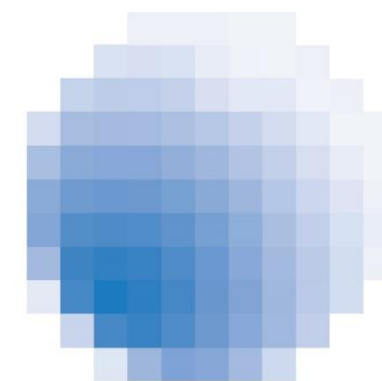




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NMGH Modular Offices
Crumpsall, Manchester

RIBA Stage 4 Acoustic Design Review

P1919-REP01-REV C-BDH

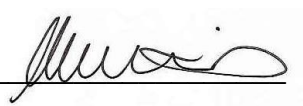
16 February 2021

PROJECT: NMGH Modular Offices
Manchester
RIBA Stage 4 Acoustic Design Review

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REFERENCE: P1919-REP01-REV C-BDH

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SUMMARY

The RIBA Stage 4 acoustic design of the North Manchester General Hospital (NMGH) Modular Offices has been developed in accordance with the *Health Technical Memorandum 08-01: Acoustics* guidance document, as published by the Department of Health in 2013.

This acoustic assessment has been based upon the results of an environmental noise survey conducted by Sol on and around the site between c.14:10 hours during Wednesday 9 December and c.13:30 hours during Thursday 10 December 2020. Based upon the findings of the noise survey and subsequent intrusive noise assessment, it should be possible (from an acoustic perspective) to adopt the use of opening windows to provide natural ventilation.

Details of the proposed external building fabric have been reviewed and assessed in terms of compliance with the adopted acoustic performance standards. An acoustic review of all proposed internal walls, floors, doors, glazed screens, and internal room finishes is also provided.

Maximum environmental noise level limits have also been specified for externally sited building services equipment (e.g. external heat pumps) and the minimum acoustic performance specification requirements for environmental noise mitigation has been provided.

Internal Noise Rating limits have been specified for the proposed mechanical services systems for each served space within the NMGH Modular Offices. An acoustic specification for all required attenuation and vibration isolation to the proposed mechanical and electrical plant is provided.

Please refer to the main report and appendices for further information.



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1 INTRODUCTION

Sol Acoustics Ltd ("Sol") has been commissioned by Extra Space Solutions (UK) Limited ("ESS") to provide a RIBA Stage 4 acoustic design review of the proposed new North Manchester General Hospital modular offices to be located on Ellis Drive in Crumpsall, Manchester (the "Facility").

This report provides the following:

- Relevant acoustic performance design standards applicable to the proposed Facility
- Minimum acoustic performance standards to be achieved by the various elements of the external building fabric
- Acoustic review of the current proposed construction details of all internal walls, floors, and other internal separating elements
- Recommendations for the use of sound absorbent finishes in order to control reverberant noise and to ensure clear communication of speech between occupants
- Noise level limits for all mechanical and electrical building services equipment to be achieved both within the Facility and at external off-site noise sensitive receptors.
- Minimum acoustic specification of attenuation and noise mitigation to be implemented into the building services design

This acoustic assessment is based upon a review of the following drawings:

- 20-074-BPA-OB-XX-DR-A2-001_P8 - Ground Floor - Set Out Superstructure
- 20-074-BPA-OB-XX-DR-A2-002_P2 - Typical Floor - Set Out Superstructure
- 20-074-BPA-OB-XX-DR-A4-007_P1 - Partition Types Sheet 1 of 2
- 20-074-BPA-OB-XX-DR-A4-008_P1 - Partition Types Sheet 2 of 2
- 20-074-BPA-OB-XX-DR-A2-021_C1 - Intermediate Floor Detail - Side Wall
- 20-074-BPA-OB-XX-DR-A2-024_P1 - Eaves Detail
- 20-074-BPA-OB-XX-DR-A2-022_P1 - Intermediate Floor Detail - End Wall
- 20-074-BPA-OB-XX-DR-A6-001_P3 - Ground Floor Reflected Ceiling Plan

- 20-074-BPA-OB-XX-DR-A6-002_P1 - 1st & 2nd Floor Reflected Ceiling Plan
- 200714 _ Modular Standalone Office _ Specification
- 20-074-YBS-OB-EX-DR-M-5701 A - External Condenser Layout
- 20-074-BPA-OB-XX-DR-A9-001_P4 - External Works Layout
- 20-074-YBS-OB-GF-DR-M-5301 A - Ground Floor Water Services Layout
- 20-074-YBS-OB-GF-DR-M-5701 - Ground Floor Ventilation and AC Layout
- 20-074-YBS-OB-GF-DR-M-5702 - Ground Floor Ventilation and AC Layout
- 20-074-YBS-OB-GF-DR-M-5703 - Ground Floor Ventilation and AC Layout
- 20-074-YBS-OB-GF-DR-M-5704 - Ground Floor Ventilation and AC Layout
- 20-074-YBS-OB-01-DR-M-5701 - First Floor Ventilation and AC Layout
- 20-074-YBS-OB-01-DR-M-5702 - First Floor Ventilation and AC Layout
- 20-074-YBS-OB-01-DR-M-5703 - First Floor Ventilation and AC Layout
- 20-074-YBS-OB-01-DR-M-5704 - First Floor Ventilation and AC Layout
- 20-074-YBS-OB-02-DR-M-5701 - Second Floor Ventilation and AC Layout
- 20-074-YBS-OB-02-DR-M-5702 - Second Floor Ventilation and AC Layout
- 20-074-YBS-OB-02-DR-M-5703 - Second Floor Ventilation and AC Layout
- 20-074-YBS-OB-02-DR-M-5704 - Second Floor Ventilation and AC Layout
- 20-074-YBS-OB-03-DR-M-5701 - Third Floor Ventilation and AC Layout
- 20-074-YBS-OB-03-DR-M-5702 - Third Floor Ventilation and AC Layout
- 20-074-YBS-OB-03-DR-M-5703 - Third Floor Ventilation and AC Layout
- 20-074-YBS-OB-03-DR-M-5704 - Third Floor Ventilation and AC Layout

2 DESCRIPTION OF SITE

2.1 General Overview of the Site and Surroundings

The proposed site is located at the corner of Ellis Drive and Eyam Road in Crumpsall, Manchester. Formally, the site was used as a car park.

Directly to the west of the site are existing industrial units. Upon site inspection, however, these units do not generate any significant levels of environmental noise.

The nearest pre-existing noise sensitive residential housing to the Facility is located approximately 10 metres to the south of the site, on the opposite side of Magna Drive.

2.2 Development Proposals

The proposed four-storey office building comprises mainly of open plan offices, meeting rooms and quiet rooms.

The Client has confirmed that the Facility is not aspiring to achieve BREEAM accreditation. There are no Employer's Requirements which specifically relate to acoustics.

The site plan is presented in Figure 1.



Figure 1: Site plan of the Facility

3 ACOUSTIC DESIGN CRITERIA

3.1 Department of Health, Health technical memorandum 08-01: Acoustics

The *Health Technical Memorandum 08-01: Acoustics* (HTM 08-01) guidance document, published by the Department of Health in 2013, sets out the acoustic design criteria that should be achieved by healthcare facilities. HTM 08-01 sets out acoustic performance standards for:

- Internal noise levels from external sources
- Internal noise levels from mechanical and electrical services
- Sound insulation performance to be achieved between internal spaces
- Room acoustics and the control of reverberation
- Internal noise levels due to rain noise
- External noise levels

The relevant acoustic design criteria are discussed further in the following subsections.

3.1.1 Internal Noise Levels from External Sources

HTM 08-01 provides criteria for noise intrusion from external sources to be met inside specified rooms and areas. The HTM 08-01 requirements as applicable to the Facility are presented in Section 6.1 of this report.

3.1.2 Internal Noise Levels from Mechanical and Electrical Services

HTM 08-01 provides internal noise criteria in terms of maximum Noise Rating (NR) levels for mechanical and electrical services. The NR limits as applicable to the Facility are listed in Section 9.2.1 of this report.

3.1.3 Sound Insulation Performance Between Internal Spaces

HTM 08-01 recognises the need for an appropriate level of airborne sound insulation between spaces. There is also a need to ensure that private conversations are not overheard by the occupants of adjacent spaces.

It provides a matrix method of establishing design criteria for sound insulation between different room types. The weighted standardised level difference ($D_{nT,w}$) is used to assess in-situ airborne sound insulation between adjacent spaces.

It also requires that impact sound insulation be considered for noise sensitive spaces. With regards to the control of impact noise generated from footfall from occupants of the space above, there are no room-specific criteria provided. However, the guidance does suggest that a weighted standardised impact sound pressure level of 65dB $L'_{nT,w}$ should be achieved where there are heavily trafficked areas over noise sensitive spaces.

Section 7 provides a review of all proposed internal wall and floor constructions and also confirms the minimum acoustic performance standard to be achieved by internal doors and glazed screens.

3.1.4 Room Acoustics and the Control of Reverberation

There are requirements to achieve minimum areas of sound absorption within Healthcare accommodation. HTM 08-01 states that:

'... Sound-absorbent treatment should be provided in all areas (including all corridors), except acoustically unimportant rooms (for example storerooms etc), where cleaning, infection-control, patient-safety, clinical and maintenance requirements allow ...'

The control of reverberation is discussed in more detail in Section 8 of this report.

3.1.5 Internal Noise Levels Due to Rain Noise

HTM 08-01 specifies that the indoor ambient noise levels as occurring during "heavy" rainfall (as defined in BS EN ISO 140-18) should not exceed the intrusive noise criteria by more than +20dB in $L_{Aeq,T}$ terms, for each relevant room type, nor exceed a maximum (absolute) internal ambient noise level of 65dB $L_{Aeq,T}$, whichever is lower. A review of the anticipated noise levels as expected during periods of "heavy" rainfall is presented in Section 6.5.

