' volunteers over 'inpatient' stays of less than 1 week.

As part of the proposals, sleeping accommodation in wards and overnight stays in the new monitor rooms on the 2nd floor may be required during some trials. In light of this, both the daytime and night-time periods are included within this assessment.

The outline site plan is presented in Figure 1.



Drawing Ref. "1ME06-MHA-ZZ-ZZ-DR-A-03001-S0-P6" by MHA Architects

Figure 1 – Proposed Site Plan

2. Environmental Noise Survey

Measurement Methodology

Baseline noise monitoring was undertaken at multiple locations around the site to establish the existing noise climate and the acoustic characterisation of the area.

The following table outlines the measurement particulars. The measurement positions used are illustrated in Figure 2, with all measurements were taken at a height of 4m above local ground in free-field conditions. Further information regarding the equipment used and the meteorological conditions during the survey is included in Appendix D.

Location	Survey Period	Measurement Particulars
MP1	12/01/2024 – 15/01/2024	Equipment affixed to a lamppost south of the existing MEU, overlooking Southmoor Road.
MP2	12/01/2024 – 15/01/2024	Equipment affixed to a lamppost north of the existing MEU, representative of rooms on the first floor.
MP3	12/01/2024 – 15/01/2024	Equipment affixed to a lamppost opposite the nearest residential receptors off Fouracres Road.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:

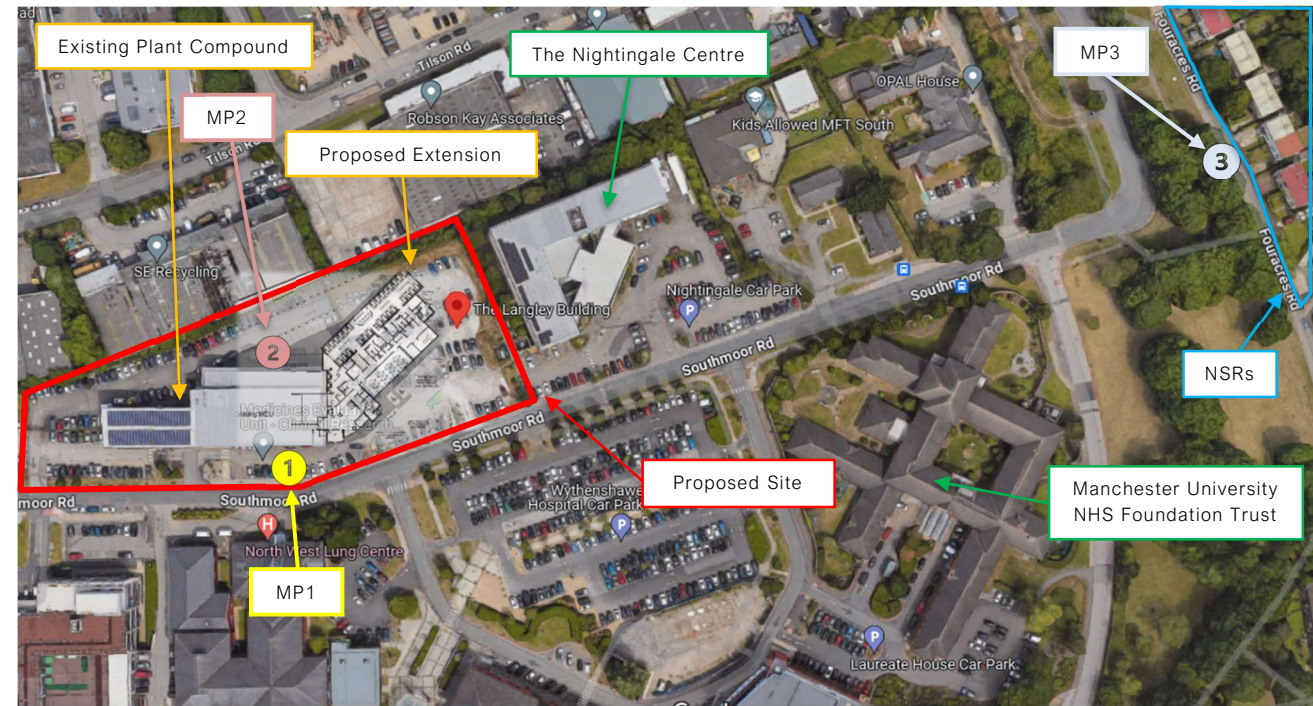


Figure 2 – Measurement Locations and Site Surroundings

Context & Subjective Impression

The site is situated in what is primarily a commercial / industrial area of Wythenshawe, approximately 10.4km south of Manchester City Centre. The buildings in the local area primarily consist of medical buildings as part of the Manchester University NHS Foundation Trust, including specialist treatment units, an emergency A&E department, and the University Hospital of South Manchester. The closest and arguably the most sensitive buildings are listed below:

- The Medicines Evaluation Unit at Langley House, adjacent to the Proposed Development.
- The Nightingale Centre, a cancer screening and treatment facility. Located approximately 10m east of the proposed site boundary.
- Northwest Lung Centre, a specialist lung treatment facility and clinical research centre.

Along the northern boundary of the site are a number of industrial premises, including an auction house, two waste management premises, and a catering / drink supplier.

A number of residential NSRs have been identified, with the most notable being No. 67 and No. 69 Fouracres Road and the houses off Nevendon Drive. It should be noted that the hospital itself is also classed as a receptor.

The acoustic environment within the area was found to be moderate to high in level, with the dominant noise sources at all three measurement positions identified as being road traffic noise and pedestrian footfall. Transport noise sources were found to include multiple private vehicles, buses, and occasional tram passes. The noise environments at MP1 and MP3 consisted of similar sources and origins, however it was noted that the environment at MP2 was slightly lower in level due to the screening provided by The Langley Building.

An existing external plant compound was identified by the northern façade of the existing MEU, which is enclosed by an open boarded timber fence. Two operational chiller units along with multiple other items of non-operational plant were contained within the compound. Plant noise from the compound was only subjectively audible at MP2 during breaks in the surrounding ambient noise and was in no way dominant.

3. Environmental Noise Survey Results

In the following sections the measured ambient and background sound levels which will be used to inform the subsequent internal ambient noise level, construction noise, and plant noise assessments are summarised.

As each assessment requires different noise level parameters, the results have separated into three tables corresponding to each assessment.

Ambient Levels for Construction Noise Impact Assessment

Average LAeq,T for the Construction Noise Impact Assessment			
Location	Average Daytime* LAeq,T (dB)	Average Evening* LAeq,T (dB)	Average Night-time LAeq,8hr (dB)
MP1	65	64	56
MP2	53	51	47
MP3	62	59	53
Notes: * Daytime denoted as 07:00-19:00 hours Monday to Friday and 07:00-13:00 hours on Saturdays. Evening denoted as 19:00-23:00 hours Monday to Friday, 13:00-23:00 hours Saturday, and 07:00-23:00 hours on Sunday. Assessment periods in line with BS5228 ABC method.			

Table 2 – Ambient Noise Level Results Summary for Construction Assessment

Ambient Levels for Internal Ambient Noise Level Assessment

Highest LAeq,1hr for the Internal Ambient Noise Level Assessment			
Location	Measurement Period ('T')	Average LAeq,T (dB)	Highest LAeq,1hr (dB)
MP1	LAeq,16hr (07:00 – 23:00)	65	68
	LAeq,8hr (23:00 – 07:00)	56	62
MP2	LAeq,16hr (07:00 – 23:00)	52	60
	LAeq,8hr (23:00 – 07:00)	47	49

Table 3 – Ambient Noise Level Results Summary for Break-in

As seen in the above table, the loudest measured LAeq,1hr value measured at the site was **68 dB**. This level is used to inform the subsequent noise break-in assessment for all facades with a line of sight to Southmoor Road. For the northern, more shielded façade, the highest LAeq,1hr of **60 dB** from MP2 has been used.

As per the proposals, overnight stays may be required on the 2nd floor. Therefore, for this floor only, the highest LAeq,1hr during the night has also been included (southern façade only).

Background Sound Level Summary

The typical background sound levels both at the site and at the nearest NSRs have been determined using statistical analysis of the measured LA90,15min noise levels. Considering the ranges and distributions of values, the modal levels have been selected as the 'typical' background and are deemed to be the most representative. A summary of the measured background sound levels is contained within the table below and the LA90,15min histogram graphs are available in Appendix D.

Background Sound Level Summary for Plant Noise Assessment		
Location	Measurement Period ('T')	'Typical' LA90,15min (dB)
MP1	Daytime (07:00 – 23:00)	51
	Night-time (23:00 – 07:00)	43
MP2	Daytime (07:00 – 23:00)	50
	Night-time (23:00 – 07:00)	46
MP3	Daytime (07:00 – 23:00)	56
	Night-time (23:00 – 07:00)	39

Table 4 – Background Sound Level Result Summary

4. Noise Break-in Assessment and Sound Insulation Scheme

Design Criteria – Internal Ambient Noise Levels

Considering the proposed floor plans, the applicable criteria for internal ambient noise levels (IANL), as presented in HTM08-01, are defined in the table below. This criterion relates to IANLs as a result of noise intrusion through the external envelope of the building only.

It should be noted that there are no specific IANL criteria for storerooms or plant rooms as these are not considered noise-sensitive spaces.

Type of Room	HTM 08-01 Classification	Indoor Ambient Noise Level (IANL) ($L_{Aeq,1hr}$ dB)
Seminar/Lecture Space	Large meeting rooms	35
Ward – Single person	Ward – Single person	40 (Daytime) 35 (Night-time) 45 L_{AFmax} (Night-time)
Smaller Offices, Consulting rooms, Examination Rooms, Meeting Rooms,	Small Office-Type Space Small Meeting Rooms	40
Ward – Multi-bed	Ward – Multi-bed	45
Larger Collaborative Workspaces and/or Offices, Break-out Areas	N/A	45 ^[1]
Laboratories	Laboratories	45
Ensuite bathrooms	Personal Hygiene (en-suite)	45
Servery, Tea Points	Public Areas	50
Kitchen	Small Food-Preparation Areas	50
Toilet/WC, Hygiene Room, Changing Room	Personal Hygiene (public)	55
Receptions, Atriums, Lobbies, Corridor & Stairs	Circulation	55

Notes:
[1] Noise criteria taken from BS8233

Table 5 – Room Categorisation and Criteria – Internal Ambient Noise Levels

Internal Ambient Noise Level Assessment

Typically, the IANL criteria presented in HTM 08-01 only apply to external noise intrusion, with separate limits provided for building services noise. However, given the nature of the development and key differences from a traditional health-care building, the above limits are applied considering contributions from external sources and any building services. Consideration of the cumulative effects is in-line with guidance presented in BS8233 and

BB93, which are generally used for offices and teaching spaces and therefore more appropriate for assessment of the site.

Rain noise is not considered when specifying indoor ambient noise levels, however, it is stated in HTM 08-01 that:

“Indoor ambient-noise levels during “heavy” rainfall should not exceed the intrusive noise criteria in Table 1 by more than 20dB(A) or should not be more than 65dB(A), whichever is lower.”

Accordingly, given the IANL criteria presented in the above table, rain noise contributions should not exceed 55dB L_{Aeq} .

Sound Insulation Scheme

Building Envelope

The noise levels within the building will be dictated by the configuration, materials and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels in combination with the glazing and ventilation systems.

a) Façades

It is understood that the structural component of the outer façade will be primarily brick, with cladding used in very limited areas. The estimated performance of a cavity brick construction is upwards of 59 dB R_w , which is likely to be used throughout the majority of the build. This achieves significantly higher levels of sound insulation than that provided by typical glazing.

