



Gym Noise Impact Assessment

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Client Address: 2nd Floor, 3 Hardman Square, Manchester, M3 3EB

Site Address: 9 Round Studio, Madison House, Little Peter Street, M15 4QJ

Date: 25/08/2021



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Executive summary

This report has been prepared to assess the level of noise impact from a boxing gym ('the Proposed Development') at Ground Floor of Madison House, Little Peter Street, Manchester, M15 4QJ. The assessment has identified the following mitigation measures that should be implemented:

Noise Breakout Assessment

- Glazed and non-glazed elements of the façade have been specified to assist in achieving inaudibility at the closest sensitive receptor.
- An amplified music limit level has been prescribed.
- A distributed and zonal sound system is required to provide an evenly distributed music level.

Airborne Noise Breakthrough

- The airborne sound insulation requirements of the adjoining wall and floor have been specified to assist in achieving inaudibility in the closest adjoining sensitive receptor.
- A double door entrance system with forced door closers should be installed to avoid noise egress whilst people are entering and exiting.
- Additional acoustic detailing has been provided in to assist the designer.

Structure Borne Noise Breakthrough

- To ensure structure borne noise breaking through from the development and re-radiating within the NSR cannot be sufficiently suppressed considering the flooring systems tested on site. This is a strong indication that either the partition and surrounding structure must be significantly upgraded in terms of sound insulation and isolation from the proposed boxing gym, or a free-weights area should not be included as part of the Proposed Development. If a free-weights section is vital to the Proposed Development, then it is advised to seek professional advice from a specialist who may be able to test the suitability of a sprung concrete floor or helical spring system.

Plant Noise Assessment

- All external plant associated with the development should not exceed the cumulative plant rating level of 37.0 dBA at the closest NSR.
 - Once all plant equipment, location and orientation has been defined, a suitably qualified person should assess all noise emissions to ensure the plant limit level is not exceeded.
- All plant should be fitted on appropriate anti-vibrational mounts.

The report has presented acoustic design proposals that should achieve compliance with the proposed acoustic criteria, subject to the implementation of the advice provided within and a high standard of workmanship. It is important to note that, as with any construction project, the ability to meet the specification will rely upon the quality of the built structure. As such the works should be carried out to a high standard of workmanship to ensure that any sound insulation measures are not breached. The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise impact assessment for a proposed boxing gym ('the Proposed Development') at Ground Floor of Madison House, Little Peter Street, Manchester, M15 4QJ ('the Site').

The applicant is preparing a planning application to be submitted ('the Application') to Manchester City Council.

The following technical noise assessment has been prepared to support the planning application to Manchester City Council. This report details an assessment of;

- Amplified music noise breakout of the proposed development,
- Airborne noise breakthrough to adjoining structure,
- Structure borne noise breakthrough to adjoining structure,
- Any noise emissions associated with fixed plant.

Based on the level of noise impact expected, where required, a series of sound insulation and noise control measures are outlined within the report to reduce the likelihood of impact and to protect the amenity of the closest sensitive receptors.

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

Scope & Objectives

The scope of the noise assessment can be summarized as follows:

- Baseline sound monitoring survey to evaluate the prevailing ambient and background sound levels at the closest noise sensitive receptor to the proposed development.
- Airborne and structure borne testing of the suitability of the existing structure of the building separating the proposed development and the closest sensitive receptor.
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2021), Noise Policy Statement for England (2010), British Standard BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound' and British Standard BS8233:2014 – 'Guidance on Sound Insulation and Noise Reduction for Buildings'. Further information on the legislation can be found in Appendix B.

Proposed Use

The proposed fit-out will provide a main gym floor space which will be used for exercise classes that include the use of boxing bags and free-weights. Amplified music will be played throughout the space. The proposed operational hours of the gym are 06:00 to 20:00 Monday to Sunday.

The proposed layout is shown in Figure 1.0 below.

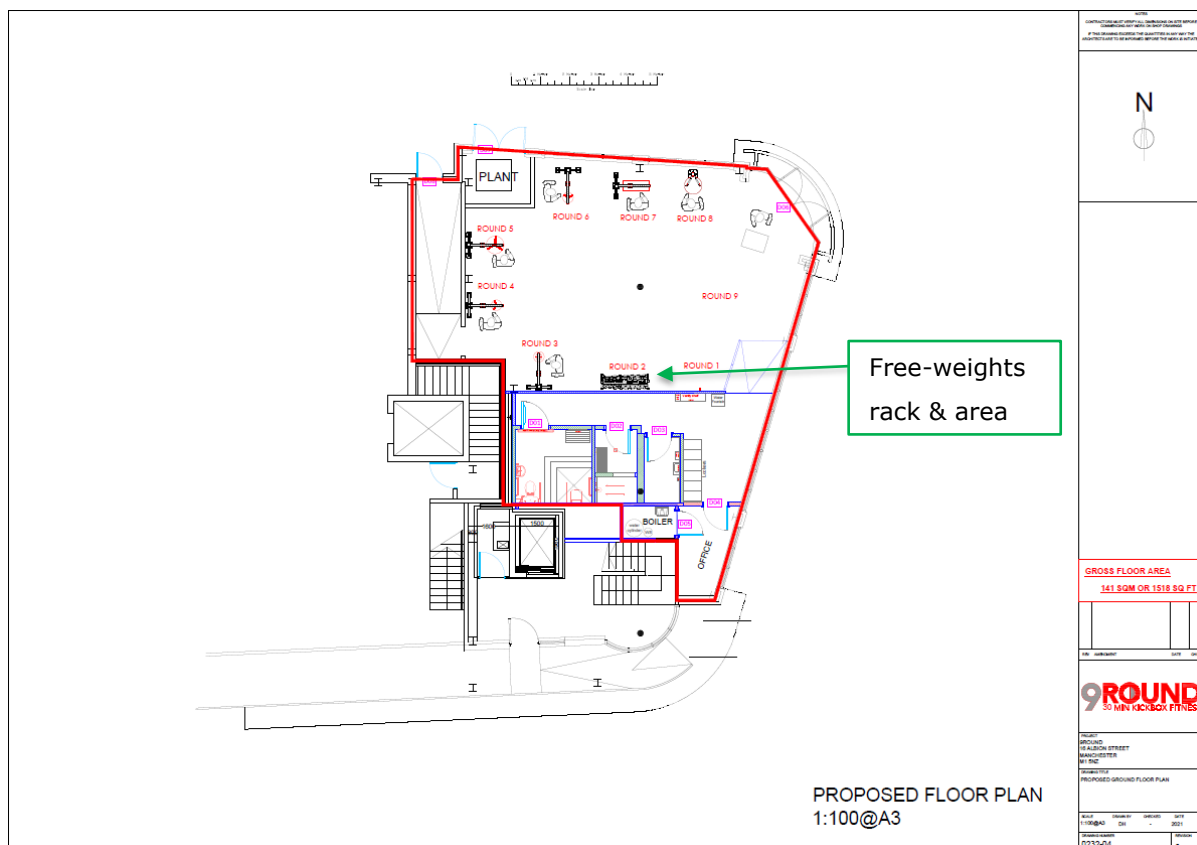


Figure 1.0 – Internal layout

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, an environmental sound survey has been carried out from 13/08/2021 to 16/08/2021. For the long-term sound monitoring, a sound level meter was located on a lamppost with the microphone approximately 3.5m above the ground. The monitoring positions were chosen in order to collect representative sound levels at the proposed development during the day and night. The monitoring locations are shown in Figure 2.0.