3.2 Environmental Noise Egress from the Facility

Planning permission for the Facility was granted by Manchester City Council on 3 November 2020 (Planning Application number: 127914/FO/2020). Condition 15 relates to noise and states the following:

'... 15) (a) Prior to the first occupation of the development hereby approved, details of any externally mounted ancillary plant, equipment and servicing shall be submitted for approval in writing by the City Council, as Local Planning Authority. For the avoidance of doubt, externally mounted plant, equipment, and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.

(b) Prior to the first occupation of the development, a verification report will be required to validate that the work undertaken conforms to the recommendations and requirements approved as part of part (a) of this planning condition. The verification report shall include post completion testing to confirm the noise criteria has been met. In instances of non conformity, these shall be detailed along with mitigation measures required to ensure compliance with the noise criteria. Any mitigation measures shall be implemented in accordance with a timescale to be agreed with the City Council, as Local Planning Authority, and thereafter retained and maintained in situ.

Reason - To minimise the impact of plant on the occupants of the development pursuant to policies SP1 and DM1 of the Manchester Core Strategy (2012) and saved policy DC26 of the Unitary Development Plan for the City of Manchester (1995) ...'

The requirements of this Planning Condition have been used to determine appropriate maximum permissible noise level limits that are to be achieved by all externally sited plant associated with the Facility. These adopted noise level limits have been derived as based upon the results of an environmental noise survey conducted by Sol during December 2020 and in accordance with the assessment methodology presented in British Standard BS4142: 2014+A1 (BS4142).

3.3 BS4142: 2014+A1: 2019

British Standard BS4142: 2014+A1: 2019: *'Method for rating and assessing industrial and commercial sound'* (BS4142) is intended to be used to assess environmental noise of an industrial nature, which includes sound from fixed installations, which comprise mechanical and electrical plant and equipment.

The procedure contained in BS4142 for assessing the impact is to compare the measured or predicted noise level from the source in question, the "Specific Sound Level" immediately outside the noise sensitive premises, with the "Background Sound Level". Where the noise contains attention attracting characteristics (i.e. acoustic features) such as tonal, impulsive, intermittent elements, it may be appropriate to apply a correction to the Specific Sound Level to obtain the "Rating Level".

BS4142 states that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level and the context in which the sound occurs:

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

For the daytime, the assessment is carried out over a one-hour period, and over a 15-minute period at night. The daytime and night time periods are typically defined as occurring between 07:00 hours to 23:00 hours, and 23:00 hours to 07:00 hours, respectively.

4 ENVIRONMENTAL NOISE SURVEY

4.1 Basis of Assessment

In order to inform this acoustic assessment, an environmental noise survey has been conducted by Sol between c.14:10 hours during Wednesday 9 December and c.13:30 hours during Thursday 10 December 2020. The purpose of this survey was to determine the prevailing pre-existing Ambient and Background Sound Levels at the nearest noise sensitive premises to the Facility, as during a typical weekday, daytime and night time period for environmental noise benchmarking and subsequent acoustic impact assessment purposes.

The environmental noise survey consisted of two environmental noise measurement positions:

- **Noise Monitoring Position 1:** Mast mounted microphone and weather station sited at 2.5 metres above local ground level, c.10 metres to the north of the existing residential housing on Magna Drive. Unattended environmental noise levels were recorded at this position between c.15:15 hours during Wednesday 9 December and c.13:30 hours during 10 December 2020.
- **Noise Monitoring Position 2:** Tripod mounted microphone sited at 1.5 metres above local ground level, situated on the north side of Ellis Drive. All construction activities on the site were stopped for the full duration of this measurement. Fully attended environmental noise levels were recorded at this position between c.14:10 hours and c.14:45 during Wednesday 9 December 2020.

The locations of the noise monitoring positions are shown in Figure 2. The full results are as presented in Appendix A.

Ground investigation works were being carried out on site during the survey. The Site Manager confirmed that works were only carried out as during daylight hours between c.08:00 hours and 17:00 hours. The results as recorded during the known periods of construction have been omitted from the assessment.

The noise survey was carried out using Type 1 Precision Grade noise monitoring equipment, and the complete measuring systems were field calibrated immediately prior to and following the noise survey period. (Full details of the noise monitoring systems are retained on file by Sol, including traceable calibration records; these are available for review if needed).

Meteorological data was recorded at Noise Monitoring Position 1 for the duration of the noise survey, as using a Professional Grade Vaisala "WXT520" weather station. The prevailing weather conditions remained favourable for the majority of the survey period for the purposes of environmental noise assessment. Brief periods of light rain were recorded between c.20:00 hours and 20:30 hours during 9 December 2020. Average wind speeds remained below 1ms^{-1} for the duration of the survey.

Notwithstanding the weather conditions recorded, the microphone systems were entirely weatherproofed and fitted with all-weather environmental windshields, each with bird spike.



Figure 2: Noise survey monitoring locations (Google Earth 2020)

5 ENVIRONMENTAL NOISE SURVEY RESULTS

Table 1 provides a basic summary of the average, free field environmental noise levels measured at Measurement Position 1 and Position 2:

Measurement Position	Daytime			Night time		
	dB L _{Amax}	dB L _{Aeq,15min}	dB L _{A90,15min}	dB L _{Amax}	dB L _{Aeq,15min}	dB L _{A90,15min}
1	54 – 72	42 – 51	39 – 45	41 – 68	36 – 50	35 – 45
2	71	45 – 49	42 – 44	-	-	-

Table 1: Summary of typical, measured environmental noise levels, broadband terms

Appendix A provides further information and a full summary of the measurement data.

6 EXTERNAL BUILDING ENVELOPE

6.1 Acoustic Design Targets

The minimum required sound insulation to be provided by the external building envelope is determined based upon the as measured and assessed environmental noise levels as expected to be incident on the façades of the Facility, and the maximum Indoor Ambient Noise Level requirements of each room. Table 2 provides the indoor ambient noise level requirements to be achieved in each type of space proposed within the Facility:

Room	Criteria for Noise Intrusion to be met inside the spaces from External Sources, dB $L_{Aeq,1hour}$
Quiet rooms, open plan office, meeting rooms, Quiet Rooms	≤40
Tea Station, Coffee Room, WC, shower	≤50

Table 2: Indoor ambient noise level requirements

6.2 Ventilation Strategy

This section of the report aims to provide guidance to the M&E Consultant and the Design Team with regards to viable ventilation strategies from an acoustic perspective.

The results of the environmental noise measurements indicate that the free-field ambient noise levels of up to 51dB $L_{Aeq,15mins}$ at the location of the proposed Facility in the absence of construction noise.

Based upon the as measured environmental noise levels, and assuming a sound reduction of c.10-15dB for a partially open window, the use of open windows could be used as a means of ventilation to all spaces.

6.3 External Glazing

Based upon the results of the environmental noise survey, standard thermal insulating double glazing should be appropriate to all spaces. **However, in order to control noise ingress to the development from the externally sited condenser units, the external glazing to the north façade of the open plan offices which overlook the external condensers should be omitted or further infilled and blacked out with suitable double skin blanking panels inside the glazing (please refer to Section 9.1).**

6.4 External Façade construction

The following wall construction is proposed:

- 30mm thick “CladEx” metal coated insulated panel
- 11mm thick OSB sheathing board
- 174mm thick steel studs with 180mm thick “Omnifit Stud 34” insulation (non-rigid) compressed not stud zone
- 15mm thick “Mega Excel” plasterboard

This construction is expected to suitably control environmental noise ingress to development from existing environmental noise sources. **However, in order to control noise ingress to the development from the proposed externally sited condenser units, the internal lining of the external façade construction (north façade only) must be increased to 2 x 15mm thick MegaExcel vinyl (please refer to Section 9.1 of this report).**

6.5 External Roof

The roof construction will need to be designed to ensure that the indoor ambient noise levels as set out in Table 2 are not exceed and that impact noise as during ‘heavy’ rainfall does not exceed 60dB $L_{Aeq,T}$.

The following roof construction is proposed:

- Kingspan “KS1000 TD Topdeck” 90mm thick insulated roof panel
- 130mm thick Earthwool Loft Roll insulation between joists
- 12.5mm thick foil backed Fireline plasterboard fixed to the underside of the joists
- Rockfon “Tropic” acoustic lay-in-grid acoustic ceiling

The proposed roof construction is capable of suitably controlling environmental noise ingress and impact noise due to heavy rainfall.

7 INTERNAL SOUND INSULATION

7.1 Internal Partitions

The minimum airborne sound insulation performance to be provided by all internal partitions is shown in Appendix B. Please note that there are two performance parameters stated for most partition types:

- The $D_{nT,w}$ parameter is the on-site performance requirement and is required to be achieved *in situ*. Note, however, that corridor walls containing a door are not required to achieve a minimum performance on site, as in practical terms the overall performance achieved will be largely dictated by the acoustic performance provided by the doorset.
- The R_w parameter is the laboratory tested performance, as tested under ideal conditions; this is always higher than the corresponding on site $D_{nT,w}$ performance. This is due to several factors including penetrations, pattering and junction detailing, on-site workmanship as well as other room factors such as physical room dimensions and reverberation time. To avoid confusion, it is the R_w parameter only that should be included on the specifications submitted to drywall suppliers.