The desired cladding is unknown, however providing this achieves at least 40 dB R_w , it is deemed to provide sufficient levels of sound insulation to enable even the most sensitive spaces to achieve acceptable internal acoustic conditions.

b) Roof

The roof structure is unknown at this stage, however based on elevation drawings it appears to be a flat roof with a service void between the rooms occupying the second floor and the roof itself. Unless the roof construction is directly above the monitoring rooms, meeting rooms, office or lecture room, this double layer system is anticipated to provide suitable levels of sound insulation; especially as the dominant external noise source is road noise which would be shielded by the façade.

c) Glazing

Windows are generally considered the weakest point of a façade in terms of reduction of external noise. After undertaking initial noise break-in calculations, the following glazing specification is considered suitable at the site. It should be noted that the break-in calculations have been conducted considering the most noise sensitive spaces along the front façade (overlooking Southmoor Road) to provide a worst-case assessment.

Room Type	Example Glazing Configuration	Minimum Attenuation (dB)
All Rooms	Double Glazing 6mm Glass / 16mm Air Cavity / 4mm Glass	28 R _w + C _{tr}

Table 6 – Glazing SRI

The glazing specifications have been taken from Pilkington’s double-glazing range, however any glazing providing the same attenuation can be used. The performance is specified for the whole window units, including frames, spandrels and the like.

The façade suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

It should be noted that curtain walling can create flanking transmissions paths between spaces if not isolated efficiently. This is discussed further in Section 6.

d) Ventilation

Given the floor area of some of the rooms and higher noise levels to the south, an open window ventilation strategy would not allow for suitable internal ambient noise levels to be achieved within the majority of rooms. With this in mind, an alternative form of ventilation will be required. Should passive systems also be installed within the building façade, acoustic trickle vents which achieve at least 42 dB D_{ne,w} + C_{tr} should be installed. An example product that would be suitable are the Greenwoods 2500EA.AC2 passive trickle vents, based on two trickle vents per room. Alternatively, the development could be ventilated by fully mechanical means.

Mechanical Services

Note that building services noise limits represent the cumulative total of all noise due to building services which shall typically include, for example, fan unit casing radiated noise, duct-borne noise, duct breakout, adjacent plant room noise and additional external plant noise. Noise generated at duct fittings, bends, dampers, grilles and diffusers must also be adequately controlled. Regenerated noise is primarily due to pressure drops across fittings, thus pressure drops must be minimised. The airspeed within each system should be selected to limit regenerated noise levels. Further attenuation may be required to minimise in-duct fan noise levels, to mitigate the potential of noise breakout above sensitive spaces. Ducts will need to be acoustically clad where breakout noise levels above are high, this should be a minimum of 25mm mineral fibre insulation with a density of not less than 10kg/m³. This may be of particular concern in areas where the soffit is exposed.

It should be ensured that all building services plant is appropriately mounted and vibration isolated in order to reduce the transmission of vibration into the building structure. It is recommended that advice is sought from equipment manufacturers regarding the use and installation of appropriate isolating materials, taking into account, amongst other things, the frequency of vibrations produced, and the loads involved. Resilient connections between the fan casings and duct work, and between ductwork and supporting structures, should also be considered. Large section ductwork should also be similarly isolated. Where possible all internal or rooftop plant should be fitted on anti-vibrational mounts to ensure sufficient isolation from the surrounding structures and reduce the likelihood of structure borne noise and vibration transferring through the proposed building.

Where fan coil units are included within sensitive rooms, they must be selected to ensure the internal ambient sound level is not exceed when running at normal capacity. Inline attenuation will be required, as well as acoustic cladding/boxing in to control the level of noise breakout from the unit casing. The manufacturer should be consulted to ensure the internal ambient sound level will be achieved for both in-duct and noise breakout from the casing when the unit is running at normal capacity.

Preferably, there should be no service penetrations of walls between occupied spaces. Where ductwork passes through partition walls, it may be necessary to use both horizontal and vertical crosstalk attenuation to maintain the acoustic integrity of the partition. This will be particularly critical for high activity noise rooms and rooms with a low noise tolerance. It may be necessary to provide acoustic lagging to ducts where these pass across occupied areas or where the crosstalk attenuator is not located on the line of the separating partition, this should be a minimum of 25mm mineral fibre insulation with a density of not less than 10kg/m³ with a >10kg/m² mass barrier outer layer. All penetrations of the building structure must be appropriately sealed to maintain the acoustic integrity of the partition/slab/building envelope.

5. Partition Sound Insulation Design & Specification

Design Criteria – Internal Partition Sound Insulation

The table below shows the criteria for internal partition sound insulation based on privacy, noise generation of the source room and noise sensitivity of the receiving room.

Type of Room	HTM 08-01 Classification	Privacy Requirements	Noise Generation of Source Room	Noise Sensitivity of Receiving Room
Lecture / Seminar Room	Lecture Theatre	Private	High	Sensitive
Monitoring Room, Examination Room, Consulting Room, CT Suite, Aseptic Suite	Single Bed/On-call Room	Confidential	Typical	Medium
Multi-bed ward	Multi-bed ward	Moderate ^[1]	Typical	Medium
Smaller Offices	Small Meeting Room	Moderate ^[1]	Typical	Medium
Larger Collaborative Workspaces and/or Offices, Break-out Areas	Open-plan Office	Not Private	Typical	Medium
Laboratories	Laboratories	Moderate	Typical	Medium
Kitchen	Ward Kitchen/Pantry	Not Private	Typical	Not Sensitive
Toilet/WC	Toilets	Moderate	Typical	Not Sensitive
Hygiene Room, Changing Room	Locker/Changing Room	Moderate	Typical	Not Sensitive
Clean Utility	Clean Utility	Not Private	Low	Not Sensitive
Dirty Utility	Dirty Utility	Not Private	High	Not Sensitive
Corridor, Lobbies & Stairs	Corridor	Not Private	Typical	Not Sensitive
Receptions, Waiting Room	Atrium, Waiting Areas	Not Private	High	Not Sensitive
Records Room	Archive Room	Moderate	Low	Sensitive
Storeroom	Storeroom	Not Private	Low	Not Sensitive
Plant Room ^[1]	N/A	Not Private	High/Very High	No Sensitive

Notes:
[1] Noise criteria adapted based on anticipated activity and/or tolerance within the space.

Table 7 – Room Categorisation and Criteria

Sound Insulation Specification – Walls

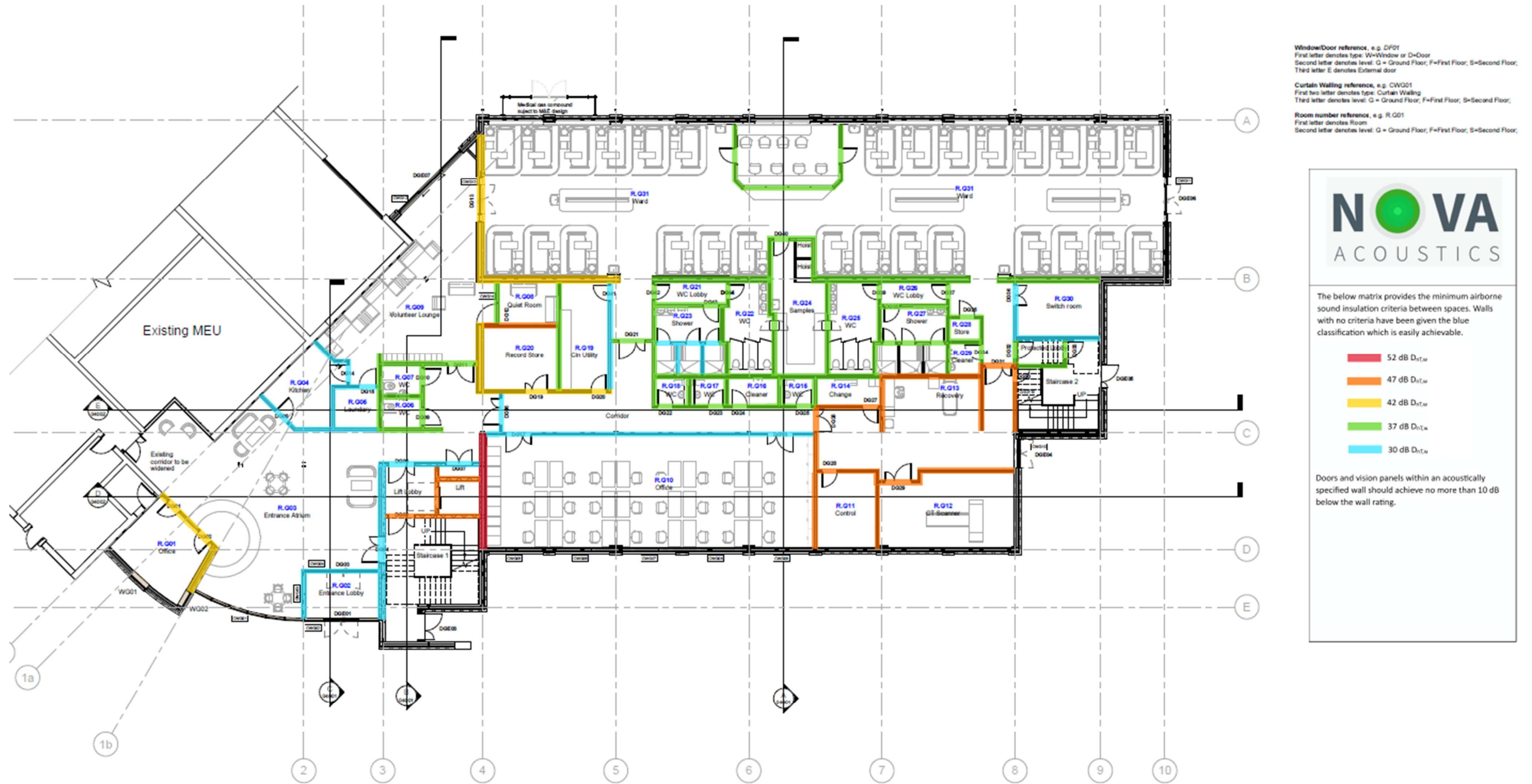
The table below shows the sound insulation matrix for healthcare building, as taken from HTM 08-01. The table indicates the minimum standards for airborne sound insulation required between rooms, having regard for the activity noise within the source room and the noise tolerance of the receiving room (N.B. there may be different requirements depending on which room is considered the source room and receiving room, therefore the “direction” which presents the most stringent criteria is used).

Privacy Requirement of Source Room	Noise Generation of Source Room	Noise Sensitivity of Receiving Room		
		Not Sensitive	Medium Sensitivity	Sensitive
Confidential	Very High	47	52	^[1]
	High	47	47	52
	Typical	47	47	47
	Low	42	42	47
Private	Very High	47	52	^[1]
	High	42	47	52
	Typical	42	42	47
	Low	37	42	42
Moderate	Very High	47	52	^[1]
	High	37	42	47
	Typical	37	37	42
	Low	No Rating	No Rating	37
Not Private	Very High	47	52	^[1]
	High	No Rating	42	47
	Typical	No Rating	No Rating	42
	Low	No Rating	No Rating	37

Notes:
[1] These adjacencies should be avoided by layout planning. Where this is not possible, $D_{nT,w}$ 57dB needs to be achieved as a minimum. In practice this is extremely difficult, as it would need very wide partitions and place onerous demands on the building structure to control flanking noise sufficiently.