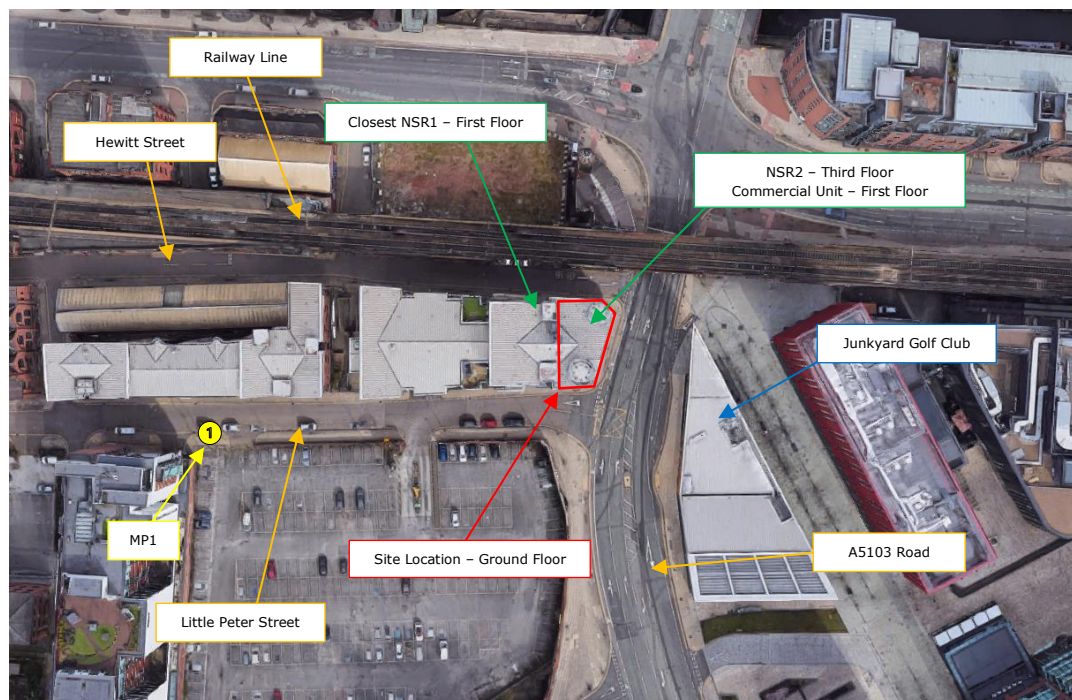


Figure 2.0 – Indicative Site Layout – Aerial View

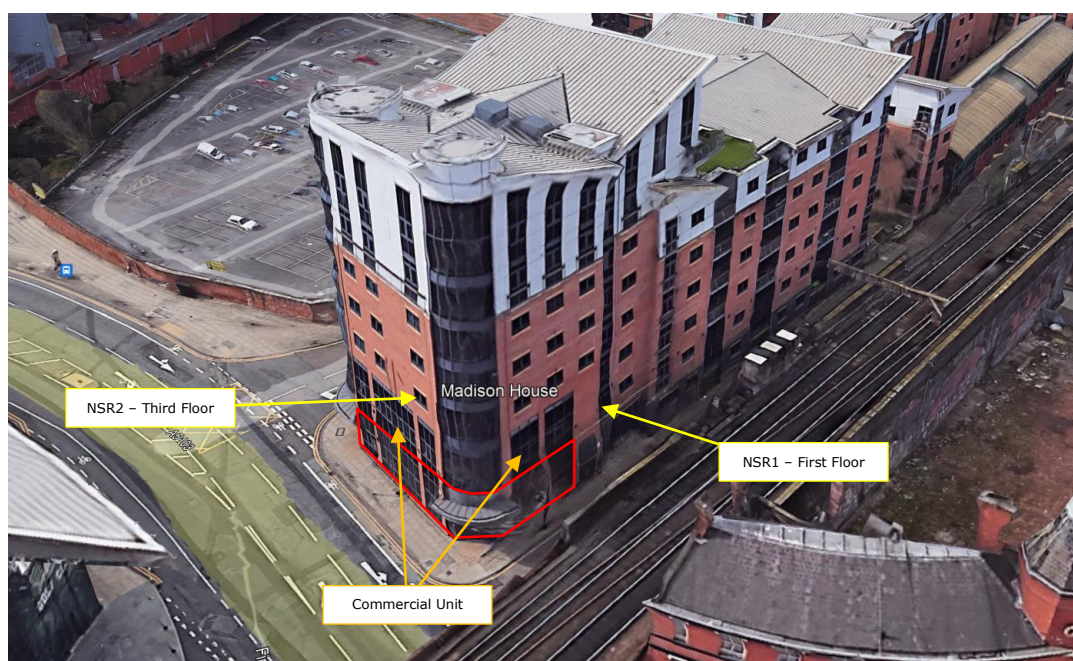


Figure 3.0 – Indicative Site Layout – 3D View

Context & Subjective Impression

The Proposed Development is located on the ground floor of Madison House, Little Peter Street, Manchester, M15 4QJ. The area surrounding the site is mixed in nature with both residential dwellings and commercial properties. The acoustic environment is deemed to be moderate to high in level and the noise profile is dominated by road traffic noise emissions from the surrounding road networks.

A residential flat is located on the first floor of Madison House, it is not directly above the Proposed Development, but it shares an adjoining wall and due to its close proximity to the Proposed Development, it is considered the closest Noise-Sensitive Receptor (NSR(1)). The closest NSR directly above the Proposed Development is located on the third floor (NSR2). It is assumed that if 'Negligible - Low Impact' can be achieved at these two NSRs then the same can be achieved at NSRs located further from the proposed Development. Additionally, there is a commercial unit on the first floor directly above the Proposed Development, which is considered a less sensitive receptor but shall still be assessed during typical working hours of 09:00 to 17:00.

Environmental Noise Survey Results

The following tables outline the background sound levels measured during the most sensitive operational hours of the proposed development that will be used in the subsequent assessments (06:00 to 07:00 hours and 09:00 to 17:00 hours). A full summary of all results can be found in Appendix D.

Measurement Position MP1							
Measurement Period ('t')	Octave Band $L_{90,t}$ (Hz, dB)						
	63	125	250	500	1k	2k	4k
Lowest $L_{90,1hr}$: 06:00 – 07:00	50.0	46.0	48.0	44.0	43.0	38.0	26.0
Lowest $L_{90,t}$: 09:00 – 17:00	55.0	51.0	51.0	49.0	49.0	43.0	34.0

Table 1.0 – Octave Band Background Sound Levels – Most Sensitive Operational Hours

It is assumed that any fixed plant servicing the Proposed Development may operate from 06:00 hours, therefore, the following table presents the background sound levels measured during the most sensitive operational period that will be used for the BS4142:2014 plant noise assessment. It is thought that if 'Low Impact' in accordance with BS4142:2014 can be achieved during the night, then it will also be achieved during the daytime when prevailing background sound levels are typically higher.

Measurement Position MP1				
Measurement Period ('t')	$L_{A90,15min}$	*SMR $L_{A90,15min}$	Min. $L_{A90,15min}$	Max. $L_{A90,15min}$
Night 1: 06:00 – 07:00	48.0	47.0	47.0	48.0
Day 3: 09:00 – 17:00	55.0	52.0	49.0	54.0

Table 2.0 – Background Sound Level Summary Results – Most Sensitive operational Hours

**Statistically Most Repeated*

As can be seen in the table above the statistically most repeated $L_{A90,15min}$ value is 47.0 dB during the night time period. The range of measured background sound levels is relatively low and the SMR sits at the bottom of this range, as such, the statistically most repeated $L_{A90,15min}$ value is deemed 'robust' and will be used in the subsequent BS4142:2014 assessment.

The table above also shows that the statistically most repeated $L_{A90,15min}$ value is 52.0 dB during the day time period. The range of measured background sound levels is relatively low and the SMR sits in the centre of this range, as such, the statistically most repeated $L_{A90,15min}$ value is deemed 'typical' and will be used in the subsequent assessments.