7.1.1 Architects Proposed Partition Construction

Table 3 shows the proposed partition constructions, as advised by the Architect. The anticipated laboratory airborne sound insulation performance, R_w , for each proposed construction is also provided:

Partition Type	Construction		Acoustic Performance Rating, dB R_w
1	1 x 15mm thick MegaExcel vinyl faced plasterboard and 1 x 12.5mm thick GTEC standard plasterboard each side of a 70mm C-stud with 50mm thick glass mineral wool insulation (16kg/m ³)		54
2	1 x 15mm thick MegaExcel vinyl faced plasterboard each side of a 70mm thick C-stud with 25mm thick glass mineral wool insulation (16kg/m ³)		46
3	1 x 15mm thick MegaExcel vinyl faced plasterboard, 12mm thick plywood on 100mm timber studs, fully filled with 100mm thick insulation*, 1 x 15mm thick MegaExcel vinyl faced plasterboard		45
4	1 x 15mm thick MegaExcel vinyl faced plasterboard and 12mm thick plywood each side of 100mm timber studs, fully filled with 100mm thick insulation*		46
5	1 x 15mm thick MegaExcel vinyl faced plasterboard on 70mm C-stud and 100mm timber stud with 50mm thick glass mineral wool insulation (16kg/m ³), 1 x 12mm thick plywood with 15mm MegaExcel vinyl faced plasterboard on a 24mm thick dryliner frame		47
6	2 x 15mm thick MegaExcel vinyl faced plasterboard on 70mm C-stud and 100mm timber stud with 50mm thick glass mineral wool insulation (16kg/m ³), 1 x 12mm thick plywood with 15mm thick MegaExcel vinyl faced plasterboard on a 24mm dryliner frame		50
7	1 x 15mm thick MegaExcel vinyl faced plasterboard each side of twin 50mm C-studs with an overall cavity depth of 204mm, cavity lined with 50mm thick mineral wool insulation*		56
8	2 x 12.5mm MegaExcel vinyl faced plasterboard each side of twin 50mm C-studs with an overall cavity depth of 204mm, cavity lined with 50mm thick glass mineral wool insulation (16kg/m ³)		65
9	2 x 12.5mm MegaExcel vinyl faced plasterboard each side of twin 50mm C-studs with an overall cavity depth of 204mm, cavity lined with 50mm thick glass mineral wool insulation (16kg/m ³)		65
10	Not used		
11	1 x 15mm thick MegaExcel vinyl faced plasterboard each side of twin 50mm C-studs with an overall cavity depth of 149mm, cavity lined with 25mm thick glass mineral wool insulation (16kg/m ³)		62
12	1 x 15mm thick MegaExcel vinyl faced plasterboard and 1 x 12.5mm thick MegaExcel vinyl faced plasterboard each side of twin 50mm C-studs with an overall cavity depth of 238mm, cavity lined with 50mm thick glass mineral wool insulation (16kg/m ³)		65
13	1 x 15mm thick MegaExcel vinyl faced plasterboard and 1 x 12.5mm thick MegaExcel plasterboard on 70mm C-stud and independent 100mm timber stud to create an overall cavity depth of 214 with 50mm thick glass mineral wool insulation (16kg/m ³), 1 x 12mm thick plywood with 15mm thick MegaExcel vinyl faced plasterboard on a 24mm Dryliner frame		66
* NB: Where cavity insulation is proposed and unspecified, this should be unfaced mineral fibre insulation such as Isover APR 1200 or similar approved with a minimum density of 10kg/m ³ . Others must comment on thermal, fire and structural requirements.			

Table 3: Proposed internal wall constructions and expected laboratory acoustic performance

7.1.2 Partition Type 1

This partition construction is capable of meeting the required minimum sound insulation performance requirements to all locations as currently shown on the Architect's setting out drawings. However, the following value engineering options could be considered:

- For partitions highlighted in **light blue** or **red** in Appendix B, it would be possible (in acoustic terms only) to omit the 1 x 12.5mm thick GTEC standard plasterboard on both sides of the stud and to reduce the thickness of the glass mineral wool insulation from 50mm to 25mm.
- For partitions highlighted in **orange** in Appendix B, it would be possible (in acoustic terms only) to omit the 1 x 12.5mm thick GTEC Standard plasterboard on both sides of the stud and also the 50mm thick glass mineral wool insulation.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.3 Partition Type 2

This partition construction is capable of meeting the required minimum sound insulation performance requirements to all locations as currently shown on the Architect's setting out drawings. However, the following value engineering option could be considered:

- For partitions highlighted in **orange** in Appendix B, it would be possible (in acoustic terms only) to omit 25mm thick glass mineral wool insulation.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.4 Partition Type 3

This partition type is proposed to be located between the ground floor electrical plantroom, and open plan office and meeting room spaces. It is recommended that this partition be rated to provide a laboratory sound insulation performance of 50dB R_w . **Further enhancement of the current proposed partition construction is therefore required.**

The following partition construction is capable of meeting the suggested sound insulation performance requirements of 50dB R_w .

- 2 x 15mm thick MegaExcel vinyl faced plasterboard
- 100mm timber studs, fully filled with 100mm thick unfaced insulation such as Isover APR 1200 or similar approved with a minimum density of 10kg/m³.
- 2 x 15mm thick MegaExcel vinyl faced plasterboard

Plywood linings can be included as required for pattering etc.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.5 Partition Type 4

This partition type is proposed to be located between the ground floor plantrooms only and as such is not required to provide a minimum acoustic performance.

7.1.6 Partition Type 5

This partition type is proposed between the stair core and adjoining store rooms and WCs and is capable of meeting the required minimum sound insulation performance requirements. However, the following value engineering option could be considered:

- For partitions highlighted in **orange** in Appendix B, it would be possible (in acoustic terms only) to omit the 50mm thick glass mineral wool insulation.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.7 Partition Type 6

This partition type is proposed between the stair core and adjoining meeting rooms and is capable of meeting the required minimum sound insulation performance requirements.

7.1.8 Partition Type 7

This partition construction is proposed between the floor lobby and circulation spaces and as such is not required to provide an acoustic function. The following value engineering option could be considered:

- For partitions highlighted in **orange** in Appendix B, it would be possible (in acoustic terms only) to omit the 50mm thick glass mineral wool insulation.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.9 Partition Types 8, 9 and 12

These proposed partition constructions are capable of meeting the required minimum sound insulation performance requirements to all locations. However, the following value engineering options could be considered:

- For partitions highlighted in **green**, **light blue** or **red** in Appendix B, it would be possible (in acoustic terms only) to omit one layer of plasterboard each side of the stud.
- For partitions highlighted in **orange** in Appendix B, it would be possible (in acoustic terms only) to omit one layer of plasterboard each side of the stud and the 50mm thick acoustic insulation.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.10 Partition Type 11

This partition construction is proposed between WCs and is capable of meeting the required minimum sound insulation performance requirements. However, the following value engineering options could be considered:

- For partitions highlighted in **light blue**, **red** or **orange** in Appendix B, it would be possible (in acoustic terms only) to omit 25mm thick glass mineral wool insulation or to adopt a single stud configuration similar Partition Type 2.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.1.11 Partition Type 13

This partition type is proposed between the stair core and adjoining meeting rooms. The following value engineering option could be considered:

- For partitions highlighted in **green** in Appendix B, it would be possible (in acoustic terms only) to omit the 1 x 12.5mm thick MegaExcel plasterboard or revert to Partition Type 6.

Others must advise of the fire, security, resistivity to mechanical damage and structural requirements.

7.2 Floor Construction

The floor construction is required to provide an airborne sound insulation performance of at least 42dB $D_{nT,w}$ and an impact sound insulation performance of less than 65dB $L'_{nT,w}$.

The following floor construction is proposed:

- 1 x 18mm thick T&G plywood
- 170mm deep modular floor beam with 200mm thick "Earthwool Loft Roll 44" insulation packed between joists
- 1 x 12.5mm thick MegaExcel plasterboard
- Tapered upstand steel flashing
- 156mm deep modular floor beam with 100mm thick "Earthwool Loft Roll 44" insulation between purlins
- 2 x 12.5mm thick MegaExcel plasterboard fixed to joists
- Rockfon Tropic acoustic lay-in-grid acoustic ceiling

The above floor construction is capable of meeting the required HTM 08-01 airborne and sound insulation performance requirements without further enhancement.



7.3 Internal Doors

HTM08-01 provides the following guidance for internal doorsets, as per following excerpt:

‘... 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. Requirements for doors are covered in paragraphs 2.72–2.86 ...’

Acoustic ratings for all proposed internal doorset are provided in Appendix B. Doorsets to risers and doorsets separating acoustically sensitive spaces and adjoining circulation areas are rated 30dB R_w .

Doorsets to partitions serving meeting rooms and quiet rooms adjoining open plan offices are rated as 35dB R_w , in order to provide a reasonable level of acoustic separation between these spaces.

Doorsets which are not rated are not required to provide an acoustic performance.

As a guide, a laboratory rating of 30dB R_w would typically be achieved by a 45mm thick solid-core timber door, as closing onto a rebated frame with full perimeter seals along the head, jambs, and threshold. The door would need to be side hinged rather than pivoted. For double leaf doors, meeting jambs would need to be rebated and fitted with proprietary acoustic seals to meet the requirements. The door leaf would typically have a weight of at least 30 kg/m².

A laboratory rating of 35dB R_w would typically be achieved by a 54mm thick solid-core timber door, as closing onto a rebated frame with full perimeter seals along the head, jambs, and threshold. A drop threshold would be required for 38dB R_w . The door would need to be side hinged rather than pivoted. For double doors, meeting jambs would again need to be rebated and fitted with proprietary acoustic seals to meet the requirements. Door leaf densities should be typically around 50 to 65kg/m², albeit lighter doors with composite constructions are available from some suppliers. Vision panels of thick acoustic laminate glass can be used (e.g. 12.8mm), albeit these must be well sealed.

7.4 Internal Glazed Screens / Vision Panels

HTM08-01 provides the following guidance for internal glazed screens/vision panels:

‘... Where observation windows are included between adjacent rooms, partitions (including the glass) should ideally achieve the target ratings given in Tables 4 and 5. 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 10 dB 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 ...’

Full height glazed screens are proposed for the partitions separating the quiet rooms and meeting rooms from the adjoining open plan offices. The sound insulation performance mark-ups as provided in Appendix B confirm that these partitions (including the glazed screens) are required to provide achieve a laboratory sound insulation performance of 45dB R_w . This is a very high sound insulation performance to be achieved by a glazed screen and is likely to require the use of acoustically laminated double glazing.