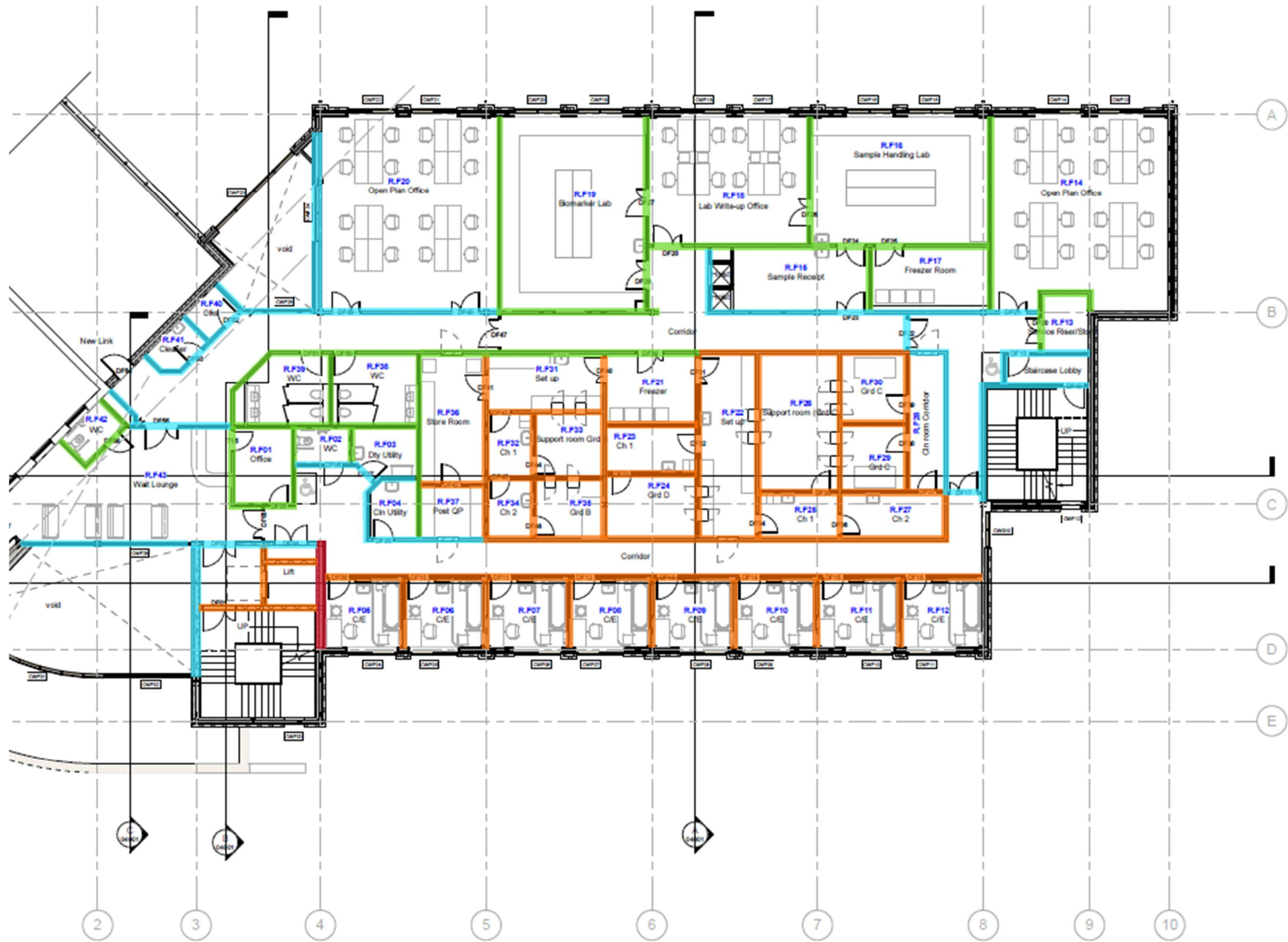
Table 8 – Sound Insulation Criteria – Airborne Sound Insulation Requirements

At this stage it is not known what the wall build-ups will be, therefore a minimum sound insulation specification has been set along with recommended constructions that are capable of meeting the criteria.



Drawing Ref. "1ME06-MHA-B1-00-DR-A-02100-S2" by MHA Architects

Figure 3 – Level 00 Separating Partitions Mark Up



Window/Door reference, e.g. DF01
First letter denotes type: W=Window or D=Door
Second letter denotes level: G = Ground Floor, F=First Floor, S=Second Floor;
Third letter E denotes External door

Curtain Walling reference, e.g. CWG01
First two letter denotes type: Curtain Walling
Third letter denotes level: G = Ground Floor, F=First Floor, S=Second Floor;

Room number reference, e.g. R.G01
First letter denotes Room
Second letter denotes level: G = Ground Floor, F=First Floor, S=Second Floor;

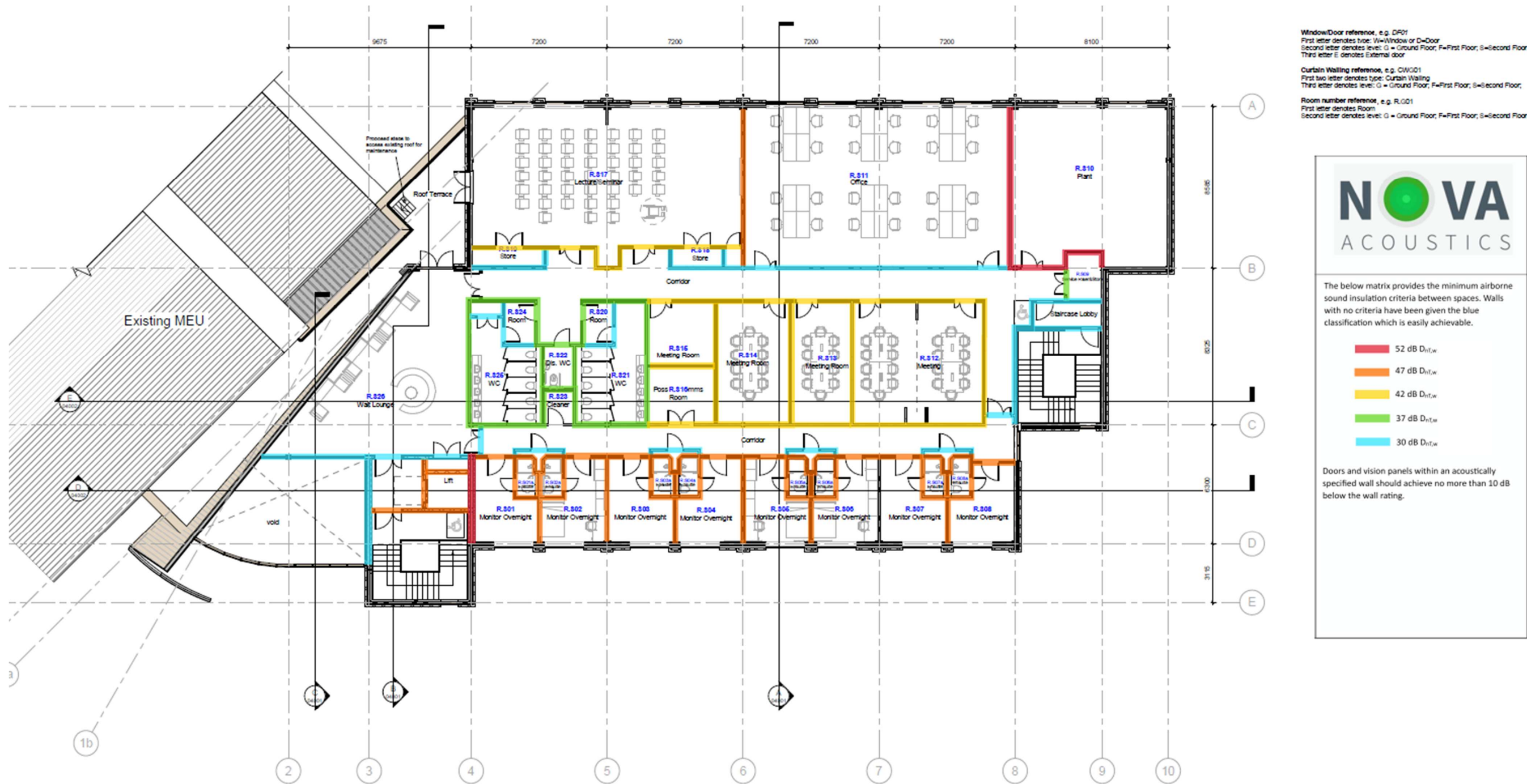
The below matrix provides the minimum airborne sound insulation criteria between spaces. Walls with no criteria have been given the blank classification which is easily achievable

	52 dB $D_{nT,w}$
	47 dB $D_{nT,w}$
	42 dB $D_{nT,w}$
	37 dB $D_{nT,w}$
	30 dB $D_{nT,w}$

Doors and vision panels within an acoustically specified wall should achieve no more than 10 dB below the wall rating.

Drawing Ref. "1ME06-MHA-B1-00-DR-A-02200-S2" by MHA Architects

Figure 4 – Level 01 Separating Partitions Mark Up



Drawing Ref. "1ME06-MHA-B1-00-DR-A-02300-S2" by MHA Architects

Figure 5 – Level 02 Separating Partitions Mark Up

The illustrated mark-ups in Figures 3-5 above correspond to following constructions contained within the table below.

ID	Element	Required Attenuation	Example Construction
1		≥52dB D _{nT,w}	- 2 No. 15mm Gyproc SoundBloc Plasterboards - 146mm Gypframe 146 AS AcouStuds - 50mm Isover APR 1200 (min. density of 12 kg/m³) - 2 No. 15mm Gyproc SoundBloc Plasterboards
2		≥47dB D _{nT,w}	- 2 No. 12.5mm Gyproc SoundBloc Plasterboards - 146mm Gypframe C Studs - 50mm Isover APR 1200 (min. density of 12 kg/m³) - 2 No. 12.5mm Gyproc SoundBloc Plasterboards
3		≥42dB D _{nT,w}	- 2 No. 12.5mm Gyproc SoundBloc Plasterboards - 48mm Gypframe C Studs - 25mm Isover APR 1200 (min. density of 12 kg/m³) - 2 No. 12.5mm Gyproc SoundBloc Plasterboards
4		≥37dB D _{nT,w}	- 2 No. 12.5mm Gyproc Wallboard Plasterboards - 48mm Gypframe C Studs - 25mm Isover APR 1200 (min. density of 12 kg/m³) - 2 No. 12.5mm Gyproc Wallboard Plasterboards
5		≥30dB D _{nT,w}	- 1 No. 12.5mm Gyproc WallBoard Plasterboards - 48mm Gypframe C Studs - 25mm Isover APR 1200 (min. density of 12 kg/m³) - 1 No. 12.5mm Gyproc WallBoard Plasterboards

Table 9 – Sound Insulation Criteria – Airborne Sound Insulation Requirements

Separating Doors

Regarding doors, the following is stated in HTM 08-01:

“A door in a partition will significantly downgrade the partition’s performance. There is no benefit in specifying a partition performance with an R_w that is more than 10 dB higher than the R_w of the doorset within it. As a typical doorset will have an R_w of 30–35 dB, this means that where there is a door, there is no acoustic benefit in providing partitions with an R_w higher than 40–45 dB, unless especially high performance doorsets or lobbied doors are used.”

Considering the above, doors within acoustically rated partitions should be no less than 10 dB below the wall specification. For partitions that have a particularly high criteria, a door set 10 dB below the wall rating may not be practically achievable. In these instances, it is recommended that a 45 dB R_w door set in installed or a lobby system is utilised. NOVA Acoustics can provide further assistance where required.