3. Noise Breakout Assessment

The following table shows the predicted level of amplified noise breaking out of the Proposed Development. This has been calculated based on the glazing being the weakest element of the façade in terms of sound reduction. A -6.0 dB correction has been applied to account for the difference between internal reverberant conditions and external non-reverberant conditions. The predicted noise levels at the worst affected NSR are based on a specified amplified music limit level and compared with the lowest measured background sound levels in the tables below. To provide additional consideration for the low frequency nature of music the assessment includes the 63Hz frequency band.

Noise Breakout Assessment – Commercial Unit

Description	Octave Band $L_{eq,t}$ (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Level (L_1)	75.0	73.0	78.0	80.0	80.0	78.0	74.0	85.0
Sound Reduction of 8mm Laminate Glass (R_w)	18.0	20.0	25.0	32.0	35.0	34.0	42.0	--
Façade Noise Level ($L_1 - R_w - 6$)	51.0	47.0	47.0	42.0	39.0	38.0	26.0	--
Distance Correction (2m)	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	--
Noise Level at Commercial Unit	45.0	41.0	41.0	36.0	33.0	32.0	20.0	39.0
Background Sound Level ($L_{90,t}$) - (09:00 – 17:00 hours)	55.0	51.0	51.0	49.0	49.0	43.0	34.0	52.0
Exceedance of Background Sound Level	-10.0	-10.0	-10.0	-13.0	-16.0	-11.0	-14.0	-13.0

Table 3.0 – Amplified Noise Breakout Assessment – Commercial Unit

Noise Breakout Assessment - NSR2

Description	Octave Band $L_{eq,t}$ (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Level (L_1)	75.0	73.0	78.0	80.0	80.0	78.0	74.0	85.0
Sound Reduction of 8mm Laminate Glass (R_w)	18.0	20.0	25.0	32.0	35.0	34.0	42.0	--
Façade Noise Level ($L_1 - R_w - 6$)	51.0	47.0	47.0	42.0	39.0	38.0	26.0	--
Distance Correction (6.5m)	-16.0	-16.0	-16.0	-16.0	-16.0	-16.0	-16.0	--
Noise Level at worst affected NSR(2)	35.0	30.0	31.0	26.0	23.0	22.0	10.0	29.0
Background Sound Level ($L_{90,t}$) - (06:00 – 07:00 hours)	50.0	46.0	48.0	44.0	43.0	38.0	26.0	47.0
Exceedance of Background Sound Level	-15.0	-16.0	-17.0	-18.0	-20.0	-16.0	-16.0	-18.0

Table 4.0 – Amplified Noise Breakout Assessment – NSR2

Discussion

The Good Practice guide on the Control of Noise from Pubs and Clubs comments that where entertainment noise takes place on a regular basis, music and associated sources should be inaudible within noise-sensitive properties at any time. For the purpose of this assessment inaudibility is considered 10.0 dB below the measured background sound level (L_{90}) in each octave band.

As can be seen in the assessment above, the octave band sound levels at the worst affect NSRs are predicted to be at least 10.0 dB below the lowest measured background sound levels in each octave band, which constitutes inaudibility and indicates 'No Observed Effect Level' (NOEL) when assessed in accordance with the NPSE and NPPF.

The noise breakout assessment has been conducted based on the existing 8mm laminate glazing, and should the music limit level be adhered too, no upgrades to the glazing are required. Should this glazing configuration differ, the amplified noise breaking out of the Proposed Development must be reassessed.

4. Airborne Noise Breakthrough Assessment

The proposed development is situated, adjacent to a residential dwelling and directly below a commercial unit. Consequently, there is the potential for the amplified music noise breaking through the adjoining wall and floor to adversely impact the occupants.

Adjoining Wall to Residential Dwelling

The following section analyses the predicted level of noise breakthrough from the proposed development compared with the internal noise level criteria presented within BS8233:2014. Where octave band sound levels have been assessed these have been compared to the appropriate Noise Rating Curve (NR Curve). To ensure 'virtual inaudibility' can be achieved, it is important to ensure a stringent criterion is applied to the low frequency bands. The music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) will be assessed so as not to exceed (in habitable rooms) 47.0 dB and 41.0 dB (L_{eq}), respectively, further details of the legislation are shown in appendix B5.

The proposed development is to operate between the hours of 06:00 to 20:00 Monday to Sunday, thus the noise levels have been assessed against the more stringent night-time criteria (06:00 – 07:00).

The predicted noise levels associated with the proposed development are based on the music limit level shown in the preceding section. The assessment below outlines the minimum sound reduction required of the adjoining wall.

Description	Octave Band $L_{eq,t}$ (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Level	75.0	73.0	78.0	80.0	80.0	78.0	74.0	85.0
NR25 Curve (dB)	47.0*	41.0*	35.2	29.2	25.0	21.9	19.5	30.0
Min. Required Sound Reduction (R_w)	28.0	32.0	43.0	51.0	55.0	57.0	55.0	55.0

Table 5.0 – Noise Breakthrough Minimum Sound Reduction of Adjoining Wall

****Moorhouse Curve Criteria***

Based on observations taken during the site visit, the level of sound insulation provided by the adjoining wall has been predicted using INSUL 9.0 Sound Insulation Prediction Software. The existing construction detail is as follows:

- 100mm Concrete Blockwork (assumed min. density of 1800 kg/m³)

The following table compares the predicted airborne sound insulation to the required minimum sound reduction of the adjoining wall .

Measurement Period ('t')	Octave Band $L_{eq,t}$ (Hz, dB)							Minimum $D_{nT,w} + C_{tr}$
	63	125	250	500	1k	2k	4k	
Predicted Airborne Sound Reduction (R_w)	33.0	36.0	34.0	37.0	45.0	52.0	57.0	38.0
Min. Required Sound Reduction (R_w)	28.0	32.0	43.0	51.0	55.0	57.0	55.0	55.0
Additional Sound Reduction Required	0.0	0.0	9.0	14.0	10.0	5.0	0.0	17.0

Table 6.0 – Noise Breakthrough Assessment of Adjoining Wall

Discussion

The assessment above indicates that additional sound reduction is required of the adjoining wall in order to achieve the appropriate residential internal noise levels. Proposed upgrades to the adjoining wall can be found in Section 7.0 of this report.

Adjoining Floor to Commercial Unit

The following section analyses the predicted level of noise breakthrough from the proposed development compared with the internal noise level criteria presented within BS8233:2014.

As of yet, the commercial activity above the Proposed Development has not been specified a Class Usage, therefore, the internal ambient noise levels for the most sensitive of commercial developments; executive offices, have been used. It is stated in the 'British Council for Offices' document that internal ambient noise levels should not be more than the NR35 Curve given in Annex B of BS8233:2014 when measured in terms of $L_{eq,T}$ – where T is the duration of the normal working day, typically 8-hours between 09:00 to 17:00.

The predicted noise levels associated with the proposed development are based on the music limit level shown in the preceding section. The assessment below outlines the minimum sound reduction required of the adjoining floor.

Description	Octave Band $L_{eq,t}$ (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Level	75.0	73.0	78.0	80.0	80.0	78.0	74.0	85.0
NR35 Curve (dB)	63.1	52.4	44.5	38.9	35.0	32.0	29.8	40.0
Min. Required Sound Reduction (R_w)	12.0	21.0	34.0	42.0	45.0	46.0	45.0	45.0

Table 7.0 – Noise Breakthrough Minimum Sound Reduction of Adjoining Floor

Based on observations taken during the site visit, the level of sound insulation provided by the adjoining floor has been predicted using INSUL 9.0 Sound Insulation Prediction Software. The existing construction detail is as follows:

- 200mm Cast In-Situ Concrete (assumed min. density of 1800 kg/m³)

The following table compares the predicted airborne sound insulation to the required minimum sound reduction of the adjoining wall .