In accordance with the HTM 08-01 guidance, it would be possible to downgrade the acoustic performance of the glazed screens to a minimum of 35dB R_w which would reduce costs. However, this will reduce the overall acoustic performance provided and will affect the level of acoustic privacy between the quiet rooms and meeting rooms from the adjoining open plan offices. The Client must therefore decide whether to compromise on cost or acoustic performance. For costing purposes only, Table 4 provides possible glazing configurations capable of providing a laboratory sound insulation performance of up to 45dB R_w :

Minimum Laboratory Sound Insulation Performance, dB R_w	Possible Glazing Configuration (For Costing Purposes Only)
35	10mm glass
37	15mm glass
40	8 mm glass / 12 mm air gap / 8.8 mm acoustic laminated glass
45	10 mm Glass / 12 mm air gap / 10.8 mm acoustic laminated glazing

Table 4: Possible glazing configurations capable of meeting the acoustic specification

These glazing configurations are provided for guidance/costing purposes only. Other requirements such as fire, cost, robustness etc. must also be taken into consideration when determining the required glazing configuration. To satisfy the acoustic requirements, the proposed glazing supplier need only confirm compliance with the acoustic (dB R_w) specification. Alternative glazing configurations can be adopted if preferred providing the acoustic specification is achieved.

7.5 Steel Column Encasement

Steel column encasement details are shown on the following architectural drawings:

- 20-074-BPA-OB-XX-DR-A2-001_P8 - Ground Floor - Set Out Superstructure
- 20-074-BPA-OB-XX-DR-A2-002_P2 - Typical Floor - Set Out Superstructure

Continuous steelwork passing through separating partitions can carry significant sound between spaces which will need to be controlled. The following bullet points provide a review of the current proposed steel column encasement:

- Steel column encasement details 1, 2, 3, 4, 5 and 14 are currently not used.
- Steel column encasement details 6 and 7 are located within partitions separating meeting rooms from the stair core. The partition separating these spaces is required to provide a minimum sound insulation performance of 42dB $D_{nT,w}$. The proposed detailing is acoustically acceptable.
- Steel column encasement details 8 and 10 are located within partition separating meeting rooms from open plan offices. These partitions are rated with a minimum laboratory sound insulation performance of 45dB R_w (no on-site performance to be achieved). The proposed detailing is acoustically acceptable.
- Steel column encasement detail 11 does not form part of any separating partition. The proposed detailing is acoustically acceptable.
- Steel column encasement detail 12 is located within partitions separating WC and open plan offices. The partition separating these spaces is required to provide a minimum sound insulation performance of 37dB $D_{nT,w}$. The proposed detailing is acoustically acceptable.
- Steel column encasement detail 13 is located within partition separating WC and adjoining circulation areas. These partitions are rated with a laboratory sound insulation performance of 40dB R_w (no on-site performance to be achieved). The proposed detailing is acoustically acceptable.

7.6 RWP and SVP pipework

Any RWP, SVP or SW pipework that passes through any space other than a riser must be lagged with 25mm thick unfaced mineral fibre and boxed in using two layers of 12.5mm thick wallboard (or equivalent to provide a mass per unit area of at least 15 kg/m²), complete with taped and staggered joints and no contact between any board/framing and pipework surfaces (including the pipe lagging). The enclosure must be constructed to be fully independent of the pipework.

Please note that a single lining of 15mm thick MegaDeco/Excel plasterboard does not provide the required minimum surface mass as currently shown for Partition Type 14. The following construction is therefore recommended for all RWP, SVP or SW pipework that passes through any space other than a riser:

- 25mm thick unfaced mineral fibre
- 12mm thick plywood
- 12.5mm thick MegaDeco/Excel plasterboard

7.7 Electrical sockets

Where recessed sockets are proposed to separating partitions, they must not be mounted in a “back-to-back” formation and care should be taken to ensure a minimum of 600mm spacing between sockets located either side of a partition. A suitable putty pad to rear of the socket must be installed in all cases.

7.8 Internal Junction Detailing

Junction detailing between internal elements with other elements and the external façade will need to be developed by the Architect and approved by the Acoustic Consultant.

7.9 Duct and Pipe Penetration Detailing

The recommended detailing of all duct and pipe penetrations is presented in Appendix C.

7.10 Deflection Head Detailing

The current proposed partition deflection head detailing is shown on the following architectural drawings:

- 20-074-BPA-OB-XX-DR-A4-007_P1 - Partition Types Sheet 1 of 2
- 20-074-BPA-OB-XX-DR-A4-008_P1 - Partition Types Sheet 2 of 2

Whilst not shown on the detailing, all spaces are to be furnished with a lay-in-grid sound absorptive ceiling or plasterboard ceiling which shall provide additional protection of the proposed deflection head detailing and would be expected to suitably control sound flanking via the partition head and lightweight roof construction in the majority of cases.

With regards to Deflection Head Detail 1 and for partitions highlighted in **green** in Appendix B, it is recommended that steel angles be fitted to the underside of the soffit either side of the partition to ensure that any gaps, as a result of onsite workmanship etc. are suitably closed. A sketch of this is shown in Figure 3:

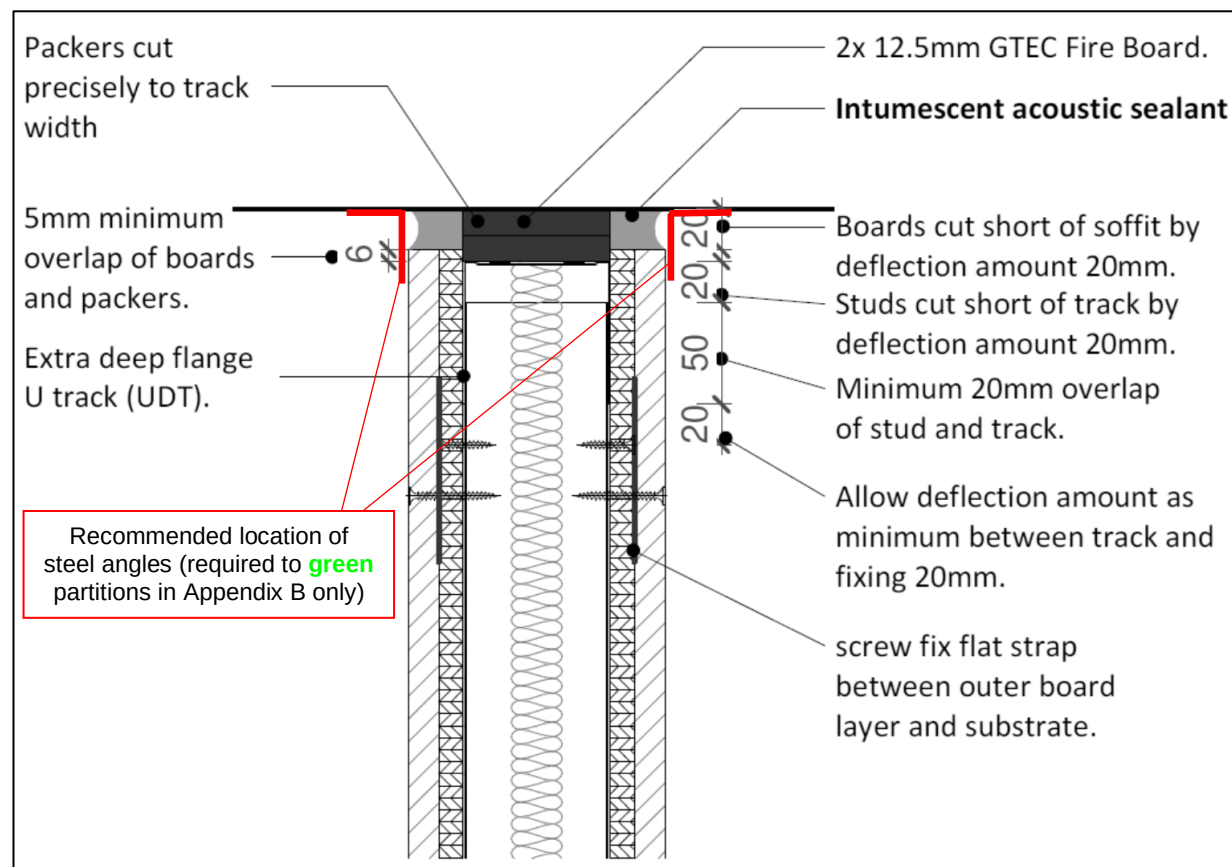


Figure 3: Deflection Head Detail 1 (recommended trim angles indicated)

8 INTERNAL ROOM FINISHES

8.1 Acoustic Performance Requirements

Sound absorbent finishes are beneficial as they help to improve speech communication within spaces used for speech and help to reduce the levels of noise generated within a space. HTM 08-01 states the following:

'... 2.109 Acoustic treatments are likely to be needed where speech intelligibility is a requirement.

2.110 Acoustically-absorbent materials should have a minimum absorption area equivalent to a Class C absorber (as defined in BS EN ISO 11654:1997) covering at least 80% of the area of the floor, in addition to the absorption that may be provided by the building materials normally used. If a Class A or B absorbent material is used, less surface area is needed. (See Chapter 10 for an example of how to calculate the absorption area required for materials with different absorption class.) ...'

The Architect's reflective ceiling plan drawings confirms that all internal rooms, with the exception of the plantrooms and stairwells (speech intelligibility is not a requirement to these spaces), are to be furnished with Rockfon Tropic or Rockfon Medicare acoustic lay-in-grid acoustic ceiling systems to the full extent of the available ceiling area. Product data confirms the proposed ceiling tiles provide Class A ($\alpha_w = 0.9$) rated sound absorption and these therefore meet the HTM 08-01 acoustic requirements in all cases.

9 BUILDING SERVICES

9.1 Externally Sited Building Services Equipment

9.1.1 Environmental (Atmospheric Side) Plant Noise Limits

Planning Permission for the Facility was granted by Manchester City Council on 3 November 2020 (Planning Application number: 127914/FO/2020). Condition 15 relates to noise and states the following:

'... 15) (a) Prior to the first occupation of the development hereby approved, details of any externally mounted ancillary plant, equipment and servicing shall be submitted for approval in writing by the City Council, as Local Planning Authority. For the avoidance of doubt, externally mounted plant, equipment, and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.