Observation Windows

Where observation windows are included between adjacent rooms, partitions (including the glass) should ideally achieve the target ratings in accordance with the performance matrix. However, it can be difficult to fit windows

that meet the full acoustic specification into the width of partitions. In this case, as a minimum, the glazing configuration alone should achieve an R_w that is no more than 10dB below that of the required R_w for the partition alone. This will reduce the sound insulation by an amount that depends on the size of the observation window in relation to the size of the partition.

Sound Insulation Specification – Floors

The proposed floor construction is unknown at this stage. To protect against both airborne and impact noise transmission, it is recommended that all floors achieve at least 47 dB D_{nT,w} to all areas except the floor of the plant room, which should be upgraded to achieve at least 52 dB D_{nT,w}.

For rooms that have a shared partition with the plant room, localised mitigation should be implemented. Examples of this include appropriate vibration isolation and correct mounting of plant to reduce the risk of structure borne noise transmission. Items such as air cushions may also be required depending on the plant required and its installation. Once the floor construction has been decided, NOVA Acoustics can review it to ensure that it is suitable.

It should also be noted that the vast majority of the site is either covered with vinyl flooring or carpet. Therefore, the resulting impact sound transfer is deemed to be negligible and should fall below the upper criterion of 65 dB L’_{nT,w} providing the airborne sound insulation criteria is also met.

6. Sound Insulation Guidance

Flanking Sound Guidance

Flanking transmission occurs when airborne sound and/or structure-borne vibration is transmitted from one area of a building to another, usually by structural components. In order to control flanking between noise sensitive spaces, careful acoustic detailing (specifically at junctions between adjacent elements) is required to maintain the specified acoustic performance of a separating wall or floor. Interfaces with other elements may include raised access floors, slab soffits, external façades, structural steel work, partitions, roofs and door sets.

Junctions Guidance

At this stage precise junction detailing is yet to be decided, therefore general good acoustic practice has been recommended instead to help inform decisions.

It should be ensured that the acoustic integrity of separating walls is maintained at junctions by breaking any flanking linings. At junctions between lightweight partitions, the flanking partition should be split by the separating partition.

Internal partitions should be full height from floor to ceiling, with connections sufficiently sealed to the underside of the roof using acoustic sealant to prevent airgaps.

It is advised that particular attention is directed to head details to ensure that all junctions and gaps are suitably filled with an acoustic sealant such that the acoustic performance is not compromised.

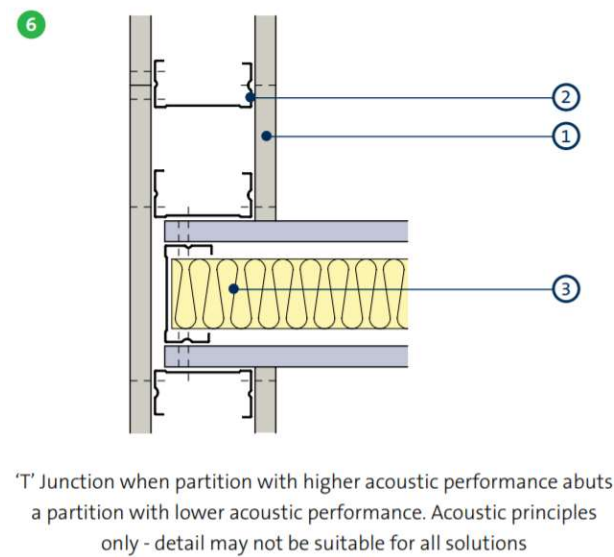


Figure 6 – Junction with Non-Separating Wall

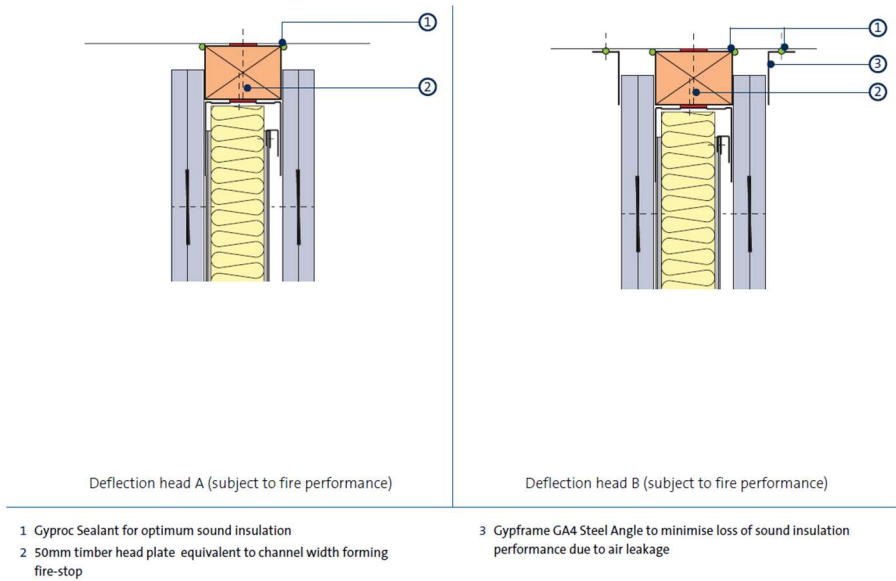


Figure 7 – Deflection Head Detail

Plasterboard linings to external walls should not run common between rooms, they should be stopped either side of the wall or floor junction with any common cavity closed off on the line of the partition/floor.

For optimum performance, an acoustic partition should extend from slab to soffit and be appropriately sealed with flexible acoustic mastic. Any joins should be taped and flanking strips installed to reduce the risk of flanking transmission.

Should a raised access floor be required, the partition should ideally extend through the floor to the slab below. However, providing the partition is properly isolated, it may be possible for the partition to be built off a raised floor in areas with a lower sound insulation requirement, depending on the total build-up.

Walls enclosing the lift shaft should be properly isolated with no rigid connections to prevent the structure borne noise transmission from the lifts to the adjoining rooms, especially the overnight monitoring rooms and any consulting / examination rooms.

Mullions

Any large, glazed areas or areas of curtain walling should be properly isolated, with mullions and transoms suitably connected to the adjoining walls. In addition, curtain walling and partitions should not sail past the separating floor.

Often walls and floors can be abutted directly up against the framework of the window. However, due to the lightweight material used within the window frame, these areas can become significant flanking routes. This is especially true in developments that have a fully glazed curtain exterior wall.

The simplest solution to avoiding any flanking issues in areas where party walls or floors are abutted up against window frames and mullions is to ensure that decoupled mullions are installed as part of the windows.

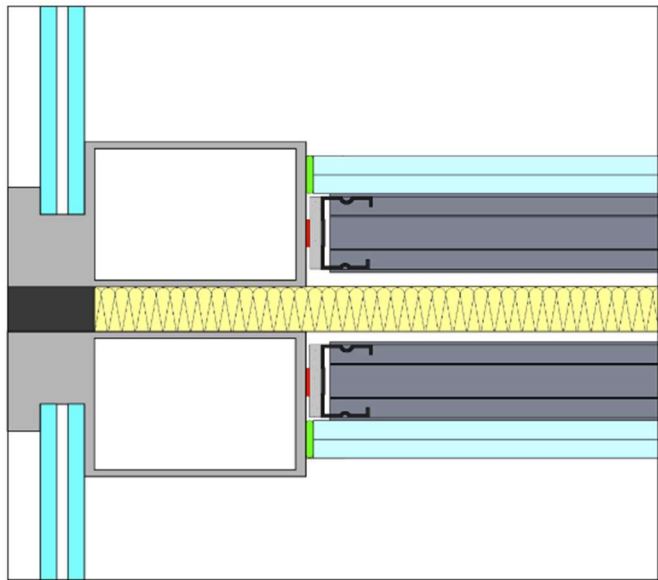


Figure 8 – De-coupled Mullion Detail

However, if this isn't possible, the detail below should be installed to reduce the amount of sound the mullion is exposed to.

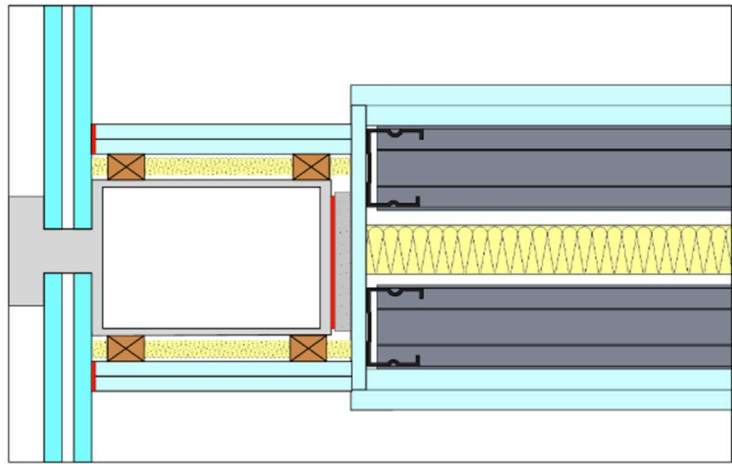


Figure 9 – Coupled Mullion Detail

Service Penetrations

Service penetrations of walls should be avoided where at all possible. If unavoidable, all penetrations should be well-sealed with non-hardening mastic. Suitable details are shown in Figure 10.

Note that it is of importance that services do not make a rigid connection between the leaves of lightweight stud partitions. Where electrical sockets are to be located on separating walls between spaces, they should ideally be surface mounted. If sockets are to be recessed, they should not be positioned back-to-back and should be staggered by a minimum of 150mm, preferably in different stud bays. Acoustic backboxes or baffles equivalent to the wall lining should be installed behind sockets in stud/framed walls with all joints fully sealed, or alternatively for standard room to room sound insulation requirements use of acoustic putty pads can be sufficient.

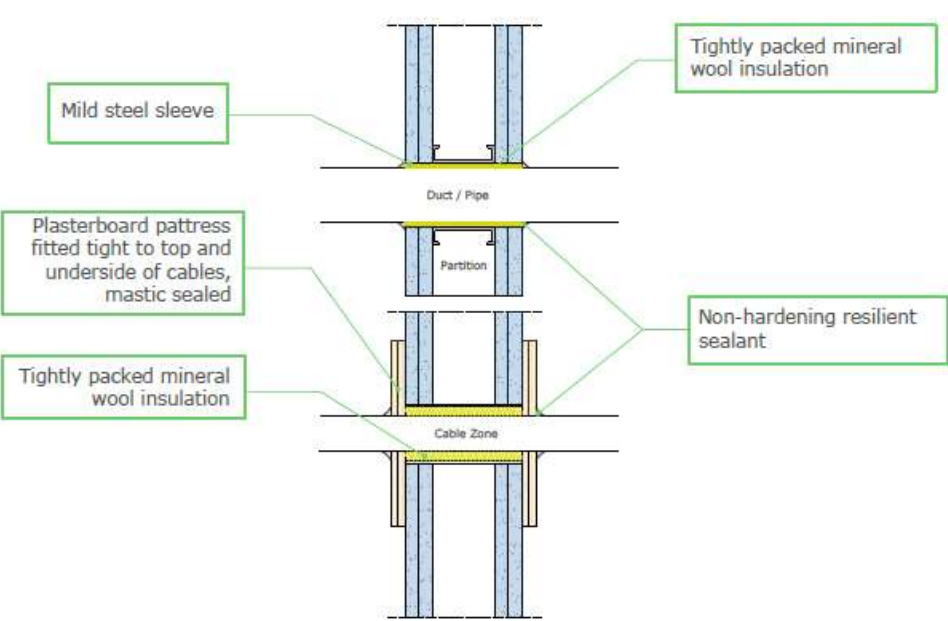


Figure 10 – Service Detailing

7. Reverberation Assessment & Design

Design Criteria – Reverberation

As there are specific no reverberation criteria provided in HTM 08-01, performance criteria have been taken from BB93 as presented in the below table.

