Noise Impact Assessment

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Executive Summary

Bruntwood is seeking to obtain full planning permission for the refurbishment of 38 Mosley Street, Manchester, to include the provision of new tenanted office space with ground floor and basement tenanted restaurant/bar use, as well as basement ancillary spaces including a gym. Replacement building services plant will be provided as part of the refurbishment, with the majority of plant emitting noise externally expected to be located at roof level where the existing plant is currently located.

A noise impact assessment has been undertaken to determine the key noise considerations and impacts associated with the proposals, with limits set for the development to achieve based on Manchester City Council (MCC) planning criteria.

To facilitate this assessment, a comprehensive noise survey has been undertaken between Monday 15th November and Thursday 18th November 2021 to establish and quantify the existing noise climate at, and in the vicinity of, the site and nearest noise sensitive receptors. Noise monitoring results confirm the site to be exposed to noise levels expected of an urban location, with elevated noise levels at the façade of the building overlooking the Metrolink tramlines.

Building services plant noise emission limits have been specified in accordance with MCC's standard planning criteria. All fixed plant shall be designed during the subsequent project stages to collectively achieve these limits. Emergency plant noise limits have also been proposed.

Noise break-out associated with the ground floor and basement restaurant/bar unit would be controlled by the sound insulation of the building fabric and is shielded from sensitive receptors by intervening buildings. Sufficient levels of sound insulation are assumed to be inherent in the building design and noise break out is not expected to give rise to disturbance to NSRs or future occupants of the development. Nonetheless, limits have been set for any entertainment noise based on MCC's standard entertainment noise criteria.

Based on the outcomes of the noise assessment, it is considered that impacts associated with the operation of the development can be controlled to an acceptable level and that the site should be considered suitable for the proposed development.

1. Introduction

This Noise Impact Assessment has been prepared by Hilson Moran Partnership Ltd on behalf of Bruntwood (hereafter referred to as 'the Applicant'). It accompanies a planning application to Manchester City Council (MCC) for the redevelopment of the existing office building at 38 Mosley Street, Manchester M2 3AZ.

This report presents the results of a baseline noise survey undertaken at the site, together with calculated noise emission limits applicable to building services noise emissions and breakout from restaurant/bar operation.

A glossary of the acoustic terminology used in this report is presented in Appendix A.

2. The Site, Site Setting and Proposed Development

2.1. Site Description

The site is located within the jurisdiction of Manchester City Council (MCC). A site location plan is provided as Figure 2.1, showing the location of the site and orientation with respect to other existing developments and the road network for the area.

The site has frontages onto Mosley Street to the south-east, West Mosley Street to the north-west, York Street to the north-east and the building shares a party wall with 57 Spring Gardens to the south-west. A regularly trafficked tramline runs along Mosley Street.

2.2. The Noise Climate

The noise climate in the area is dominated by noise from regularly passing trams (approximately one each way every 5 minutes during typical daytime hours) on the Metrolink tramlines on Mosley Street. Noise from plant units serving commercial properties surrounding the site, intermittent local road traffic on Mosley Street and more distant road traffic from the Manchester city centre road network also contribute to the noise climate at the site.

Noise monitoring results confirm the site to be exposed to typical noise levels for an urban location, albeit elevated noise levels at the façade of the building overlooking the Metrolink tramlines were observed.

2.3. Noise Sensitive Receptors

The surrounding area consists largely of commercial uses, although one residential building considered sensitive to noise has been identified within the vicinity of the site. The noise sensitive receptor (NSR) for assessment of impact from the development is detailed in Table 2.1 and the location is shown in Figure 2.1.