Measurement Period ('t')	Octave Band $L_{eq,t}$ (Hz, dB)							Minimum $D_{nT,w} + C_{tr}$
	63	125	250	500	1k	2k	4k	
Predicted Airborne Sound Reduction (R_w)	36.0	36.0	36.0	44.0	52.0	58.0	63.0	42.0
Min. Required Sound Reduction (R_w)	12.0	21.0	34.0	42.0	45.0	46.0	45.0	45.0
Additional Sound Reduction Required	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 8.0 – Noise Breakthrough Assessment of Adjoining Floor

Discussion

The assessment above indicates that the existing concrete floor provides sufficient sound reduction in order to achieve the appropriate internal noise levels.

5. Structure Borne Noise Assessment

The proposed development is situated adjacent to a residential dwelling and below a commercial unit. Consequently, there is the potential for structure borne noise breaking into and being re-radiated from the adjoining wall and floor to adversely impact the occupants. Weight drop testing has been conducted in order to characterise the structure borne sound insulation of the separating structures between the proposed development and closest noise sensitive receptors. One measurement location was directly above the free-weights area in the commercial unit, and the second was in the hallway adjacent to NSR1 in the residential flats on the first floor. It is assumed that should negligible or low impact be achieved for NSR1 and the commercial unit, then negligible or low impact can be achieved for those receptors (NSR2) further from the Proposed Development.

The following section analyses the level of structure borne noise from the proposed development based on a sample of different gym acoustic flooring products. The $L_{\max, \text{weightdrop}}$ with each acoustic floor build up will be compared to the appropriate Noise Rating Curve. Information of the test procedure can be found in Appendix E.

The following acoustic gym flooring products have been tested:

- MuteMat Gym 32
- MuteMat Gym 51
- MuteMat Gym 70
- MuteMat Gym 70 + MuteMat USP 625-17

The figures below shows the following results:

- Figure 3.0. shows the 1/1 octave $L_{\max, \text{weightdrop}}$ measured in the commercial unit above the Proposed gym compared to the NR35 noise rating curve.
- Figure 4.0 shows the 1/1 octave $L_{\max, \text{weightdrop}}$ measured in the first floor hallway adjacent to the closest residential dwelling (NSR1) compared to the NR25 noise rating curve.

Discussion

The assessment within the commercial indicates that the only flooring system capable of achieving the appropriate internal noise levels (NR35) is the MuteMat Gym 70 + MuteMat USP 625-17. All other systems have marginally exceeded that 125Hz frequency band.

However, the assessment within the first-floor hallway adjacent to the closest residential dwelling, indicates that none of the flooring systems are capable of achieving the appropriate internal noise levels (NR25). This is a strong indication that either the partition and surrounding structure must be significantly upgraded in terms of sound insulation and isolation from the proposed boxing gym, or a free-weights area should not be included as part of the Proposed Development.

If a free-weights section is vital to the Proposed Development, then it is advised to seek professional advice from a specialist who may be able to test the suitability of a sprung concrete floor or helical spring system. Further details can be found in Section 7.0 of this report.