Type of Room	BB93 Classification	BB93 Reverberation Time Criteria (T_{mf} Seconds)
Overnight Monitoring Rooms	SEN Calming Room	≤ 0.6
Consulting Rooms, Examination Rooms, CT Sutie, Aseptic Suite	Counselling Room	≤ 0.8
Multi-bed Ward, Recovery Bay	Medical Room	≤ 1.0
Lecture / Seminar Room	Lecture Theatre	≤ 1.0
Meeting Rooms	Meeting Rooms	≤ 0.8
Offices	Office	≤ 1.0
Laboratories	Science Lab	≤ 0.8
Receptions, Waiting Areas, Lounges	Atrium, Foyer, Entrance Hall	≤ 1.5
Kitchen	Kitchen	≤ 1.5
Corridor, Lobbies & Stairs	Corridor, Stairwell	^[1] See Note Below
Toilets (ensuite and public), Changing Room, Dirty Utility, Clean Utility	Changing Area, Toilet	≤ 1.5

Notes:

[1] The objective is to absorb sound in corridors, entrance halls and stairwells so that it does not interfere with activities in adjacent rooms. The amount of absorption required should be calculated according to Approved Document E, section 7, Ref 3. This describes 2 calculation methods, A and B, for controlling reverberation in the common internal parts of domestic buildings. Either of these methods can be used to determine the amount of absorption required in corridors, entrance halls and stairwells in schools. Typically, the criteria can be achieved by covering an area equal to the floor with a Class C absorptive material. Consequently, it is expected that appropriate reverberation times will be achieved by installing ceiling tiles which achieves up to Class C absorption.

Table 10 – Room Categorisation and Criteria – Reverberation

There are no reverberation time criteria for any store areas, such as the freezer rooms or general storage areas.

Teaching and Learning Spaces

As a lecture/seminar space is included within the proposals, section 1.5 of BB93 has been consulted. This part of the standard provides suitable reverberation times (RTs) to enable:

- a) Clear communication of speech between teacher and student
- b) Clear communication between students

The reverberation in rooms needs to be controlled to guarantee that the acoustic environment is reasonable for speech communication. Meeting rooms and learning areas with lots of acoustically hard surfaces will inevitably have long reverberation times or echoes, leading to a ‘blurring’ of sounds which can particularly impede speech intelligibility. Longer reverberation times also raise reverberant noise levels within a room, and to compensate the natural reaction is to raise your voice level, exacerbating the problem. BB93 sets out target reverberation time criteria for different room types. The recommended reverberation times are calculated in terms of T_{mf} , which is the arithmetic average of the reverberation times in the 500Hz, 1kHz, and 2kHz octave band centre frequencies.

Reverberation Specifications

In order to achieve the reverberation times contained within Table 10, it is recommended that Class C absorptive ceiling tiles are fitted throughout the development, with the exception of any storage areas and the kitchen. Reverberation calculations for a variety of spaces are presented in Table 11 on the overleaf, with two different Class C ceiling tiles suggested (one medical grade, one standard).

Room	Proposed Interior Finishes	Criteria (s)	Predicted <i>T_{mf}</i> (s)
Larger Offices	- Wall Finish: Plaster - Floor Finish: Carpet Flooring - Ceiling Finish: Zentia BioBloc Ceiling Tiles (Class C)	≤1.0	0.5
Smaller Offices	- Wall Finish: Plaster - Floor Finish: Carpet Flooring - Ceiling Finish: Plasterboard Ceiling	≤1.0	0.9
Meeting Rooms,	- Wall Finish: Plaster - Floor Finish: Capet Flooring - Ceiling Finish: Siniat Creason Ceiling Tiles (Class C)	≤0.8	0.4
Overnight Monitoring Rooms	- Wall Finish: Plaster - Floor Finish: Capet Flooring - Ceiling Finish: Zentia BioBloc Ceiling Tiles (Class C)	≤0.6	0.4
Multi-bed Ward & Recovery Room	- Wall Finish: Plaster - Floor Finish: Vinyl Floor Covering - Ceiling Finish: Zentia BioBloc Ceiling Tiles (Class C)	≤1.0	0.7
Receptions, Waiting Areas, Lounges	- Wall Finish: Plaster - Floor Finish: Carpet Flooring - Ceiling Finish: Siniat Creason Ceiling Tiles (Class C)	≤1.5	1.0
Consulting / Examination Rooms, CT Suite, Aseptic Suite	- Wall Finish: Plaster - Floor Finish: Vinyl Floor Covering - Ceiling Finish: Zentia BioBloc Ceiling Tiles (Class C)	≤0.8	0.6
Laboratories	- Wall Finish: Plaster - Floor Finish: Vinyl Floor Covering - Ceiling Finish: Zentia BioBloc Ceiling Tiles (Class C)	≤0.8	0.6
Kitchen	- Wall Finish: Plaster - Floor Finish: Vinyl Floor Covering - Ceiling Finish: Plasterboard Ceiling	≤1.5	1.0
Hygiene Room, Changing Room, Toilets (ensuite & public)	- Wall Finish: Plaster - Floor Finish: Vinyl Floor Covering/Carpet Flooring - Ceiling Finish: Zentia BioBloc Ceiling Tiles (Class C)	≤1.5	0.6

Table 11 – Reverberation Specification

The reverberation times within each room have been calculated using standard acoustic formulae using publicly available absorption information for the proposed interior finishes.

As can be seen in the table, the reverberation within rooms with a suspended ceiling featuring Class C absorption tiles. Providing this is implemented, appropriate reverberation times can be achieved across the development.

8. Construction Noise Impact Assessment

The following section discusses the likely noise impact during the construction phase.

BS5228-1:2009+A1:2014 Criteria

Code of practice for noise and vibration control on construction and open sites. Part1: Noise

This is the current guidance and approved code of practice document for the control of construction noise. The document provides methods for controlling noise and explains procedures for predicting, measuring and assessing the impact of construction noise. The BS5228 guidance is thought to present the most appropriate assessment criteria for the Proposed Development.

Two methods for estimating impact levels are given in BS5228. As the existing ambient noise levels in the area are moderate in level (47 – 65 dBA), it is recommended that the more stringent and restrictive criteria shown in 'Method 2' are used. The calculation method is explained below:

“Change Method 2: 5 dB(A) Change: Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,Period}$, from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more.

Further to this, a threshold noise level is provided for eligibility for noise insulation and temporary rehousing. For eligibility for sound insulation, the daytime Monday to Friday (08.00-18.00) and Saturday morning (08.00-13.00) threshold is 75dB $L_{Aeq,10h/5h}$. This level also needs to be exceeded for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.”

Calculated Threshold Levels

It is understood that construction will take place during daytime hours exclusively. Considering the measured ambient sound levels, it is recommended that the cumulative noise emissions from the site and the general environment combined should not exceed **70 dBA, 58 dBA and 67 dBA** at positions representative of MP1, MP2 and MP3 respectively. This means the specific noise emissions from the site should not exceed approximately **67 dBA, 55 dBA, and 64 dBA**.

Construction related activities are inherently noisy in nature, with limited practical mitigation measures implementable; especially if receptors are situated at height with a direct line of sight over the development. However, noise arising from these activities are temporary and with good acoustic practice there are ways to reduce the impact to as low as practicably possible.

Specific Sound Levels & Noise Modelling Data

A three-dimensional noise model has been created using SoundPlan 9.0 software to accurately predict the construction noise emissions from the site, taking into account the existing built environment. The assumptions and parameters using within the model are listed below:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years.
- For the purpose of the assessment, the ground between the source and receivers is considered to be primarily acoustically 'hard' surfaces.
- All source data is from BS5228-1 and is modelled using the 1/1 octave bands from 63 Hz to 8kHz. Percentage on-time corrections as listed in Table 13 below have been used.
- BS5228-1 calculation methodology was used along with 2nd order reflections.
- ISO 9613-2 assumes a 'downwind' model to the NSRs.
- The sound map grid height has been set to 1.5m, however, the noise levels used in the assessment has been taken from the most exposed point of each façade.
- The heavy mobile plant is assumed to behave as slow-moving point sources. This has been modelled as a line source.
- Site hoarding approximately 1.8m tall is included within the model, with an opening left for site access.

It is understood that the construction phase of the development shall take around 18 months. The expected phases of construction, approximate durations and assumed plant that may be used are contained within the following table. Note that the assumed plant is based on previous project experience and is subject to change, however it provides a good indication as to what construction noise levels may consist of.

Phase	Included Activities	Approximate Duration	Possible Plant Used
Site Preparation and Groundworks	- Mobilisation - Site clearance - Erection of hoarding - Setting out - Excavation - Piling - Installation of foundations	5 months	- Piling Rig - Vibrating Poker - Concrete Pump - Excavator doing groundworks - Excavator loading rubble - Dumper - Telescopic Handler - Mobile crane - Road lorry (deliveries) - Generator
Frame / Roof Construction	- Erection of outer frame - Build of central core - Roof construction	3 months	- Mobile crane - Handheld tools - Telescopic Handler - Road lorry (deliveries) - Generator
External Envelope	- Installation of cladding - External wall construction - Fenestration installation	4 months	- Mobile crane - Handheld tools - Telescopic Handler - Road lorry (deliveries) - Generator
Fit Out & Landscaping	- Internal fit out - M&E installation - Landscaping - Car park resurfacing - Highways work	6 months	- Handheld tools - Road lorry (deliveries) - Resurfacing plant - Whacker plate - Generator

Table 12 – Construction Phases

For this assessment, a worst-case scenario and a general scenario have been used. On the following page is a table containing the reference plant sound power levels, assumed percentage on-times, and data source location with BS 5228-1.

Phase	Plant Name	Sound Power Level (dBA)	Percentage On-Time	BS5228 Reference
General Construction (Frame & Roof Erection)	Handheld Tools	101	10%	Table C4, No. 95
	Circular Saw	119	10%	Table C4, No. 70
	Telescopic Handler	60*	50%	Table C2, No. 35
	Mobile crane	98	10%	Table C3, No. 30
Absolute Worst-Case (Site Preparation & Groundworks)	Piling Rig	108	30%	Table C3, No. 22
	Vibrating Poker	97	10%	Table C4, No. 34
	Concrete Pump	106	25%	Table C3, No. 25
	Excavator doing groundworks	104	30%	Table C2, No. 5
	Excavator loading rubble	113	10%	Table C1, No. 10
	Dumper	67*	10%	Table C4, No. 3
	Telescopic Handler	60*	30%	Table C2, No. 35
	Mobile crane	98	20%	Table C3, No. 30
Both Scenarios	Road lorry (deliveries)	67*	10%	Table C6, No.21
	Generator	92	100%	Table C4, No. 79
Notes:				
* Based on a moving point source with a speed of 8 km/h.				

Table 13 – Reference Construction Plant Noise Levels

Noise Contour Maps

To allow for a better visualisation of the noise propagation from construction-based activities, two noise contour maps are provided in Figures 11 and 12 on the overleaf.