Table 2.1 Noise Sensitive Receptors

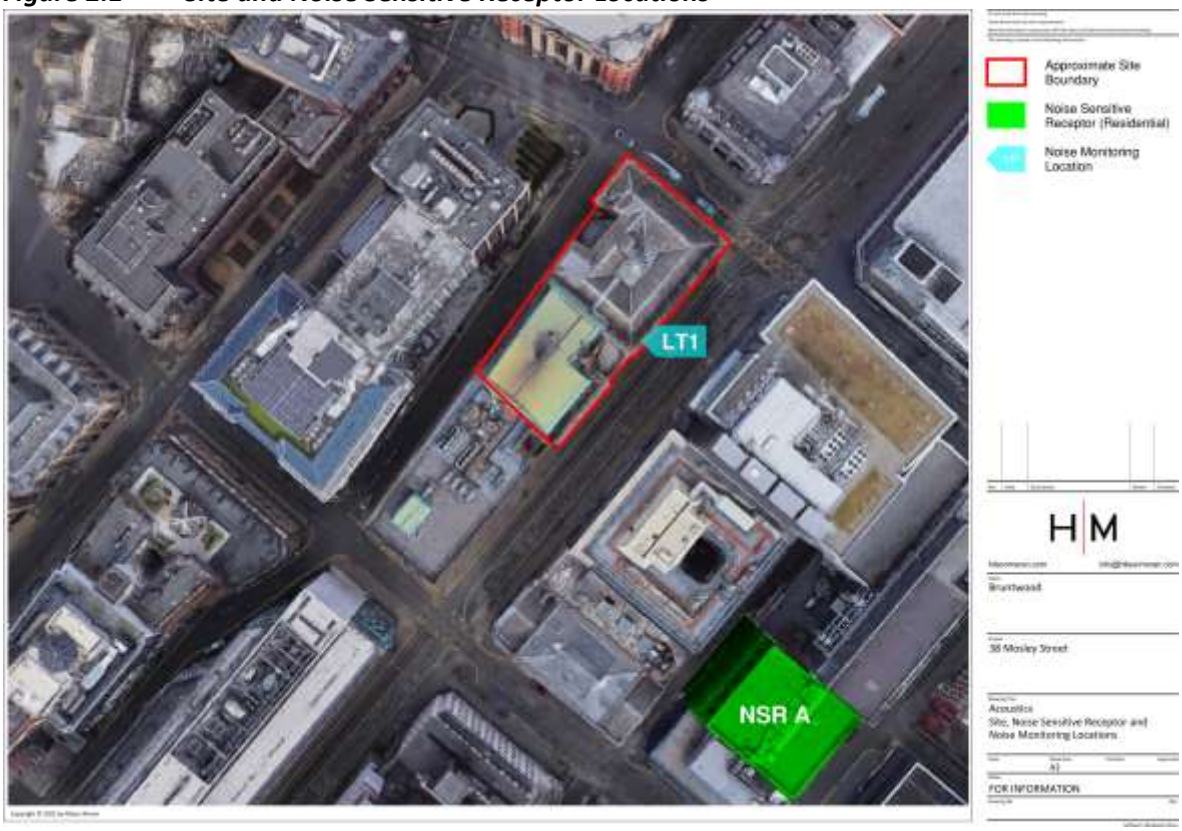
Receptor Location (Figure 2.1)	Name	Type of Receptor	Approximate Distance from Site Boundary
NSR A	Manhattan Apartments, 36 George Street	Residential	50 m to the south-east

2.4. Proposed Development

The proposed development comprises the refurbishment of the vacant 38 Mosley Street building to provide new tenanted office space with ground floor and basement tenanted restaurant/bar use, as well as basement ancillary spaces including a gym.

Replacement building services plant will be provided as part of the refurbishment, with the majority of plant emitting noise externally expected to be located at roof level where the existing plant is currently located.

Figure 2.1 Site and Noise Sensitive Receptor Locations



3. Planning Policy and Guidance

3.1. National Planning Policy

3.1.1. National Planning Policy Framework, 2019

The National Planning Policy Framework (NPPF)[1] for England was revised in June 2019. The NPPF, which is based on the principle of sustainable development, sets out nationally important issues and leaves other matters for determination by local councils and communities.

In relation to noise, the NPPF seeks to conserve and enhance the local environment, including preventing developments from contributing to, and/or, being put at an unacceptable risk from, noise pollution. In support of this, paragraph 185 of the NPPF states that:

"*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 impacts 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".

There is currently no specific guidance within England for the assessment of the suitability of a site for non-residential noise sensitive development.

3.2. Local Policy

3.2.1. MCC Planning & Noise Technical Guidance

3.2.1.1. Noise Emissions from External Plant

MCC's plant noise requirements are set out in the Planning & Noise Technical Guidance document[2]. The MCC plant noise requirements are provided below:

"*Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.*"

There is no specific reference to noise from emergency plant in the guidance, where often a relaxed noise limit may be considered acceptable.

[1] Department for Communities and Local Government (DCLG) (2019); '*The National Planning Policy Framework*', HMSO, London.
[2] Environmental Protection (2015); '*Planning & Noise Technical Guidance*', MCC.

3.2.1.2. Entertainment Noise

As well as plant noise, the Planning & Noise Technical Guidance document details specific requirements to achieve in terms of controlling entertainment noise, which will apply to the proposed ground and basement level restaurant/bar.

The MCC requirements state:

"*Entertainment noise (L_{Aeq}) should be controlled to 10dB below the background noise level (L_{A90}) without the entertainment noise present, in each octave band at the nearest noise sensitive location*".