(b) Prior to the first occupation of the development, a verification report will be required to validate that the work undertaken conforms to the recommendations and requirements approved as part of part (a) of this planning condition. The verification report shall include post completion testing to confirm the noise criteria has been met. In instances of non conformity, these shall be detailed along with mitigation measures required to ensure compliance with the noise criteria. Any mitigation measures shall be implemented in accordance with a timescale to be agreed with the City Council, as Local Planning Authority, and thereafter retained and maintained in situ.

Reason - To minimise the impact of plant on the occupants of the development pursuant to policies SP1 and DM1 of the Manchester Core Strategy (2012) and saved policy DC26 of the Unitary Development Plan for the City of Manchester (1995) ...'

Accordingly, it is necessary to limit the total, aggregate environmental noise from all M&E plant, when operating simultaneously, to an ambient noise level (in $L_{Aeq,T}$ terms) equating to the lowest, pre-existing daytime or night time background noise level at any residential property façade, in $L_{A90,T}$ terms, less a further 5dB. The lowest typical recorded daytime and night time background noise levels, in the absence of construction noise, as recorded at Position 1 were 41dB $L_{A90,T}$ and 36dB $L_{A90,T}$ respectively. On this basis, the following plant noise limits are applicable at the residential housing on Magna Drive (free-field):

Location	Maximum Permissible Rating Level Limit Imposed by Condition 15, dB $L_{Aeq,T}$	
	Daytime (07:00hrs to 23:00hrs)	Night time (23:00hrs to 07:00hrs)
Housing on Magna Drive	36	31

Table 5: Environmental noise limits for building services plant

9.1.2 External Condenser Units

Details of the proposed externally sited plant are shown on the M&E Consultant (Yorkshire Building Services Ltd) drawing no. 20-074-BPA-OB-XX-DR-A9-001_P4 - External Works Layout, dated 3 February 2021. The external plant comprises of the following condenser units, which are all to be located to the external plant area to the north of the proposed office building:

- 4 off Mitsubishi type PURY-P350YNW-A1 units (plant ref: C01, C04, C07, C10). Sol has been informed that these units are only required to operate during daytime hours only (i.e. 07:00 – 23:00 hours).
- 4 off Mitsubishi type PURY-P400YNW-A1 units (plant ref: C02, C05, C08, C11). Again, Sol has been informed that these units are only required to operate during daytime hours only (i.e. 07:00 – 23:00 hours).
- 4 off Mitsubishi type PUHZ-ZRP35VKA2 units (plant ref: C03, C06, C09, C12). Sol has been informed that these units are expected to operate on a 24 hour basis.

Table 6 provides a summary of the manufacturer confirmed sound pressure level data for the three condenser types as currently proposed:

Condenser Model Reference	Units Reference	Unweighted Sound Pressure Levels at 1m Distance, dB $L_{eq,T}$ @ Octave Band Centre Frequency, Hz								dB L_{Aeq}
		63	125	250	500	1k	2k	4k	8k	
PURY-P350YNW-A1	C01, C04, C07, C10	72	71	64	62	57	54	52	48	64
PURY-P400YNW-A1	C02, C05, C08, C11	81	70	70	68	62	59	54	49	69
PUHZ-ZRP35VKA2	C03, C06, C09, C12	58	51	45	44	40	37	32	31	46

Table 6: Manufacturer confirms sound pressure level data at 1m distance for external condensers

The Specific Sound Level as expected from the externally sited building services equipment at the identified NSRs has been calculated using proprietary 3D DataKustik “CadnaA” noise mapping software and based on the manufacturer confirmed noise level data, the dimensions of the plant, distances to the receptors and other environmental factors.

9.1.3 Predicted Noise Level impact on Residential Housing

Table 7 shows the predicted Specific Sound Level at the worst affected NSR with the above noise mitigation measured implemented. The predicted Specific Sound Level relates to all condenser units operating, and it is significantly below the pre-existing Background Sound Level.

As such, any acoustic character associated with the combined operation of the condenser units is not expected to be of any significance, and thus no BS4142 penalty correction has been applied in order to determine the BS4142 defined Rating Level for acoustic assessment purposes:

Noise Sensitive Receptor	Assessment Period	Predicted Specific Level, dB $L_{Aeq,T}$	Predicted Rating Level, dB $L_{A1,T1}$	Maximum Permissible Noise Rating Level Limit Imposed by Condition 15, dB $L_{A1,T1}$	Pass/Fail
A – Housing on Magma Drive (south west of the Facility)	Daytime (07:00hrs – 23:00hrs) $T = 1$ hour	26	26	36	Pass
	Night Time (23:00hrs – 07:00hrs) $T = 15$ minutes	0	0	31	Pass

Table 7: Planning Condition 15 summary assessment

Thus, the predicted Rating Level at the existing noise sensitive residential housing on Magna Drive meets the noise limits as imposed by Planning Condition 15.

9.1.4 Predicted Noise Level impact on Occupied Spaces within the Development

The proposed external condenser units are to be sited within an external plant area located directly to the north of the proposed development. Based upon the details provided, noise from the proposed condenser units is expected to exceed the maximum permissible internal Noise Rating limit of NR35 within the adjacent open plan office spaces. In order to reduce the noise impact generated, it is recommended that the following noise mitigation measures be implemented on site:

- Omit (or infill via double skin black out panelling) the currently proposed external glazing on the north façade (all floors) to all open plan office spaces adjacent to the external plant area.
- Increase the internal lining of the external façade construction to 2 x 15mm thick MegaExcel vinyl faced plasterboard.
- Locate the 4 off Mitsubishi PURY-P400YNW-A1 units (plant ref: C02, C05, C08, C11) to be furthest away from the building façade.

The recommended noise mitigation measures are shown in Figure 4:

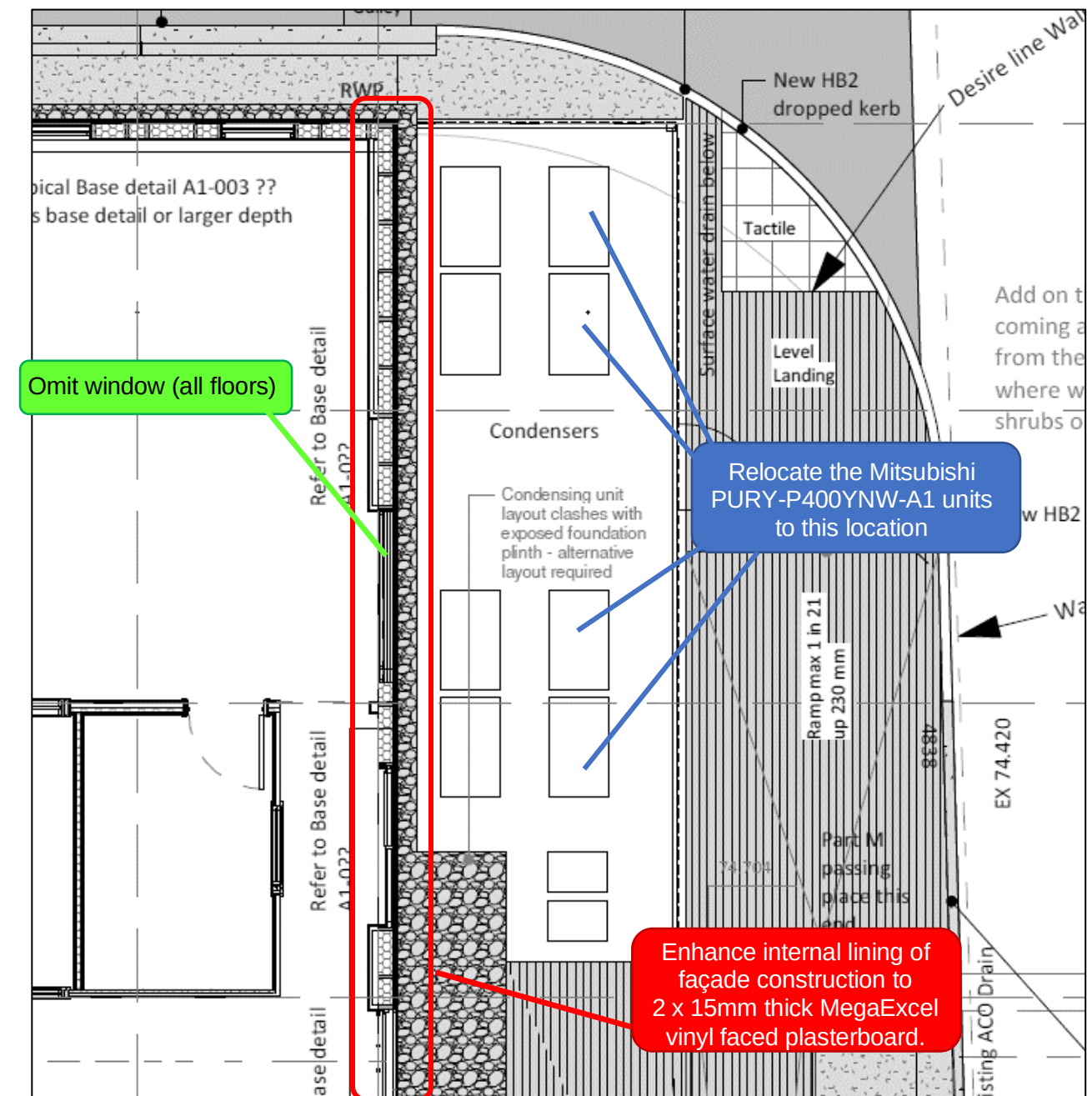


Figure 4: Recommended noise mitigation measures to reduce noise impact from externally sited plant area

9.2 Internally Sited Building Services Equipment

9.2.1 Internal Building Services Noise Limits

HTM 08-01 provides internal noise criteria for mechanical and electrical services. Table 8 provides the required noise level limits to be achieved within each space within the Facility:

Space	Maximum Internal Noise Rating Limits from Mechanical and Electrical Services*
Quiet Rooms, Open Plan Office, Meeting rooms	NR35
Tea Station, Coffee Room	NR40
WC, Shower	NR45
* Maximum internal Rating Levels shall be taken as a room spatial average.	