Figure 11 – General Construction Scenario Noise Contours

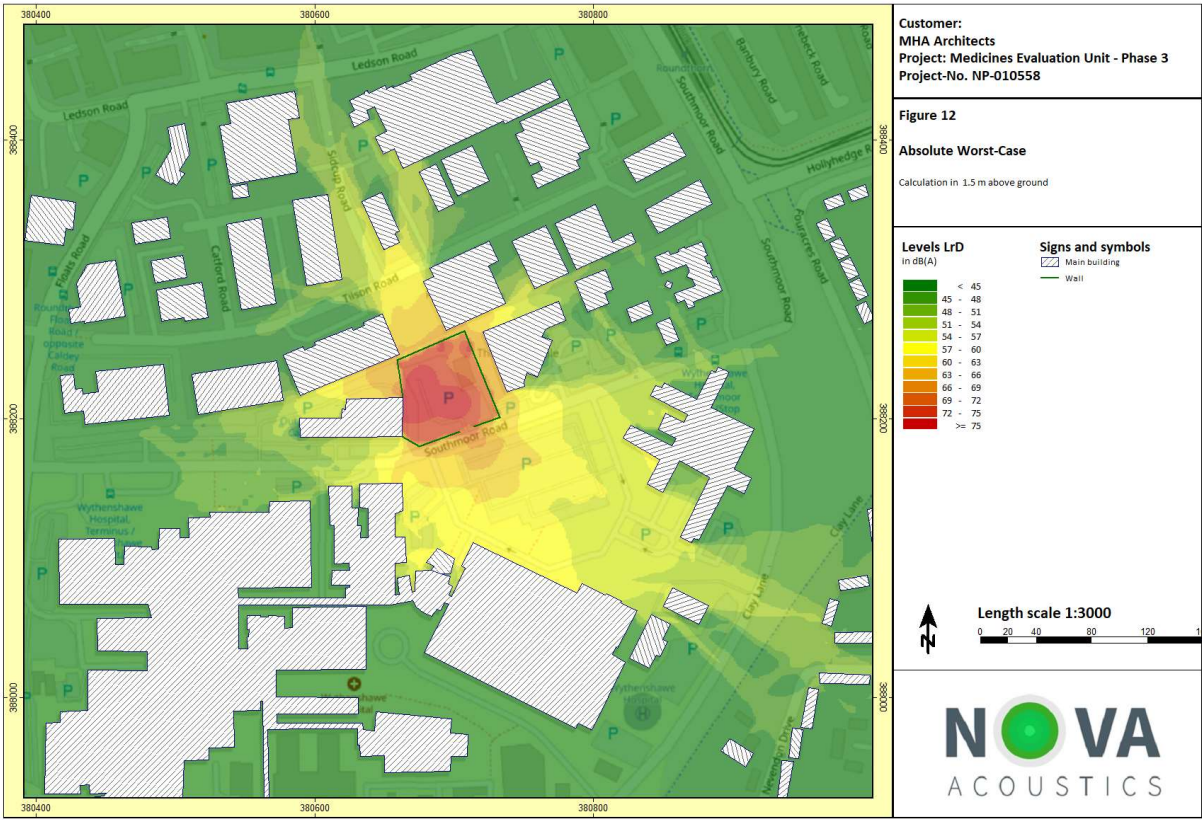


Figure 12 – Absolute Worst-Case Scenario Noise Contours

BS5228-1:2009+A1:2014 Assessment

The noise impact assessment is conducted at the most affected NSR (the existing hospital building) in the table below.

Construction Noise Impact Assessment – Absolute Worst-Case								
Description	1/1 Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Specific Sound Level at existing MEU	56	63	69	74	75	74	69	80
Existing Ambient Sound Level	As seen in Table 2.							53
Cumulative Sound Level	Existing ambient noise level plus construction noise.							80
BS5228:2009 Method 2 Criteria	Existing ambient noise level plus 5 dB.							58
Exceedance of Criteria	Exceedance of cumulative level over criteria.							+22
BS5228:2009 Outcome	A significant impact is expected, depending on the context.							
NPPF & NPSE Outcome	'Significant Observed Adverse Effect level ('SOAEL').							
Recommendations	Additional mitigation should be implemented where possible							

Table 14 – Noise Impact Assessment – Absolute Worst-Case Scenario

Construction Noise Impact Assessment – General Construction								
Description	1/1 Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Specific Sound Level at existing MEU	36	56	56	60	63	66	71	75
Existing Ambient Sound Level	As seen in Table 2.							53
Cumulative Sound Level	Existing ambient noise level plus construction noise.							75
BS5228:2009 Method 2 Criteria	Existing ambient noise level plus 5 dB.							58
Exceedance of Criteria	Exceedance of cumulative level over criteria.							+17
BS5228:2009 Outcome	A significant impact is expected, depending on the context.							
NPPF & NPSE Outcome	'Significant Observed Adverse Effect level ('SOAEL').							
Recommendations	Additional mitigation should be implemented where possible							

Table 15 – Noise Impact Assessment – General Scenario

Note that in both scenarios, no impact is expected on the southern façade of the MEU and at the nearest residential dwellings (67-69 Fouracres Road and dwellings off Nevendon Drive).

Discussion

Both scenarios highlight that the construction works will have a significant impact on the neighbouring MEU unit, mainly due to the unavoidable proximity to the works. It is not known whether the existing MEU or the Nightingale Centre contains internal equipment which is sensitive to noise and vibration, therefore any contractors should act cautiously and transparently with the neighbouring buildings.

During the worst-case scenario the dominant contributor is from piling activities occurring outside the closest northern and western windows. The existing floor plan for the MEU is unknown and therefore the sensitivity of the most exposed places cannot be determined.

Whilst a significant exceedance is expected, there is limited mitigation that can be installed to reduce the impact from piling. However, the amount of the time that the piling rig will be outside the windows will be relatively short, which reduces the impact. As the construction works are required for the extension to the MEU, the facility may be able to temporarily avoid using the worst-affected rooms whilst the closest piles are being installed. Alternatively, it may be possible to install temporary acoustic coverings to the existing windows to improve the sound insulation, however this would likely reduce the level of natural light within the spaces.

During more general activities, the circular saw is likely to be dominant source of noise. It is not known exactly whether this will be required, however should it be needed to perform any on-site alterations to the building materials, it is recommended that it is housed within an acoustic enclosure, such as the CS Compact or CS Cutting Station provided by echo barrier.

It is recommended that solid gates are fitted to the hoarding and that these are to remain closed when not required for immediate access to the site.

The calculations and model assume no screening from the impending structure, therefore as the build progresses noise from the site will be increasingly screened. On this basis, it is recommended that the extension is built from west to east, gradually moving away from the existing MEU.

The site should ensure they are operating within best practicable means at all times and remain courteous to surrounding receptors.

Best Practicable Means

It is recommended that all operatives are suitably trained to employ appropriate techniques to keep site noise to a minimum and should be effectively supervised to ensure that best working practices with regards to noise control are being followed.

Before any works take place, a schedule of works should be provided to the neighbouring MEU and Nightingale Centre, with advance warning given for any particularly noisy or disruptive works so that the facilities can rearrange noise sensitive activities in advance if required. A complaints procedure should be set up and the details of who to contact with any noise or vibration complaints should be made readily available.

When procuring equipment and plant, the quietest version of the equipment should be chosen providing it can still do the task required (i.e., if an alternative, quieter piling rig can be used without compromising the task at hand then this should be chosen).

Further to this, it is recommended that:

- That all operatives are trained in the proper use of the equipment and all equipment and tools are properly maintained.
- Machinery is positioned to reduce the noise emissions to the neighbouring receptors and to site personnel.
- Unnecessary noise should be avoided whilst carrying out manual operations and when operating plant and equipment. Examples of this include turning equipment off when not in use, not leaving mobile plant in idle, not using radios for background music outside, and limiting the use of shouting unless required for safety reasons.
- Deliveries and large vehicles should be discouraged from waiting outside the NSRs or sounding horns to enter the site. White noise reversing alarms should be used where possible.

9. Fixed Plant Noise Impact Assessment

At this stage of the design process, the exact fixed mechanical plant details are unknown, however it is anticipated that some of the plant shall include external condensers, air source heat pumps, air handling units, heat recovery units, and extract fans.

To aid in the procurement of equipment, fixed plant rating limit levels have been set to ensure that no adverse impact would be expected at the nearest NSRs. It is recommended that the cumulative plant noise emissions from new plant, inclusive of any acoustic characteristic penalties, do not exceed the existing background sound level. This would be classed as ‘No Observed Effect Level’ in line with NPPF and NPSE, and ‘low impact’ in accordance with BS4142.

Plant Limit Levels

Although arguably it could be regarded as self-impact, there are provisions for overnight stays at both the existing MEU and the new extension; therefore, fixed plant rating limit levels have also been set for the development itself. Using the typical background sound levels reported in Table 4, limit levels of **50 dB** during the day and **43 dB** during the night should not be exceeded at the closest window of any room used for resting or overnight stays.

The cumulative fixed plant rating levels of **56 dB** during the day and **39 dB** during the night should not be exceeded at the nearest unassociated residential NSR.

Once the plant has been decided, the manufacturers noise levels along with the mechanical plans of the development should be forwarded to NOVA Acoustics for review. Should any mitigation then be required, appropriate forms of attenuation can then be put forward to ensure that these rating level limits can be met.

10. Conclusion and Action Plan

The Proposed Development has been assessed against the HTM-08-01 criteria to ascertain whether appropriate internal acoustic conditions can be achieved. Providing the development adheres to the minimum specifications set out in this report, the site is expected to be suitable for the intended use.

Using assumptions made within the report, it is deemed that the operational use of new proposed extension should not have a negative impact on the surrounding NSRs. To support this, fixed plant rating limit levels based on the typical background sound levels have been set, equating to 'low impact, depending on context' in line with BS4142 and 'No Observed Effect Level' in line with NPPF and NPSE.

During construction, a significant impact is expected at the neighbouring MEU facility. Mitigation measures to fully remove the impact are unlikely to be feasible due to the MEU's close proximity to the proposed works and the first-floor windows directly overlooking the site. However, the exposure period and occupant stay duration will be relatively low, thus reducing the impact. Nevertheless, the site should operate within best practicable means to reduce the impact as much as possible. No impact is expected at the nearest unassociated residential NSRs.

The following action plan has been set out to ensure the design considerations and specifications from this report are duly implemented:

1. The minimum glazing specification is detailed within Section 4.
2. The external envelope of the building should meet the minimum sound insulation criteria contained within Section 4.
3. Separating partitions should meet the minimum requirements set out in Section 5. Special consideration should be given to the shared partitions to the second-floor plant room to prevent structure-borne noise transmission.
4. Where glazed internal partitions are required, the glazed elements should achieve the equivalent R_w performance as that derived from the performance matrix. Where there are also doors within the partition, it may be acceptable to reduce the specification of the glazing by up to 10 dB.
5. Any large, glazed areas or areas of curtain walling should be properly isolated, with mullions and transoms suitably connected to the adjoining walls. Where possible, decoupled mullions should be installed as part of the window system.
6. The predicted reverberation times within rooms with Class C ceiling tiles used throughout (except for the kitchen, utility areas, and storage areas where plasterboard ceilings were acceptable), all internal spaces should comfortably achieve the required reverberation times. Therefore, no additional ceiling treatments, such as suspended acoustics panels, are required.
7. New plant should be chosen and designed so that the cumulative fixed plant rating limit levels, inclusive of any acoustic characteristic penalties, do not exceed the existing typical background sound levels. NOVA Acoustics can conduct a full BS4142 assessment to demonstrate compliance and put forth any mitigation measures once the M&E design has progressed.
8. During construction the contractors and operatives should operate within the best practicable means, reducing noise emissions to as low as practicably possible. Methods to do this include specifically using quieter variations of plant and equipment, erecting localised barriers, properly maintaining equipment, and turning off all plant and equipment fully when not in use.