4. Noise Impact Assessment Criteria

4.1. Building Services Plant Noise Emission

The significance of building services noise impacts depends upon a number of factors. These include:

- the absolute noise level;
- the nature of the noise;
- the time and duration at which the noise occurs;
- whether the noise is temporary, intermittent or permanent;
- whether the impact is as a result of a new source; and
- whether it is a change to an existing source and/or the sensitivity of the receptor.

At this stage in the design of the development, specific details of the type, number and configuration of new building services plant are not fixed. As a consequence, it is not possible to undertake predictions to determine whether standards might be met. Therefore, noise emission limits to which plant should adhere have been set, based on the results of the baseline noise survey (see Section 5) and MCC's plant noise criteria (see Section 3).

4.2. Noise Breakout from Use of Non-office Units

The significance of noise impacts associated with the ground and basement level restaurant/bar and basement gym space depends upon the type of tenants and the nature of noise sources, as these will dictate the sound insulation performance of the primary building fabric in controlling noise break-out.

The basement gym does not have any façades above ground level, meaning that any noise emitted would need to pass through the ground floor before escaping to the surrounding environment. Because of this, no noise impacts are expected at NSRs, and this use is not considered further in assessment.

Specific details of the end users of the restaurant/bar unit and operational times of the development are not known at this stage and would be dependent on the future tenants and licencing regulations. Details of the incoming tenant are not currently known, so an assessment of noise breakout from these uses cannot yet be undertaken. However, noise emission limits have been set for restaurant/bar tenants to achieve at the façades of NSRs so that noise breakout from these uses are in line with MCC requirements.

It should be noted that the nearest residential NSR is shielded from the ground floor restaurant/bar façade by intervening buildings, as well as considerable distance (50 m) and so negligible impacts are expected at this receptor.

5. Baseline Noise Conditions

Environmental noise surveys have been undertaken at the proposed development site to determine prevailing noise levels affecting the site and its surroundings.

5.1. Survey Strategy

Long-term unattended noise monitoring was carried out externally between Monday 15th November and Thursday 18th November 2021 at a key location described in Table 5.1 and illustrated in Figure 2.1. Monitoring was carried out over a 72-hour period. The purpose of the measurements was to establish and quantify the existing noise climate at and within the vicinity of the site.

Table 5.1 Noise Monitoring Locations

Monitoring Location (Figure 2.1)	Period	Description	Observations and Predominant Noise Sources
LT1	72 hours	Façade measurement at a position fronting Mosley Street. Microphone position on the 3rd floor roof overlooking the parapet.	Noise from regular trams (approximately one each way every 5 minutes), as well as regular, but not constant cars, buses, HGVs on Mosley Street. Plant noise from the surrounding buildings also contributes to the noise climate, as well as constant, distant road traffic from the Manchester road network.

All noise measurements were taken with calibrated precision grade (Class 1) frequency (one-third-octave band) sound level meters to provide a detailed description of the prevailing environmental noise characteristics. The sound level meters were set-up to record over consecutive 5-minute periods the L_{eq}, L_{90}, L_{10}, L_{max} and L_1 noise indices in the A-weighting network over a 125 ms fast response time constant interval for the duration of the survey. The indices are described in Appendix A, but roughly translated they describe in turn the average, background, road traffic, maximum noise level and typical maximum noise level discounting one-off events.

Full details of the instrumentation used for the noise measurements, including calibration certificates are available on request.

Weather conditions, whilst not actively measured during the survey period, were monitored remotely throughout. Weather conditions were generally ideal for the measurement of noise, it being fine and mostly dry, with just light westerly winds (<5 ms^{-1}) prevailing. The data during instances of rainfall and one instance of wind speed above 5 ms^{-1} (5.8 ms^{-1}) was checked to verify its suitability for use, with no data requiring removal from the dataset.

Due to the distance of NSR A away from the site and monitoring location, the background noise levels measured at position LT1 may not be fully representative of those at NSR A. Because of this, historical noise surveys undertaken at the location of NSR A have been reviewed against data captured at LT1. These documents are available on the Manchester City Council Planning Portal.