Table 8: Maximum internal Noise Rating limits from mechanical and electrical services

NR levels within rooms shall be measured in accordance with *ANC guidelines – Noise measurement in Buildings Part 1: Noise from Building Services*, at a minimum distance of 1.5 metres from any service grille or opening under typical plant operational duties in unoccupied spaces.

As a guide, the maximum permissible ductwork air velocities are outlined in Table 9 below, as recommended in order to achieve the required room noise level NR criteria:

Low Velocity Systems	Room Noise Criterion	
	NR35	NR40 / NR45
Riser ductwork and ductwork above plasterboard ceilings (m/s)	7.5	9
Ductwork above suspended ceilings (m/s)	5	6
Grilles face velocity (m/s, no OBDs)	3	3
Diffusers face velocity (m/s, no OBDs)	2	2
Ceiling extract ducts (m/s)	3	4

Table 9: CIBSE Guide B2 guidance on maximum airspeeds in building services

It is essential that grilles and diffusers are suitably sized such that the criteria in Table 9 is not exceeded. There must not be any opposed blade dampers (OBDs) incorporated within any terminal grilles and/or diffusers. Any required system balancing must be achieved via the use of duct mounted volume control dampers located at least one linear metre duct length from any grilles and diffusers.

Building services noise must not contain any features, such as knocking, rattling, tone(s) or whistling, that is likely to attract attention.

9.2.2 Heat Recovery Units

Details of the proposed Heat Recovery Units (HRUs) have been provided to Sol by Yorkshire Building Services Ltd (YBS) in January 2021. YBL have confirmed that the duty of the HRUs will vary are expected but are likely to be operating at up to “fan speed 3” for 95% of the time for normal operation. This assessment is therefore based upon the noise data provided for the HRUs operating at “fan speed 3”.

Table 10 provides a summary of the manufacturer confirmed in-duct octave band sound power level data for the outlet of the proposed HRUs (noise data for the HRU inlet has not been provided) operating at Speed 3:

HRU Unit	Location	Spaces Served	In-Duct Sound Power Level (dB L _w) @ Octave Band Centre Frequency (Hz)								Broadband Sound Power Level (dB L _{WA})	Noise Rating
			63	125	250	500	1k	2k	4k	8k		
LGH-65RVX-E	Outlet	Open Plan Offices, WCs	59	62	56	57	51	49	44	32	58	NR53
	Inlet		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
LGH-100RVX-E	Outlet	Open Plan Office, Quiet Rooms, Meeting Rooms, Tea Stations	67	67	62	64	59	59	54	43	66	NR62
	Inlet		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

Table 10: HRU in-duct sound power levels (fan speed 3)

Table 11 provides a summary of the published manufacturer casing radiated sound pressure levels as measured at 1.5 metres distance from the proposed HRUs:

HRU Unit	Spaces Served	Sound Pressure Level (dB L _{eq}) At 1.5 Metres @ Octave Band Centre Frequency (Hz)								Broadband Sound Pressure Level (dB L _{Aeq,T})	Noise Rating
		63	125	250	500	1k	2k	4k	8k		
LGH-65RVX-E	Open Plan Offices, WCs	44	38	31	27	22	15	12	10	29	NR22
LGH-100RVX-E	Open Plan Office, Quiet Rooms, Meeting Rooms, Tea Stations	47	40	34	30	25	18	12	10	32	NR26

Table 11: HRU casing radiated sound pressure levels as measured at 1.5 metre distance (fan speed 3)

The mechanical ventilation layouts indicate that 600mm long attenuators are currently proposed on the immediate fresh air intake (FAI), supply, extract and exhaust ductwork to each HRU. Table 12 provides the minimum required insertion loss performance to be provided by each attenuator:

HRU	Location	Minimum Insertion Loss Performance, dB ΔL_w , @ Octave Frequency Band Centre Frequency, Hz							Typical Attenuator Arrangement
		63	125	250	500	1k	2k	4k	
LGH-65RVX-E	FAI	3	6	10	19	24	29	19	600mm long circular attenuator
	Supply	3	6	10	19	24	29	19	600mm long circular attenuator
	Extract	3	6	10	19	24	29	19	600mm long circular attenuator
	Exhaust	3	6	10	19	24	29	19	600mm long circular attenuator
LGH-100RVX-E	FAI	3	6	10	19	24	29	19	600mm long circular attenuator
	Supply	3	6	10	19	24	29	19	600mm long circular attenuator
	Extract	3	6	10	19	24	29	19	600mm long circular attenuator
	Exhaust	3	6	10	19	24	29	19	600mm long circular attenuator

Table 12: Minimum required acoustic performance (insertion losses) for HRU attenuators

The attenuators must be fitted directly to the HRU in all cases. These must be no intervening ductwork between the unit and the attenuators, in any instance. In addition, it is essential that a minimum 500mm linear length of acoustic flexible ductwork, specifically “*Lindab Tecflex 400*” type (see product link below) or equal and approved (not simply “acoustic flex”), is installed to all supply and extract ductwork, to connect each air terminal (i.e. grille/diffuser/plenum box where present), subject to M&E Engineer approval. Product link below:

<https://itsolution.lindab.com/lindabwebproductsdoc/pdf/documentation/ads/uk/technical/tecflex400.pdf>

It should be noted that the proposed HRUs could be expected to operate at fan speed 4 (i.e. highest speed setting) for approximately 5% of the time. HRU fan speeds are not recommended in acoustic terms and this could lead to slightly elevated room noise levels (up to c.NR37). If this is not likely to be acceptable to the Client, Sol would recommend that 900mm long attenuators be fitted to the supply and extract of the HRU.

9.3 Fan Coil Units

The M&E Consultant DDA Ltd has provided Sol with details of the proposed Fan Coil Units (FCUs) during January 2021. Additional noise data has been provided by the manufacturer, Mitsubishi Electric Europe during February 2021. Table 13 provides the manufacturer confirmed in-duct octave band sound power level data for the proposed ceiling void mounted FCUs (noise data for the FCU intake has not been provided):

Ceiling Void FCU	Location	Spaces Served	In-Duct Sound Power Level (dB L_w) @ Octave Band Centre Frequency (Hz)								Broadband Sound Power Level (dB L_{WA})	Noise Rating
			63	125	250	500	1k	2k	4k	8k		
PEFY-M50VMA-A	Outlet	Open Plan Offices, Coffee Rooms	70	50	48	45	41	34	26	20	48	NR44
	Intake		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
PEFY-M80VMA-A	Outlet	Open Plan Offices, Tea Stations	54	49	47	44	42	33	24	19	46	NR42
	Intake		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

Table 13: Ceiling void FCUs induct sound power levels (medium speed, 50Pa static pressure)

Table 14 provides the manufacturer confirmed case radiated sound pressure levels at 1.5 metre distance from the proposed ceiling void mounted FCUs:

Ceiling Void FCU	Location	Sound Pressure Level (dB L_{eq}) At 1.5 Metres @ Octave Band Centre Frequency (Hz)								Broadband Sound Pressure Level (dB $L_{Aeq,T}$)	Noise Rating
		63	125	250	500	1k	2k	4k	8k		
PEFY-M50VMA-A	Open Plan Offices, Coffee Rooms	37	44	39	36	32	21	15	15	37	NR32
PEFY-M80VMA-A	Open Plan Offices, Tea Stations	37	44	39	36	32	21	15	15	37	NR32

Table 14: Ceiling void mounted FCU case radiated sound pressure levels at 1.5 metres distance (50Pa external pressure, medium speed)

No further noise mitigation is expected to be required to the ceiling void mounted FCUs.

Table 15 provides the manufacturer confirmed case radiated sound pressure levels for the proposed wall mounted FCUs:

Wall Mounted FCU	Location	Sound Pressure Level (dB L_{eq})* @ Octave Band Centre Frequency (Hz)								Broadband Sound Pressure Level (dB $L_{Aeq,T}$)	Noise Rating
		63	125	250	500	1k	2k	4k	8k		
PKFY-P10VLM-E	Quiet Rooms	44	31	30	26	23	14	0	0	28	NR23
PKFY-P15VLM-E	Meeting Rooms	44	31	30	25	24	14	12	11	28	NR24
PKFY-P25VLM-E	Meeting Rooms	48	34	37	31	31	22	15	13	35	NR31
PKFY-P32VLM-E	Comms Room	50	41	44	38	36	31	24	16	41	NR36

* Whilst not confirmed on the manufacturer's datasheet, it is assumed the reported sound pressure levels are measured at 1.5m distance on a reflective plane.

Table 15: Wall Mounted FCUs sound pressure levels at assumed at 1.5 metre distance

In the case of wall mounted FCUs, no further noise mitigation is recommended nor likely to be practicable.

9.3.1 Crosstalk Attenuation

“Crosstalk” describes the level of sound transmission between separate rooms via common ductwork connections. The use of crosstalk attenuators are required in order to control sound transmission between spaces in order to maintain the sound insulation performance. **NB: crosstalk attenuators are not currently shown in the ventilation drawings and will need to be added.**

Crosstalk attenuators are required to be installed to the following locations:

- Ventilation ductwork serving any Quiet Room
- Ventilation ductwork serving any Meeting Room

The crosstalk attenuator shall be installed as close as practicable to the duct penetration through the separating wall. Any ductwork serving cellular spaces, such as Meeting Rooms and Quiet Rooms, shall enter the spaces via the corridor wall (ideally above the room doorset) only. Ductwork penetrations through walls separating Quiet Rooms and/or Meeting Rooms are not permitted.