9. Site hoarding of at least 1.8m should be erected around the site and connect with the existing MEU structure. Additionally, the site ingress and egress points should be protected with a solid gate which shall remain closed when not in immediate use. This is to prevent there being a significant break in the shielding provided by the hoarding.

This report is suitable for submission to the Local Planning Authority and should be used to inform the RIBA Stage 3 and Stage 4 design choices.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T , has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for $N\%$ of a specified time interval
Rating Level, $L_{Ar,Tf}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10 \log_{10} (p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Environmental Survey

B.1 – Time History Noise Data

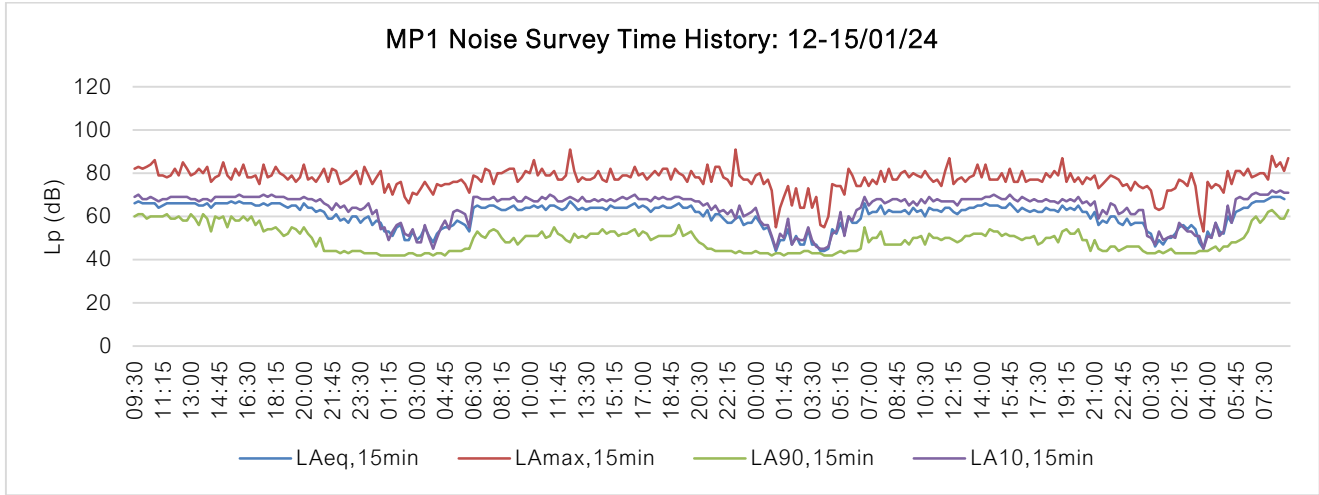


Figure 13 – MP1 Noise Survey Time History

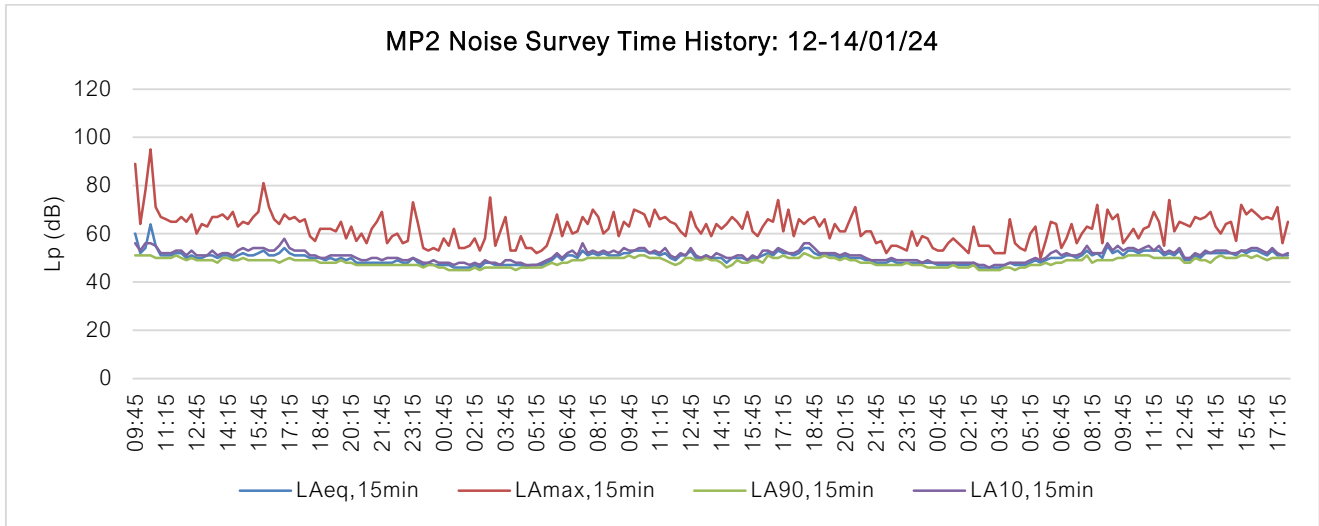


Figure 14 – MP2 Noise Survey Time History

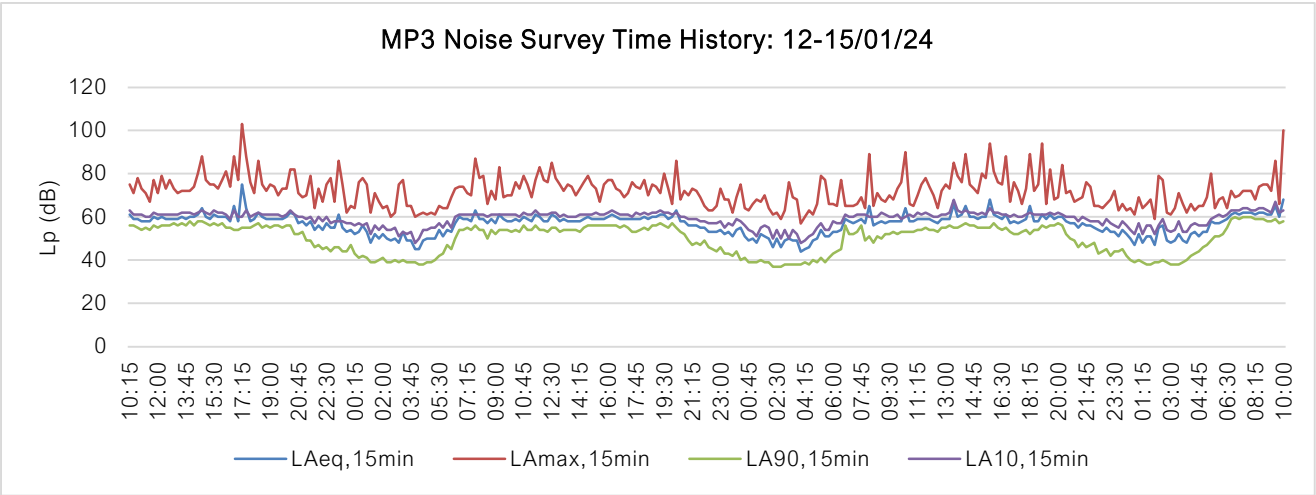


Figure 15 – MP3 Noise Survey Time History

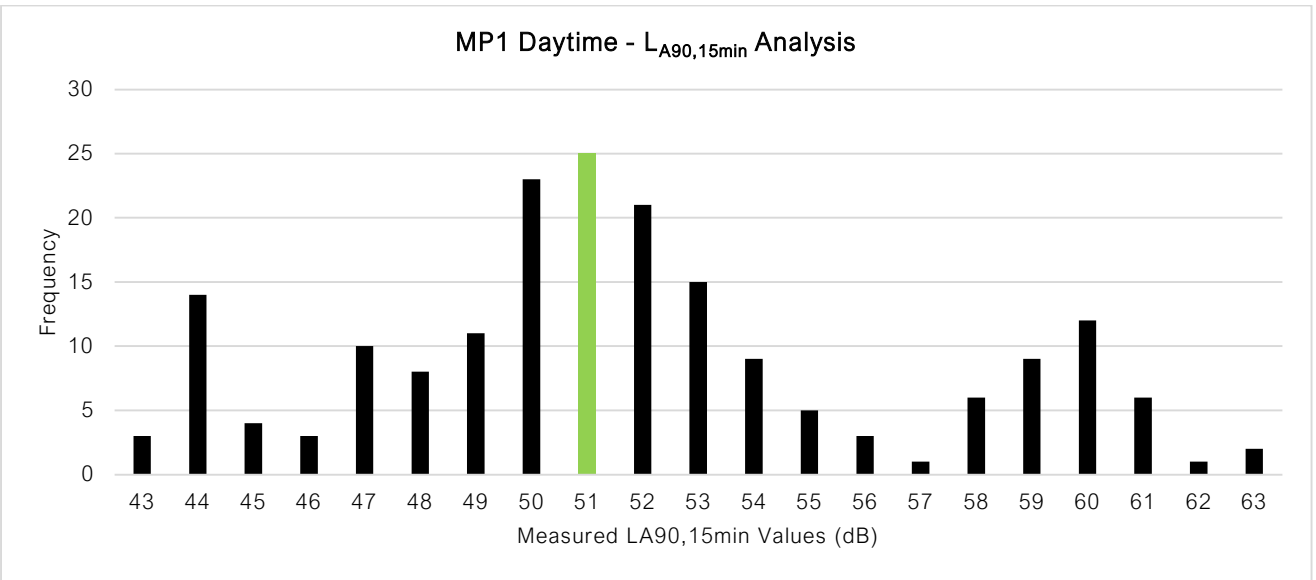


Figure 16 – LA90,15min Histogram – MP1 Day

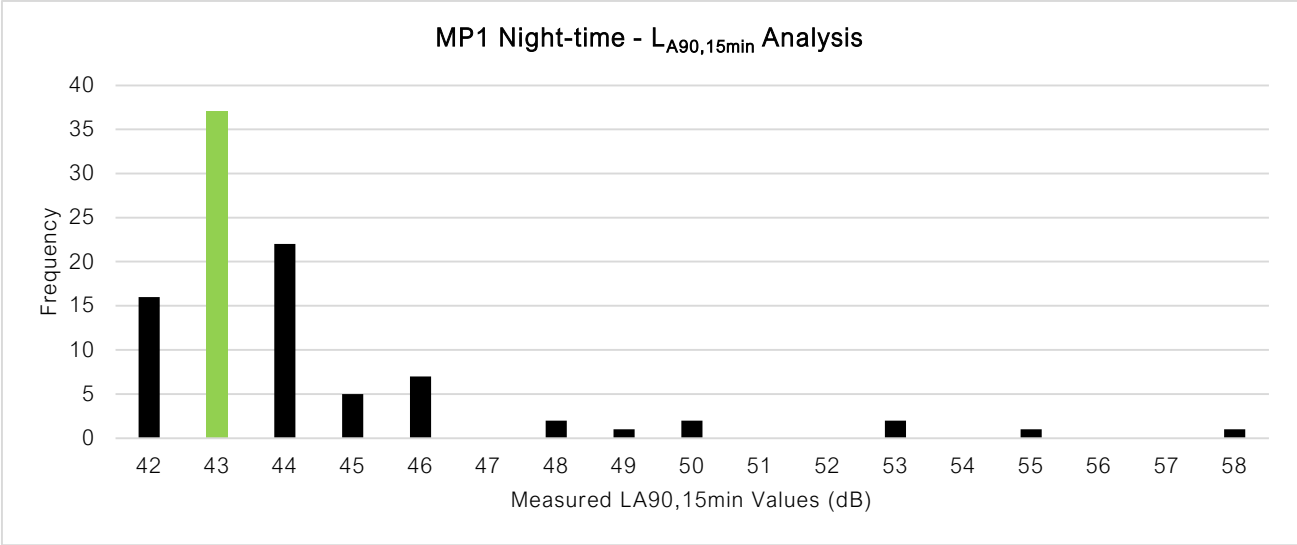


Figure 17 – $L_{A90,15min}$ Histogram – MP1 Night

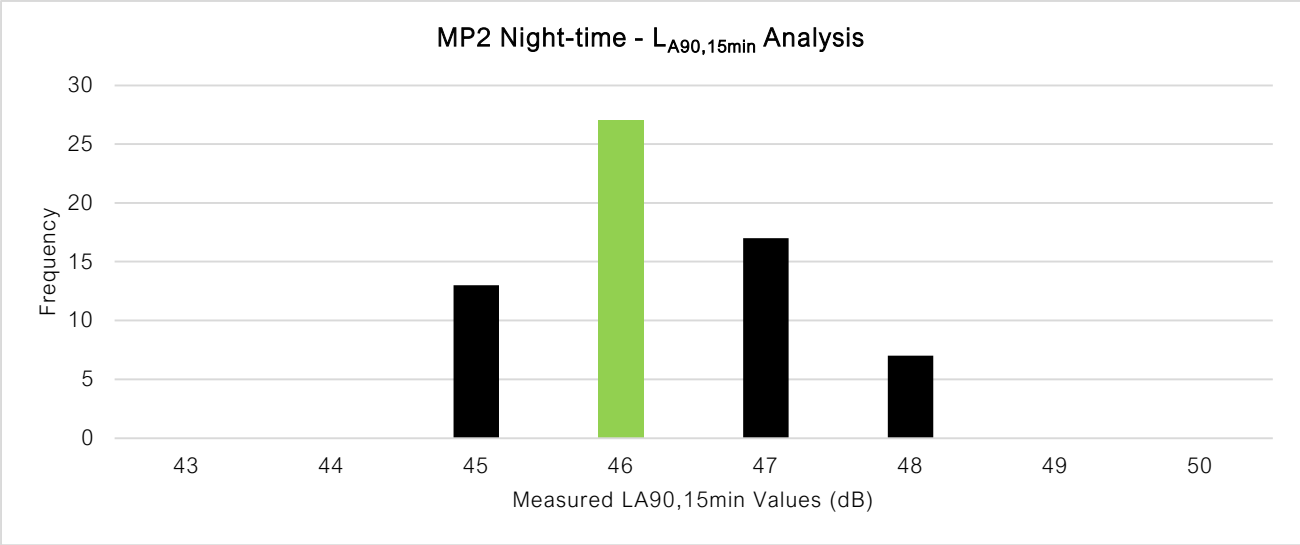


Figure 19 – $L_{A90,15min}$ Histogram – MP2 Night