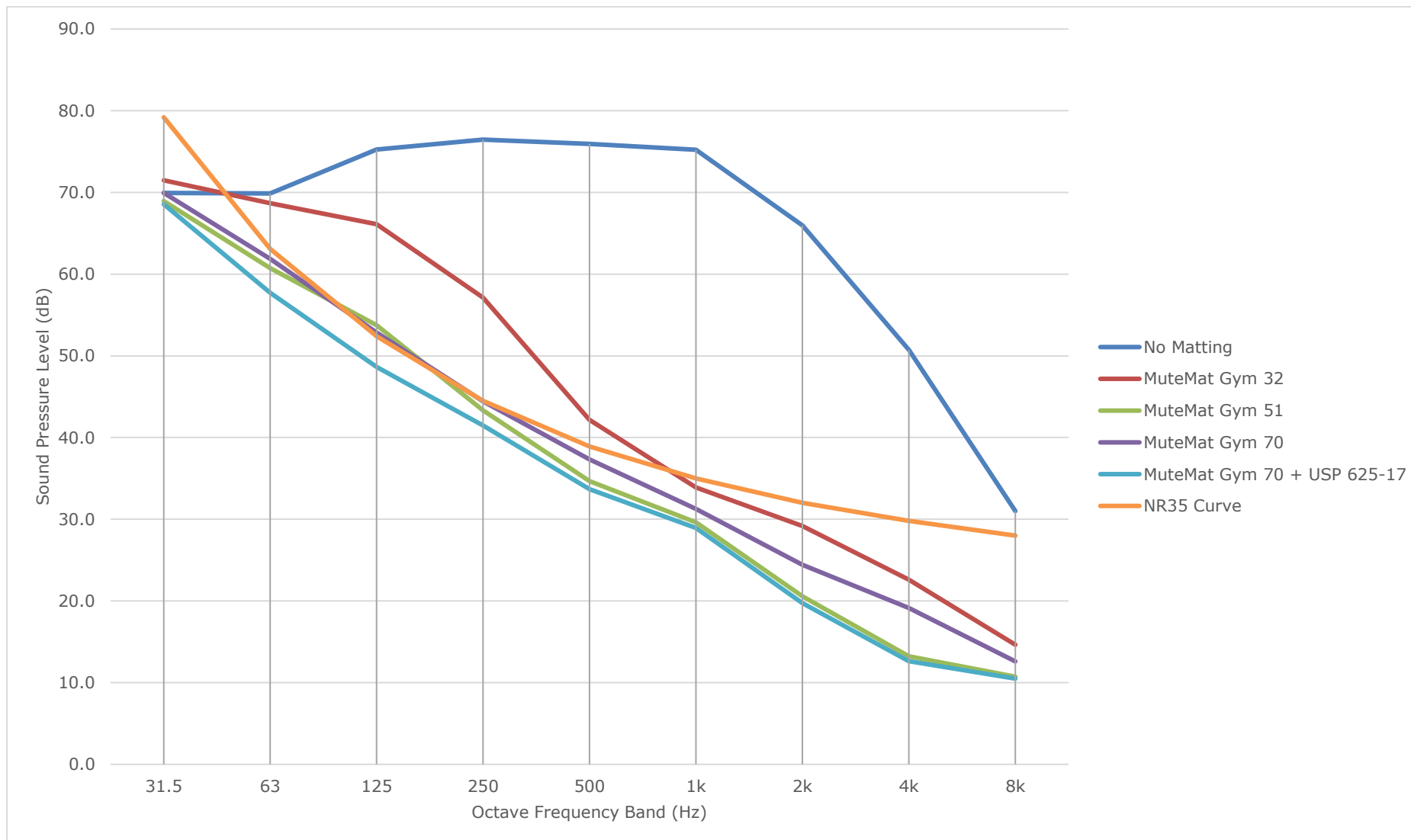


Figure 4.0 – Weight Drop Testing Results Compared to NR35 Curve

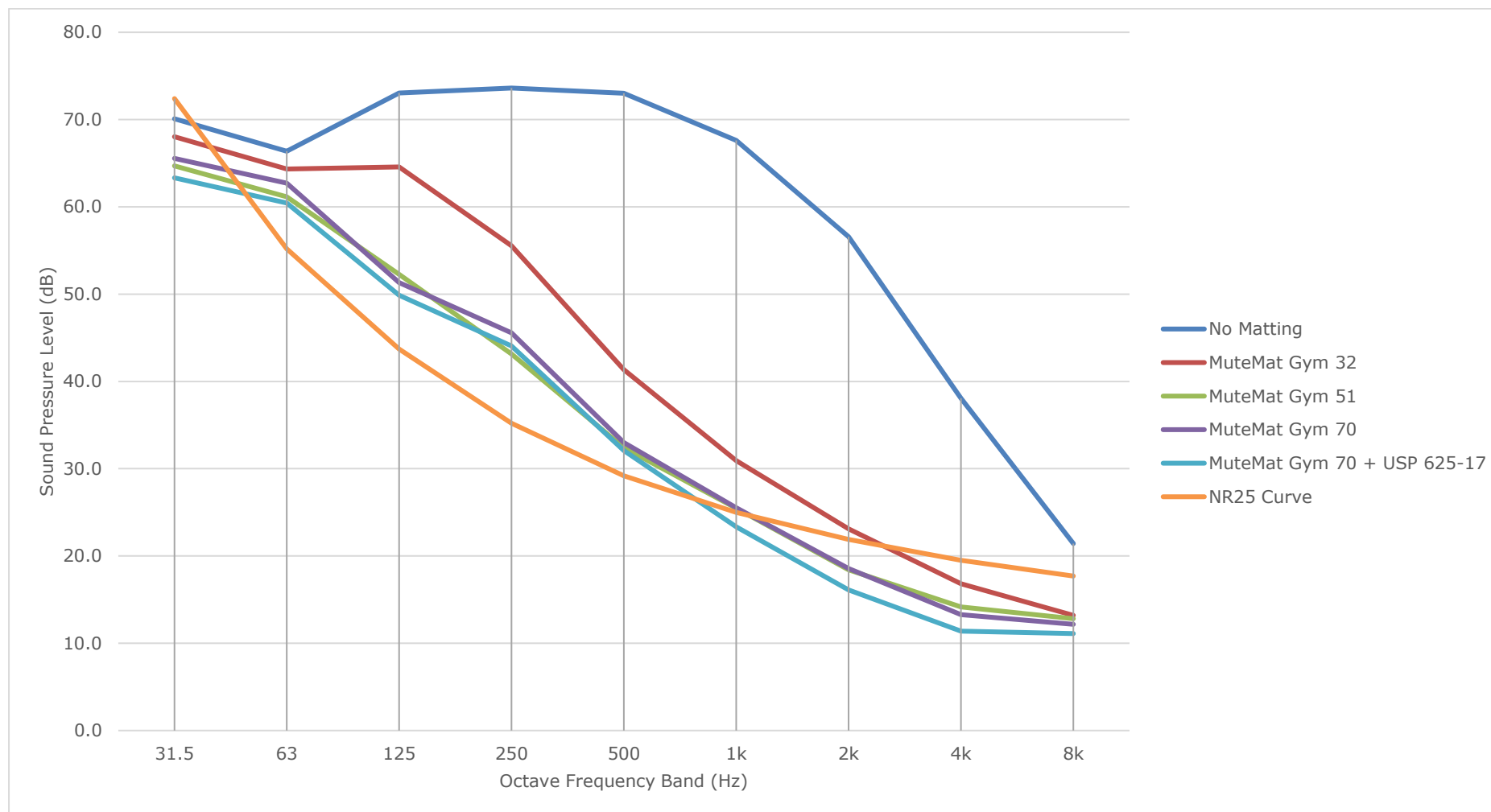


Figure 5.0 – Weight Drop Testing Results Compared to the NR25 Curve

6. BS4142:2014 Plant Noise Assessment

The following section of the report analyses the impact of any external fixed plant that may be installed on site.

Cumulative Plant Rating Noise Limit Level

In this section of the report, a plant noise limit level for any external plant will be set based on the measured background levels at the site. The specification and exact locations of all external plant have not yet been defined, consequently, a cumulative plant noise limit level has been provided to ensure all plant noise emissions fall significantly below the background sound level at the surrounding NSRs.

The table below shows the cumulative plant noise limit level at the NSRs. The plant rating limit level has been defined to ensure that all external plant noise falls below the lowest measured background sound level, as stated in Section 6.2 of the "Supplementary Planning Document – Adopted 2009 – Local Development Framework", it also has taken into account the addition of a rating penalty for a possible tonal component to the sound spectrum of the plant. This is shown in the table below.

Description	Value (dB)
SMR Background Sound Level ($L_{A90,15min}$)	47.0
Cumulative Plant Rating Noise Limit Level at NSR ($L_{AR,Tr}$)	37.0
Exceedance of Background Sound Level	-10.0

Table 9.0 – External Plant Limit Level

Discussion

As can be seen in the assessment above, provided the Cumulative Plant Rating Noise Limit Level is adhered to, all noise emissions for said plant will fall 10.0 below the SMR $L_{A90,15min}$ background sound level. This indicates 'Negligible Impact' when assessed in accordance with BS4142:2014 and 'No Observed Effect Level' (NOEL) when assessed in accordance with the NPSE and NPPF.

Given the outcome of the assessment, no further mitigation measures are required.

Recommendations & Mitigation

The following section outlines the mitigation measures that are necessary to reduce the impact any external fixed plant that may be installed.

- All mechanical plant associated with the development should not exceed the cumulative plant noise limit level of **37.0 dBA** at the closest NSR.
- All mechanical plant should be fitted on appropriate anti-vibrational mounts.
- Once all plant has been specified a suitably qualified person assess all emissions and plant locations to ensure the cumulative plant limit level can be achieved.

7. Sound Insulation Scheme & Noise Control Measures

The following section outlines the required sound insulation scheme and noise control measures that should be installed at the proposed development to protect the closest sensitive receptors. The mitigation measures should be installed prior to occupation and be retained thereafter.

Noise Breakout Mitigation

The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels. The facade construction for lightweight or heavyweight constructions will provide ample levels of sound insulation, for the purposes of this report it is assumed the facade provides a minimum sound reduction of 50.0 dB R_w . The following section provides a sound insulation scheme based on the glazed elements of the facade, as well as noise control measures to reduce the impact from amplified music. It is noted that it is assumed that heating and cooling will be provided by an air conditioning system and thus there will be no requirement for ventilation systems to penetrate the facade and compromise the sound insulation. Further to this windows will not be open during operations.

a) Glazing Specification

The noise breakout assessment has been conducted based on the existing glazing, and should the music limit level be adhered too, no upgrades to the glazing are required. The following table outlines the minimum sound reduction of the 8mm laminated glass currently installed, should this glazing configuration differ, the noise breaking out of the Proposed Development must be reassessed. Should different glazing be installed for any reason, it is required to provide the minimum octave band sound reduction shown in the following table.

Glazing	Octave Band $L_{eq,t}$ (Hz, dB)						
	63	125	250	500	1k	2k	4k
Minimum Sound Reduction (R_w)	18.0	20.0	25.0	32.0	35.0	34.0	42.0
Existing Glazing (R_w)	Single Glazing: 8mm Laminated Glass						
	18.0	20.0	25.0	32.0	35.0	34.0	42.0

Table 10.0 – Minimum Glazing Sound Reduction

The glazing 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.

b) Entrances and Exits

People entering and existing the gym whilst it is operating presents the risk for amplified music noise to emanate from the building through the doorway. A double door entrance system with forced door closers should be installed to avoid noise egress whilst people are entering and exiting.

c) Amplified Music Limiting Device

Automated volume controls capable of limiting noise at specific frequencies to prevent significant low frequency music should be implemented at the site. The following maximum amplified music limit level should be set as shown in the following table.