Figure 5 shows the required arrangement. This principle applies to both the supply and extract ductwork systems:

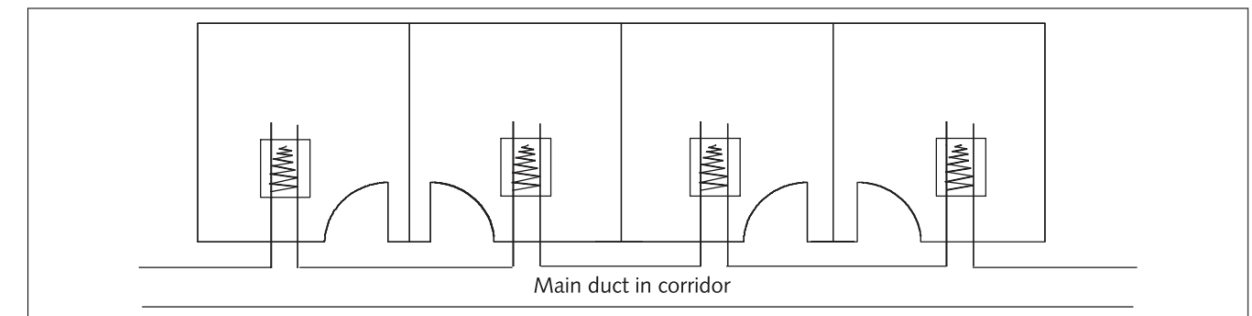


Figure 5: Typical crosstalk attenuator arrangement

NB: the current ventilation drawings indicate a number of locations where the ductwork is expected to penetrate the separating walls in these locations and must therefore be revised.

In this arrangement there will be at least two crosstalk attenuators in series between any two adjacent spaces. On this basis, Table 16 provides the minimum required insertion loss performance to be achieved by all crosstalk attenuators. **NB: again, crosstalk attenuators are not currently shown in the ventilation drawings and these will need to be added in all instances:**

Location	Minimum Insertion Loss Performance, dB ΔL_w , @ Octave Frequency Band Centre Frequency, Hz							Typical Attenuator Arrangement
	63	125	250	500	1k	2k	4k	
Any supply and extract ductwork serving any Quiet Room or Meeting Room	3	3	6	14	20	23	21	300mm long circular attenuator, duct internal diameter 150mmØ

Table 16: Required minimum insertion loss performance for crosstalk attenuators

In addition, it is essential that a minimum 500mm linear length of acoustic flexible ductwork, specifically “Lindab Tecflex 400” (see product link below) or equal and approved (not simply “acoustic flex”), is installed to all supply and extract ductwork, to connect each air terminal (i.e. grille/diffuser/plenum box where present), subject to M&E Engineer approval. Product link below:

<https://itsolution.lindab.com/lindabwebproductsdoc/pdf/documentation/ads/uk/technical/tecflex400.pdf>

9.4 Vibration Isolation Requirements

Vibration from all building services plant, including pumps and associated pipework, and also from lifts and electricity substations (transformers) should be vibration isolated from the building structure using appropriate anti-vibration mounts, resilient connections, pipework spring hangers, and flexible duct connections etc., where required.

The water booster units as proposed within the ground floor electrical plant room must be fitted with OEM (Original Equipment Manufacturer) specified anti-vibration mountings, likely to comprise of neoprene pads having an as fitted static deflection of c.3mm.

APPENDIX A NOISE SURVEY DETAILS & SUMMARY RESULTS

LOCATION

Ellis Drive, Crumpsall, Manchester

WEATHER CONDITIONS

Date	Daytime (07:00 hours – 23:00 Hours)				Night Time (23:00 hours – 07:00 hours)			
	Temp, °C	Rain, mm/h	Wind Direction	Average Wind Speed, m/s	Temp, °C	Rain, mm/h	Wind Direction	Average Wind Speed, m/s
09/12/2020	5	0.6	E	0.4	6	0.1	SE	0.5
10/12/2020	7	0.0	SE	0.9	-	-	-	-

PERSONNEL PRESENT DURING MEASUREMENTS

Brian Horner BSc (Hons) MIOA – Sol Acoustics Ltd

INSTRUMENTATION

Measurement Position 1

01dB Cube Sound Level Meter (Serial No. 12068)
01dB Pre22 Microphone Preamplifier (Serial No. 1936010)
GRAS 40CD Microphone Capsule (Serial No. 292577)
01dB CAL 21 Acoustic Calibrator (Serial No. 34675320)

Measurement Position 2

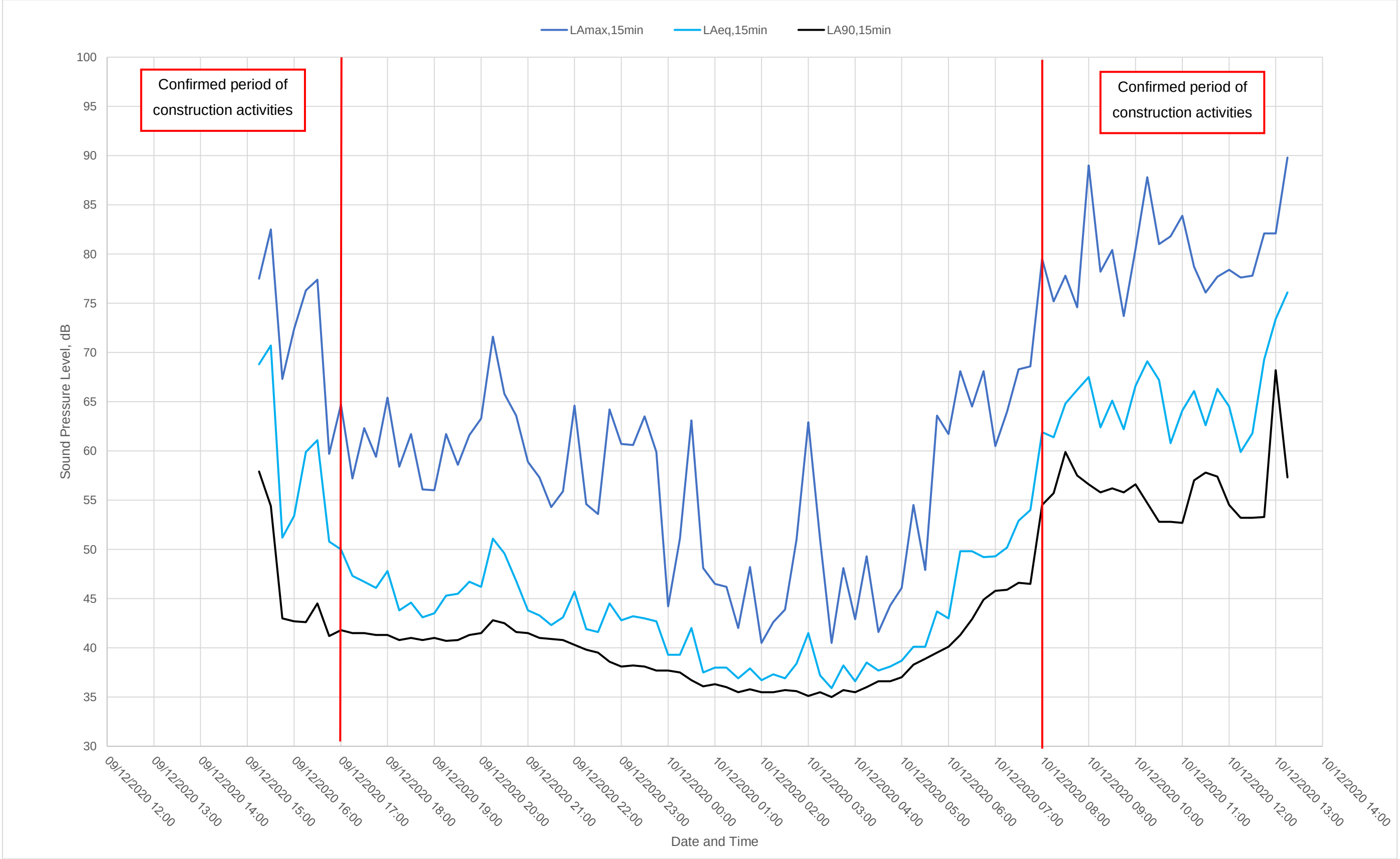
01dB Cube Sound Level Meter (Serial No. 12070)
01dB Pre22 Microphone Preamplifier (Serial No. 1915040)
GRAS 40CD Microphone Capsule (Serial No. 288057)
01dB CAL 21 Acoustic Calibrator (Serial No. 34675320)

METHODOLOGY

Before and after the measurements the sound level meters were checked and calibrated to an accuracy of ± 0.3 dB using the 01dB CAL 21 Calibrator. The calibrator produces a sound pressure level of 94dB re 2x10⁻⁵ Pa @ 1kHz.

MEASUREMENT RESULTS

Graph A1 summarise the results obtained at Measurement Position 1.