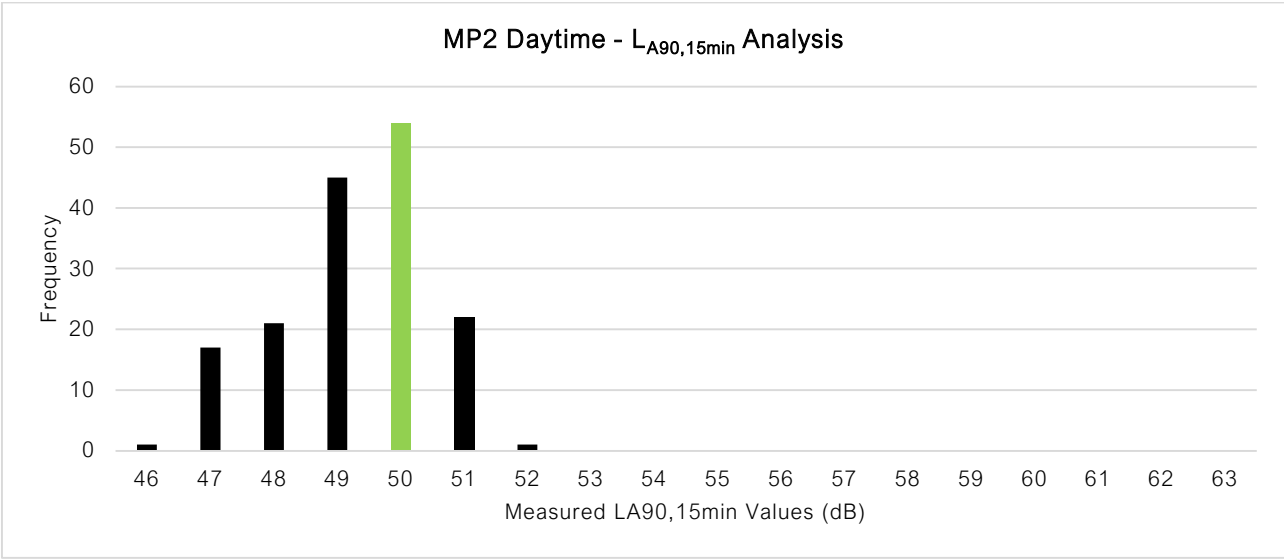


Figure 18 – $L_{A90,15min}$ Histogram – MP2 Day

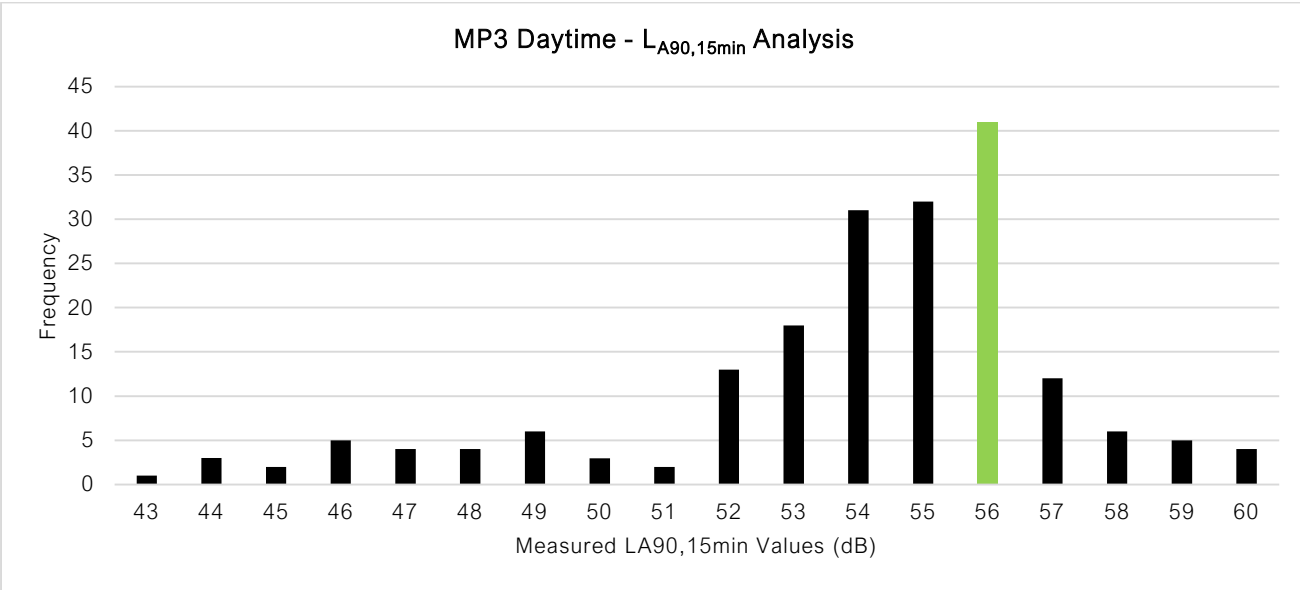


Figure 20 – $L_{A90,15min}$ Histogram – MP3 Day

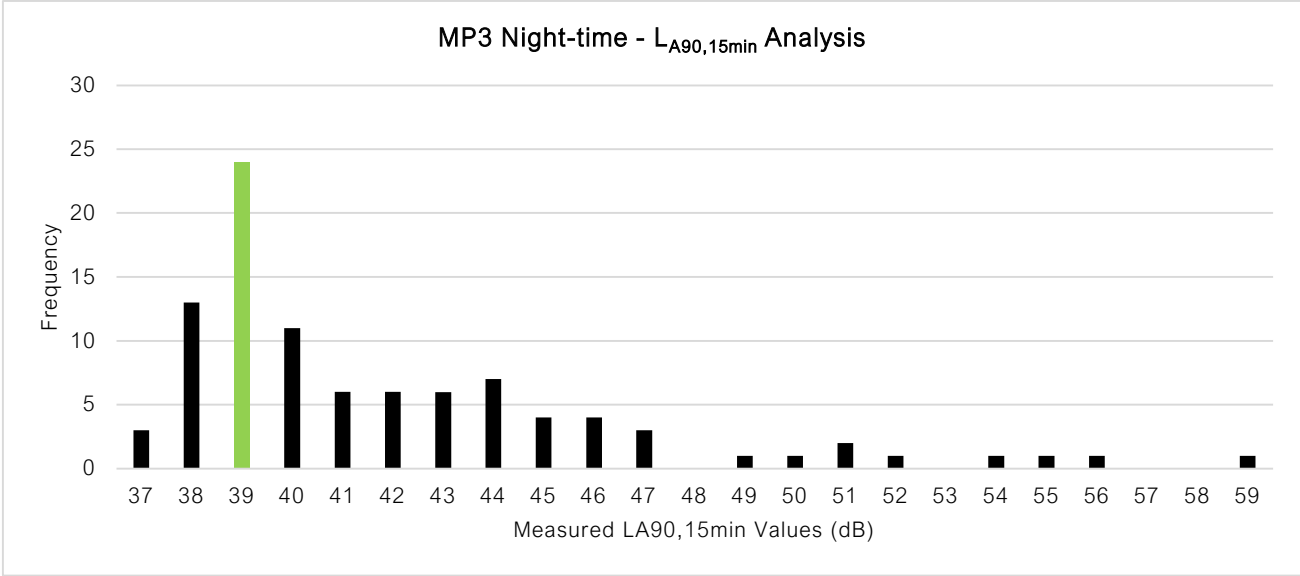


Figure 21 – LA90,15min Histogram – MP3 Night

B.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV971 Class 1 Sound Level Meter	127628	≤0.1
CESVA CB006 Class 1 Calibrator	901927	
CESVA SC420 Class 1 Sound Level Meter	T250681	≤0.1
CESVA CB006 Class 1 Calibrator	901927	
CESVA SC420 Class 1 Sound Level Meter	T246458	≤0.1
CESVA CB006 Class 1 Calibrator	901927	

Table 16 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with negligible deviation noted. All sound level meters are calibrated every 24 months, and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

B.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in

accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Timperley Weather Station (Approx. 2km Northwest of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
12/01/2024 – 00:00 – 23:59	3.2 – 6.3	0.0	SSW	0.0 – 2.2
13/01/2024 – 00:00 – 23:59	2.8 – 7.9	0.0 – 0.5	W	0.0 – 1.8
14/01/2024 – 00:00 – 23:59	-1.3 – 5.7	0.0	WNW	0.0 – 2.7
15/01/2024 – 00:00 – 23:59	-4.3 – 3.2	0.0	W	0.0 – 2.7

Table 17 – Meteorological Conditions



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