Z-weighted Octave Band Sound Pressure Level (Hz, dB)							
63	125	250	500	1k	2k	4k	Overall (dBA)
79.0	78.0	80.0	80.0	80.0	80.0	75.0	85.0

Table 11.0 – Maximum Amplified Music Limit Level

d) Distributed PA System

To minimize the internal sound level required to achieve a uniform and distributed noise level within the gym, a distributed and zonal PA system should be installed. This will allow the gym to have full control of the maximum noise level. The speakers should be mounted as low as feasible to bring the speakers closer to the users and thus allow the overall noise level to be reduced, whilst retaining a feeling of loudness. A distributed sound system involves installing a higher quantity of speakers all emitting a lower level, this method takes advantage of the proximity of the listener to the speaker thus reducing the noise emissions of the gym. The speakers should be focused on the main operational area of the gym and not located near to and directed away from entrances and exits. All speakers should be installed on appropriate anti-vibrational mounts.

Airborne Noise Breakthrough Mitigation – Adjoining Wall to Residential

To ensure the airborne noise breaking through the adjoining wall is sufficiently suppressed the following sound insulation upgrades should be implemented at the site, any other construction capable of providing the attenuation outlined in Section 4.0 will be suitable.

Proposed Separating Wall Construction Detail								
- Existing 100mm Concrete Blockwork (min. density of 1800 kg/m³) - Min. 25mm Air Cavity - Either 70mm 'C' Steel Independent Studwork or 100mm Timber Independent Studwork; both lined with 50mm RW45 RockWool Slab Insulation (min. density of 45 kg/m³), - 2 No. Gyproc SoundBloc Plasterboards (min. density of 12.6 kg/m²)								
Description	63	125	250	500	1k	2k	4k	R_w
Expected Sound Reduction (R_w)	36.0	54.0	64.0	79.0	87.0	92.0	100.0	64.0

Table 12.0 – Adjoining Wall Specification

Airborne Noise Breakthrough Mitigation – Adjoining Floor to Commercial

Although the noise breakthrough assessment has indicated that the existing floor construction provides the minimum required sound reduction, it is good practice to install the following sound insulation upgrades at the site.

Proposed Separating Floor Construction Detail								
- Existing 150mm In-Situ Concrete Floor (min. density of 1800 kg/m³) - Gyproc Acoustic Hangers (affixed to concrete floor) - Min. 150mm MF Suspended Ceiling lined with 50mm Mineral Wool Insulation (min. density of 10 kg/m³) - 1 No. 12.5 Gyproc SoundBloc Plasterboard (min. density of 12.6 kg/m²)								
Description	63	125	250	500	1k	2k	4k	R_w
Expected Sound Reduction (R_w)	33.0	50.0	50.0	58.0	65.0	70.0	87.0	54.0

Table 13.0 – Adjoining Floor Specification

Curtain Walled Glazing

Where any curtain wall glazing traverses the party floor there is potential for excessive sound transference. The detailing surrounding the curtain wall glazing and party floor junction will require further review to ensure this area does not present a weak point for sound transference.

Structure Borne Noise Breakthrough Mitigation

To ensure structure borne noise breaking through from the development and re-radiating within the NSR cannot be sufficiently suppressed considering the flooring systems tested on site.

This is a strong indication that either the partition and surrounding structure must be significantly upgraded in terms of sound insulation and isolation from the proposed boxing gym, or a free-weights area should not be included as part of the Proposed Development.

If a free-weights section is vital to the Proposed Development, then it is advised to seek professional advice from a specialist who may be able to test the suitability of a sprung concrete floor or helical spring system. The premise is to minimise the vibration transmitted into the building and often requires a platform that will likely comprise of a floating 100mm dense concrete slab on a helical spring system which can provide the adequate deflection based on the weight being dropped. A resilient rubber covering will be required above the slab to avoid degradation.

Please note that the testing and audibility of weight drops is based upon the dropping of a 24kg kettlebell. It is assumed that weights that are heavier than these could and will likely be audible in the closest sensitive receptor. Therefore, it is required that a standard policy be implemented that it is not permitted to unreasonably drop free weights from any height. This should be closely managed via onsite staff, CCTV monitoring and with signage in appropriate areas and as such should be a rare event.

Plant Noise Mitigation

The following section outlines the mitigation measures that are necessary to reduce the impact any external fixed plant that may be installed.

- All mechanical plant associated with the development should not exceed the cumulative plant noise limit level of **37.0 dBA** at the closest NSR.
- All mechanical plant should be fitted on appropriate anti-vibrational mounts.

- Once all plant has been specified a suitably qualified person assess all emissions and plant locations to ensure the cumulative plant limit level can be achieved.
- The make, model and location of the external unit should not be altered. If alterations to the specification and location of the units are required further assessment should be undertaken.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
L _{eq,T}	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
L _{max,T}	A noise level index defined as the maximum noise level during the period T. L _{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L _{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L _{90,T}	A noise level index. The noise level exceeded for 90% of the time over the period T. L ₉₀ can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L _{10,T}	A noise level index. The noise level exceeded for 10% of the time over the period T. L ₁₀ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the

time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} .

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms.

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2019. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 185 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;*
- Mitigate and minimise adverse impacts on health and quality of life;*
- Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 `Guidance on sound insulation and noise reduction for buildings`

The British Standard BS 8233: 2014, Guidance on Sound insulation and noise reduction for buildings provides additional guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, WHO Guidelines on Community Noise, 1999. The criteria desirable levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 14.0 – BS8233 Internal Noise Level Criteria

It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

The standard also recommends that for traditional external amenity areas, such as gardens, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, and that 55 dB $L_{Aeq,T}$ would be acceptable in noisier environments. However, it is recognised that these values may not be achievable in all areas where development is desirable and in such locations, development should be designed to achieve the lowest practicable levels.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the LOAEL as defined in the NPSE above.

B.4 – British Standard BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound

Overview

BS4142:2014 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142:2014 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142:2014 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features

are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

- a) subjective method;
- b) objective method for tonality;
- c) reference method."

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) *Tonality*

A rating penalty of +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) *Impulsivity*

A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

c) *Other Sound Characteristics*

BS4142:2014 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."

d) *Intermittency*

BS4142:2014 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time ... if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."

Background Sound Level

The background sound level is the underlying level of sound over a period, T , and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply

select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142:2014 states: "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". An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- "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 negligible impact, depending on the context."

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound 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 sound level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact and would therefore classified as a No Observed Adverse Effect Level.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

B.5 – Entertainment & Leisure Noise Legislation

Noise from entertainment and leisure venues, e.g. noise from recorded music, live bands, gyms or karaoke, can be particularly annoying for residents and business if it is not adequately contained within the venue. When considering the potential impact of a proposal for an entertainment premises or residential near to entertainment premises a consideration for the overall noise level (L_{Aeq}) and the 63Hz and 125Hz octave band noise levels. Music noise in the 63Hz and 125Hz octave bands, which is described as 'bass noise' is particularly difficult to contain and the impulsive and non-steady character of low frequency music noise is particularly disturbing for residents exposed to it.

A lively city centre bar can operate around 95 dB L_{Aeq} and nightclubs can be even higher at 105 dB L_{Aeq} . The range of level of 63Hz and 125Hz octave bands is wider than the a-weighted levels and can be up to 115 dB L_{eq} and 110 dB L_{eq} respectively (Davies et al 2005).

There is a lack of consensus on an assessment method for noise levels within habitable rooms regarding entertainment noise. The design aim should be to design to 'inaudible'*. The building structure is therefore key, and will usually involve a high performing solution in either the music venue or residential premises. Existing noise standards/criteria are not appropriate for evaluating low frequency noise; in almost all other situations the established noise descriptors are based on the A-weighted sound level (dBA) which effectively filters out low frequency sound (Moorhouse et al 2011).