Graph A1: Measurement Position 1, 9 to 10 December 2020

APPENDIX B HTM 08-01 INTERNAL SOUND INSULATION PERFORMANCE REQUIREMENTS

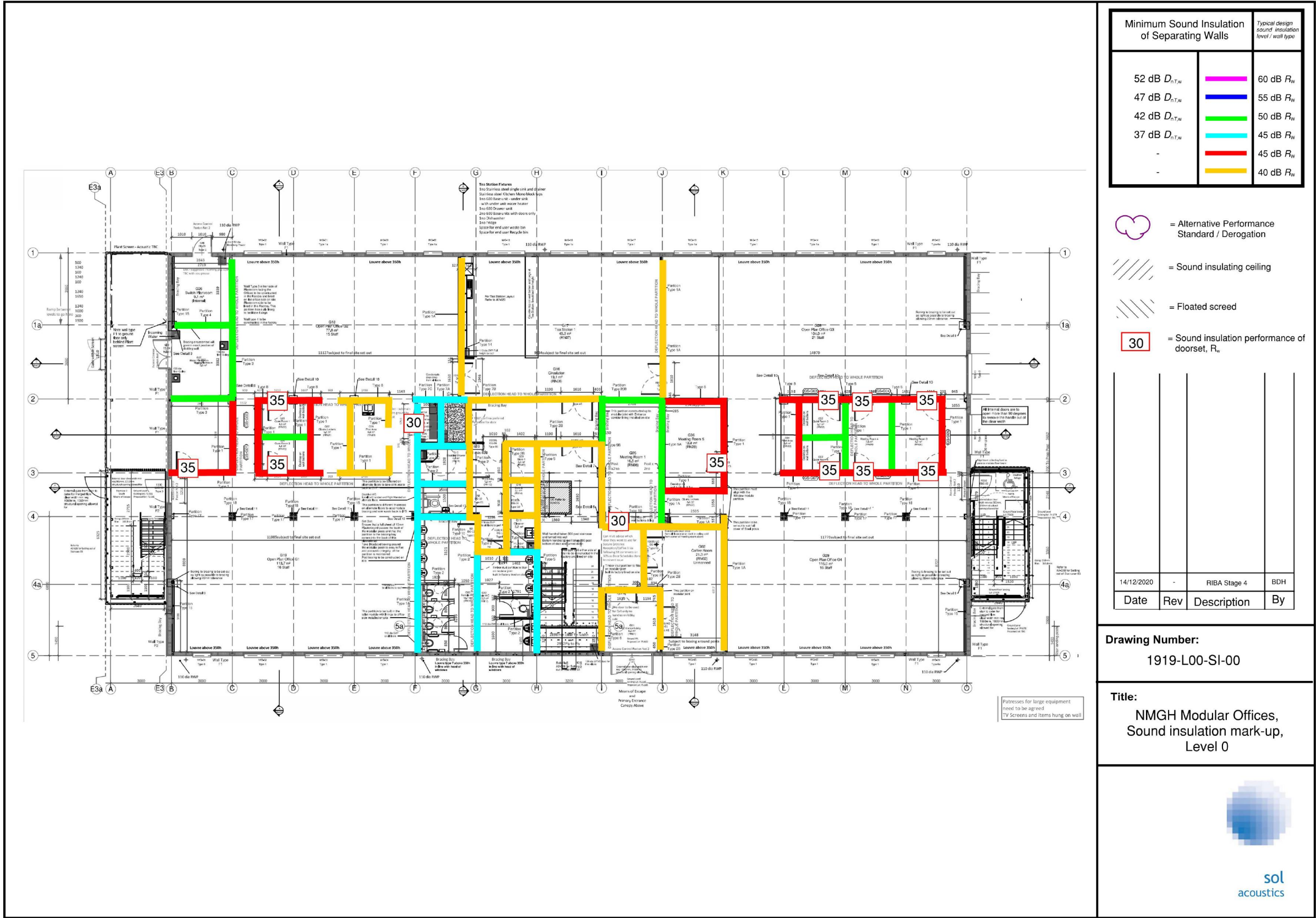


Figure B1: Ground Floor Sound Insulation mark-up

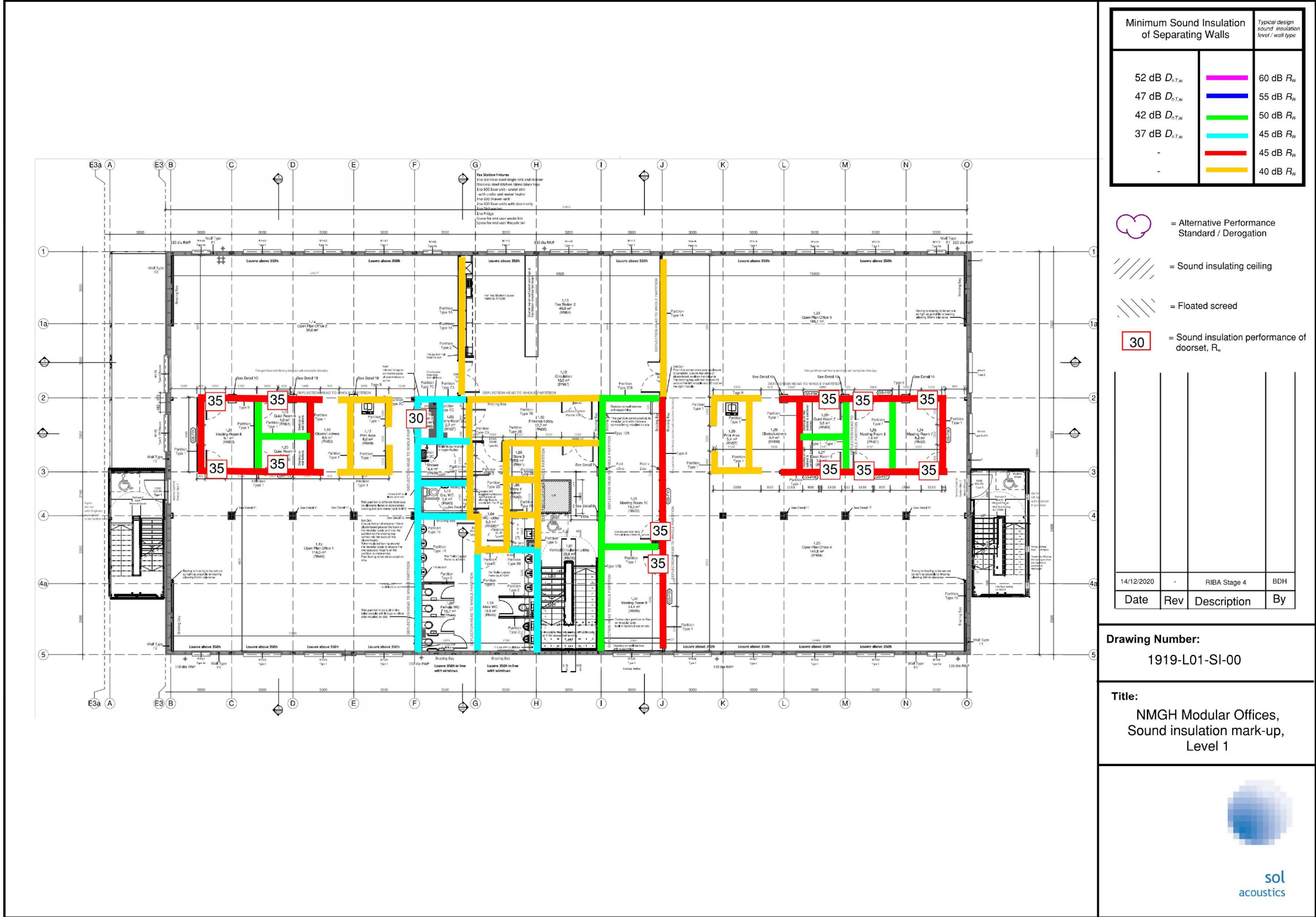


Figure B2: First and upper floor Sound Insulation mark-up

APPENDIX C DUCT/PIPE PENETRATION DETAILING

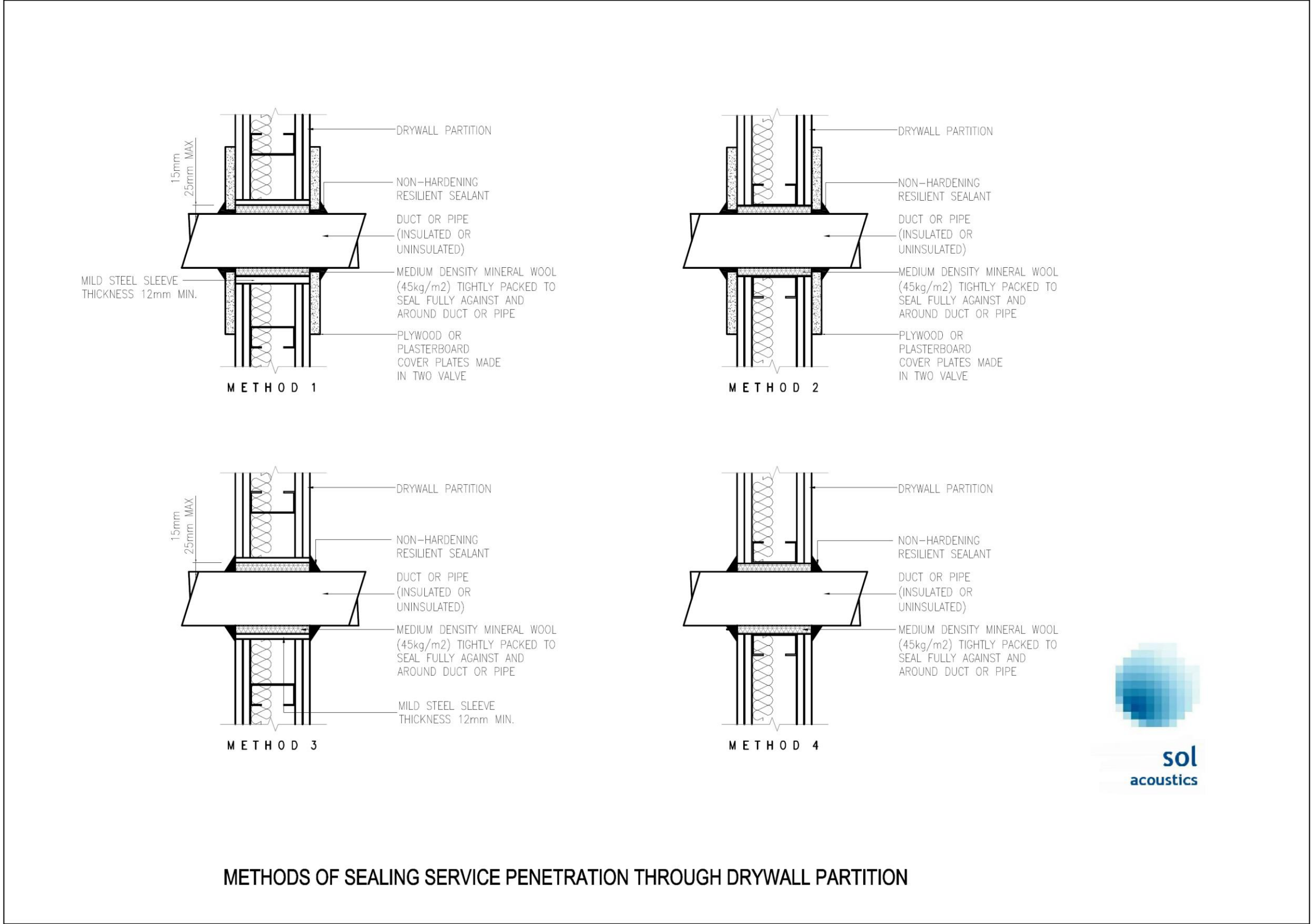


Figure C1: First and upper floor Sound Insulation mark-up