**Noise is considered to be inaudible when it is at a sufficiently low level such that it is not recognizable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question. The DEFRA report 'Noise from Pubs and Clubs – Phase 1', which, on page 17 reproduces the Institute of Acoustics (IOA) working group guidance to achieve music noise levels which are 'virtually inaudible' inside a residential property.*

When dealing with noise control, especially at the lower frequencies it is usual to look at the octave band data as a Z-weighting (linear) and not the A-weighting, due in main to the amount you have to 'take off', resulting in meaningless data (-26.2dB at 63Hz) and also with respect to the sound insulation performance of various construction materials. Rather than just A-weighted levels being assessed e.g. internal noise levels as per BS8233:2014; a low frequency band analysis should be carried out (McCullough et al 2004).

In the 'Procedure for the assessment of low frequency noise complaints – Revision 1', Moorhouse et al (2011) use limits for low frequency noise levels in 1/3 octave bands between 10Hz and 160Hz. For the assessment of low frequency music noise, it is more practical to consider the 63Hz and 125 Hz octave bands. The Noise Council's Code of Practice on 'Environmental Noise Control at Concerts' suggests limits on both these octave bands. The DEFRA report 'Noise from Pubs and Clubs – Phase 1' suggests limits on 1/3 octave bands. However, the problem with this suggestion, and one of the reasons it is not widely used, is due to the difficulty in obtaining 1/3 octave band sound insulation performance data for various construction materials. With regards to assessing music noise at the 63 Hz and 125 Hz octave band levels a good correlation is shown between the NR 15 curve and Moorhouse curve at low frequencies. See Figure 6.0.

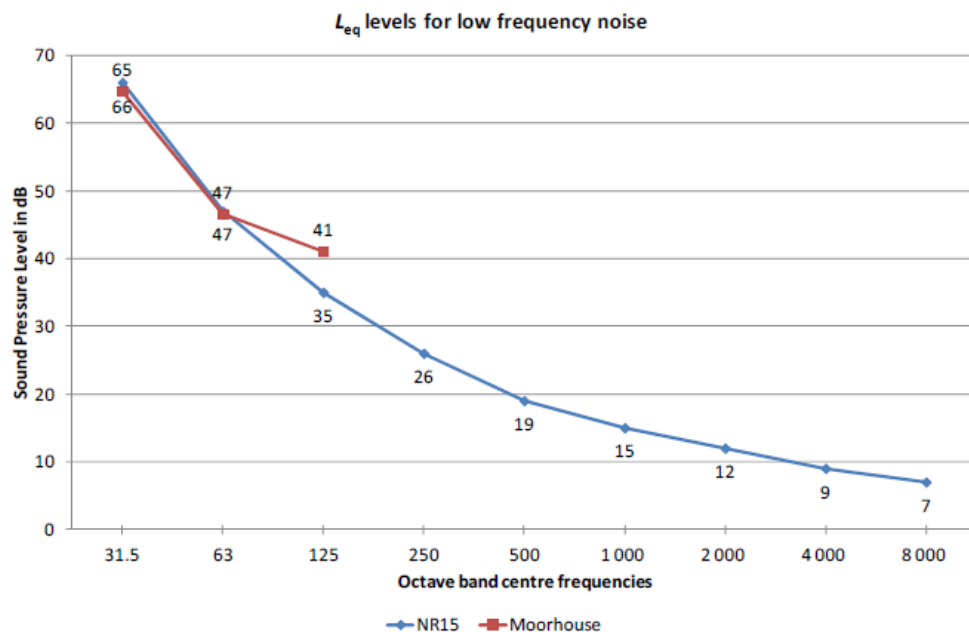


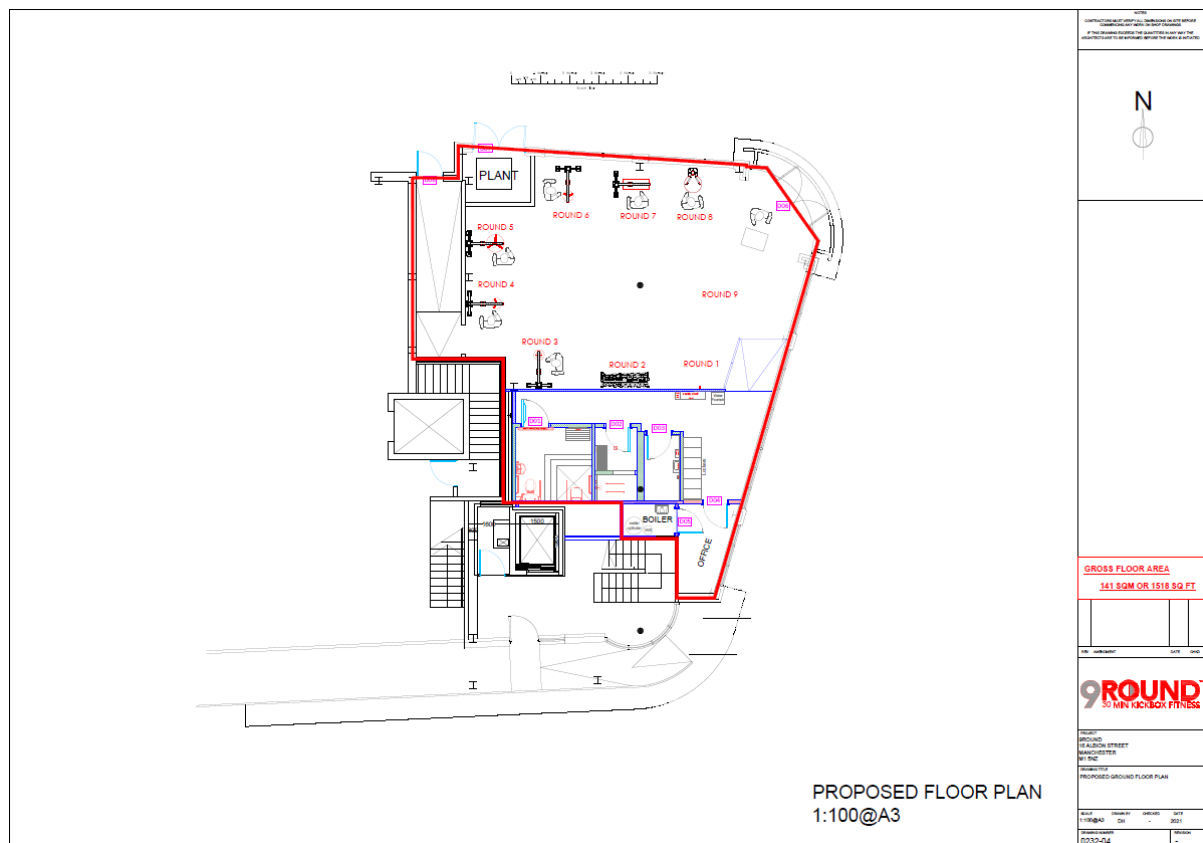
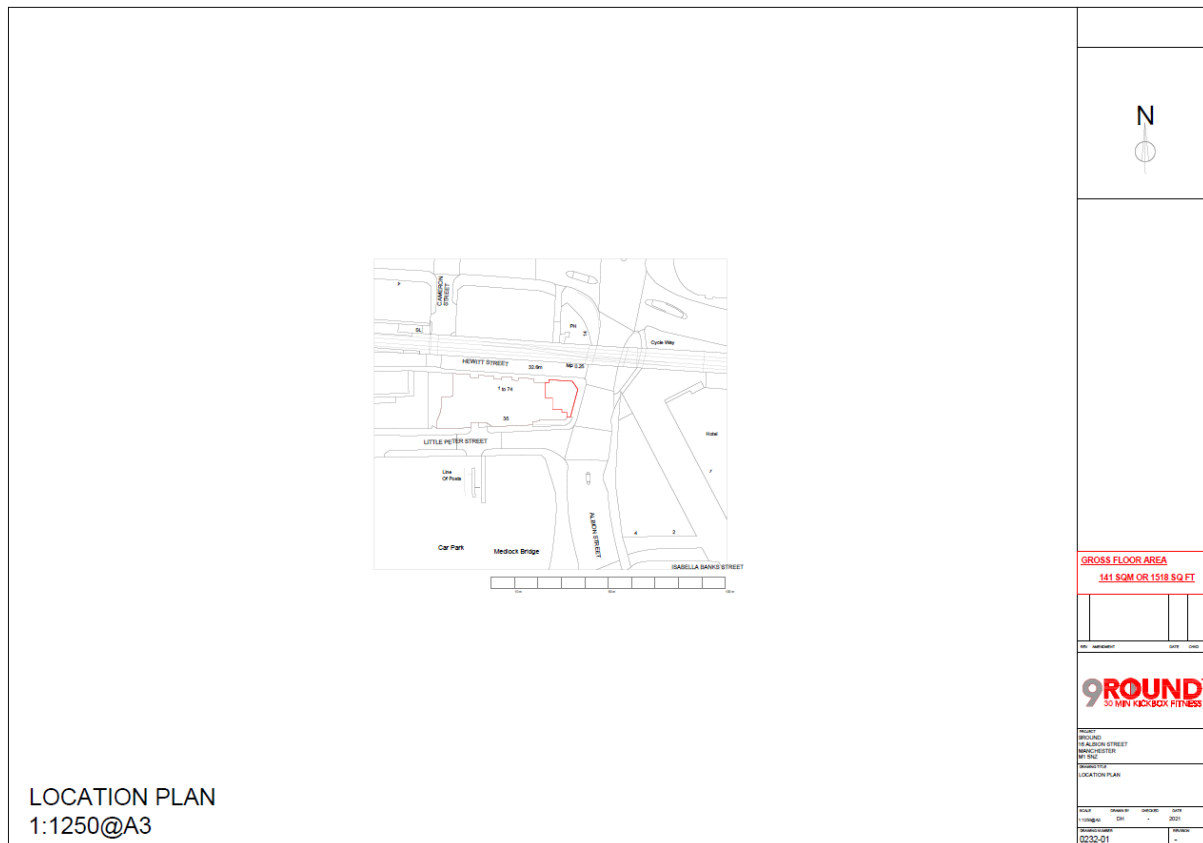
Figure 6.0 – Moorhouse Low Frequency Noise Rating Curve

However, The NR curve may be too stringent at mid and higher frequencies and may be lower than background noise levels in habitable spaces. Further, the NR curve is most commonly used to set limits for mechanical services noise in buildings i.e. steady, continuous noise sources. Music noise has distinctive characteristics and as such can be described as unsteady and non-continuous in comparison. Even though the Moorhouse curve does not specifically relate to entertainment noise (as per the caveat in the revised edition) these levels provide a good practical basis to assess low frequency music noise. They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces. Therefore, a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be: *'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}), respectively'*. This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue.

References:

- i) Institute of Acoustics (2002) – Good practice guide on the control of noise from pubs and clubs – Draft Annex 2.
- ii) McCullough et al (2004) A practical evaluation of objective noise criteria used for the assessment of disturbance due to entertainment music
- iii) Moorhouse et al (2005) Proposed criteria for the assessment of low frequency noise disturbance, Defra (updated in 2008 and 2011)

Appendix C – Site Plans



Appendix D – Environmental Survey

D.1 – Tabulated Summary Noise Data

Sensitive Operational Period Background Sound Level Summary							
Measurement Period ('t')	Octave Band L _{90,t} (Hz, dB)						
	63	125	250	500	1k	2k	4k
Night 1: 06:00 – 07:00	50.0	47.0	48.0	45.0	45.0	38.0	26.0
Night 2: 06:00 – 07:00	49.0	46.0	49.0	44.0	43.0	38.0	30.0
Night 3: 06:00 – 07:00	55.0	51.0	50.0	48.0	48.0	43.0	34.0
Measurement Period ('t')	L _{A90,15min}		SMR L _{A90,15min}		Min L _{A90,15min}		Max L _{A90,15min}
Night 1: 06:00 – 07:00	48.0		47.0		47.0		48.0
Night 2: 06:00 – 07:00	47.0		47.0		47.0		48.0
Night 3: 06:00 – 07:00	54.0		49.0		49.0		54.0
Full Background Sound Level Summary							
Measurement Period ('t')	Octave Band L _{90,t} (Hz, dB)						
	63	125	250	500	1k	2k	4k
Day 1 – 13/08/21: 11:15 – 23:00	64.0	58.0	56.0	56.0	55.0	51.0	45.0
Night 1 - 13/08/21: 23:00 – 07:00	57.0	51.0	52.0	50.0	49.0	44.0	36.0
Day 2 - 14/08/21: 07:00 – 23:00	61.0	54.0	54.0	52.0	52.0	48.0	42.0
Night 2 - 14/08/21: 23:00 – 07:00	55.0	51.0	52.0	50.0	49.0	45.0	39.0
Day 3 - 15/08/21: 07:00 – 23:00	57.0	52.0	53.0	49.0	49.0	45.0	38.0
Night 3 - 15/08/21: 23:00 – 07:00	58.0	53.0	52.0	50.0	49.0	45.0	39.0
Measurement Time Period ('t')	L _{A90,15min}		SMR L _{A90,15min}		Min L _{A90,15min}		Max L _{A90,15min}
Day 1 – 13/08/21: 11:15 – 23:00	59.0		55.0		54.0		60.0
Night 1 - 13/08/21: 23:00 – 07:00	53.0		49.0		46.0		54.0
Day 2 - 14/08/21: 07:00 – 23:00	53.0		54.0		48.0		55.0
Night 2 - 14/08/21: 23:00 – 07:00	53.0		47.0		47.0		53.0
Day 3 - 15/08/21: 07:00 – 23:00	53.0		52.0		47.0		55.0
Night 3 - 15/08/21: 23:00 – 07:00	53.0		47.0		46.0		54.0

Table 15.0 – Sound Survey Summary Results

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound level meter	T244498	≤0.5
CESVA CB006 Class 1 Calibrator	901910	
CESVA SC420 Class 1 Sound level meter	T246421	≤0.5
CESVA CB006 Class 1 Calibrator	901911	

Table 16.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. 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.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localized records of weather conditions were taken. However, during the set up and collection of the monitoring equipment the weather conditions have been documented in the following table. All measurements have been compared with met office weather data of the area, specifically the closest weather station, 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 – Northenden Road, Sale (Approx. 7.3km SW of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
13/08/21: 00:00 – 23:59	13.4 – 21.4	0.0	SSE	0.0 – 0.9
14/08/21: 00:00 – 23:59	14.7 – 17.3	0.0	ENE	0.0
15/08/21: 00:00 – 23:59*	13.0 – 18.0	0.0	W	0.0 – 6.1
16/08/21: 00:00 – 23:59	14.4 – 17.3	0.0	W	0.0 – 1.3

Table 17.0 – Weather Summary

*Weather data obtained from a weather station at Manchester Airport as no data was recorded at the weather station in Sale.

Appendix E – Test Methods

E.1 – Weight Drop Testing

Samples of isolation matting were placed directly on the floor in a minimum of 3 No. locations. A 24Kg kettlebell is dropped onto the samples of impact isolation matting from a standardized height of 0.7m whilst the resultant noise level was measured in the adjoining premises. To ensure the testing is deemed robust the test locations are chosen based on proximity to the adjoining receptor and flanking constructions, such as concrete pillars. This was undertaken to ensure that if the gymnasium layout changes adequate acoustic mitigation has been provided.

It is understood that the free weights area will contain weight benches and racks for dumbbells. There will be no designated area for dropping weights. It is the standard policy of the gym that it is not permitted to unreasonably drop dumbbells from any height. This is closely managed via onsite staff, CCTV monitoring and with signage in appropriate areas and as such should be a rare event.