5.1.1. Noise Survey Results

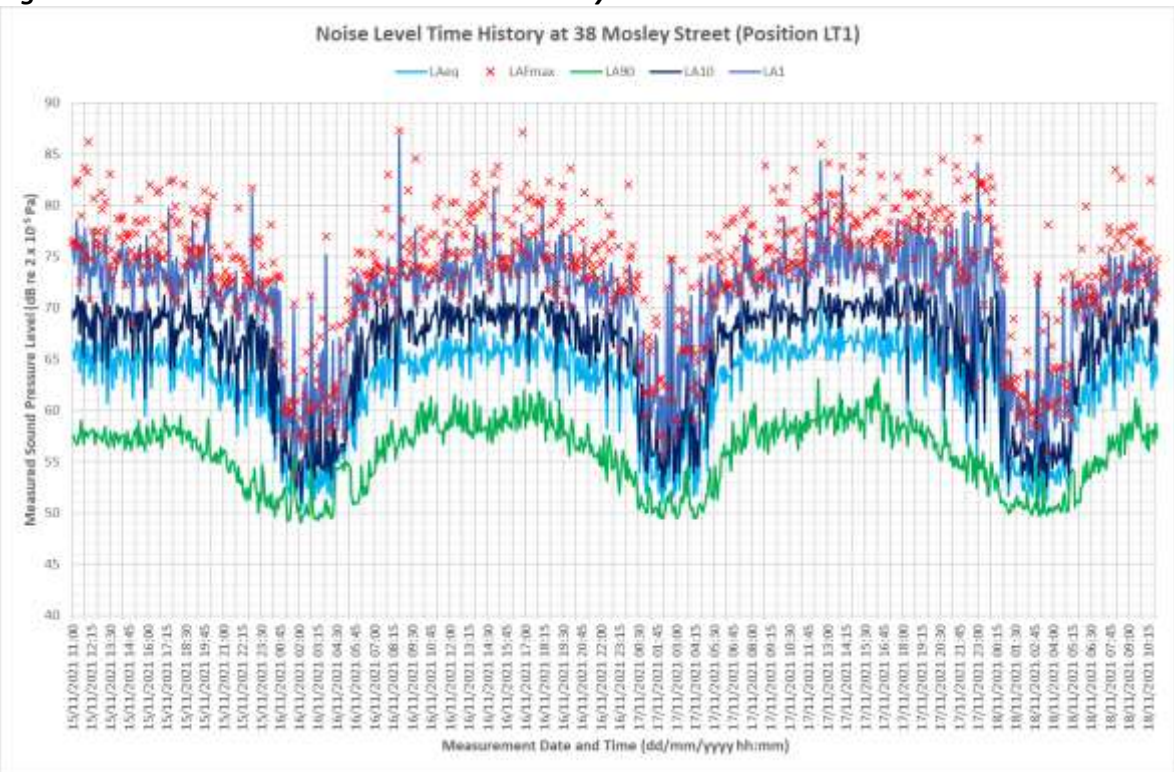
The full results of the long-term noise measurements are displayed graphically in time-history format in Figure 5.1, whilst a summary of the measured daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) noise levels for the survey period are provided in Table 5.2. Octave band background noise levels are provided in Appendix B, which are used to assess entertainment noise in line with MCC guidance.

Table 5.2 Summary of Baseline Noise Monitoring Results – Façade Values

Monitoring Location (Figure 2.1)	Period	Duration	$L_{Aeq,T}$ dB	$L_{A90,15min}$ dB		$L_{AFmax,5min}$ dB	$L_{A1,1hr}$
			Ave[1]	Min	Mode[2]	95%ile[3]	Max[4]
LT1	Day	16 hours	65	51	58	83	76
	Night	8 hours	60	49	50	78	72

Notes: [1] Logarithmic average over the day/night survey periods; [2] Lowest modal value over the day/night survey periods, considered to represent the typical background noise level; [3] The 95th percentile L_{AFmax} value presented is considered representative of typical L_{AFmax} levels experienced; [4] The arithmetic average of the maximum $L_{A1,1hr}$ values measured during each of the day/night survey periods. All figures rounded to nearest whole decibel.

Figure 5.1 Measured Noise Level Time History at Position LT1



5.1.1.1. Historical Noise Survey

As noted above, a historical noise survey undertaken at the location of NSR A has been reviewed to check whether the background noise levels measured at position LT1 are in line with the expected background noise levels at NSR A. An Environmental Noise Study (Report Ref: PR0547-REP01-MPF) was undertaken by Fisher Acoustics in February 2016 at the site of NSR A, for the application to convert the building into residential apartments (Planning Ref: 115207/FO/2017).

The measured background noise levels at the location nearest 38 Mosley Street (position 2 in the Fisher Acoustics report) were found to be between 51 and 60 dB L_{A90} during the daytime, and between 50 and 58 dB L_{A90} during the night-time. It can be seen that the background noise levels measured at position LT1 show good correlation with the level ranges measured at NSR A, as presented by Fisher Acoustics. It is therefore considered that the background noise levels at position LT1 can be used to set appropriate noise limits to be achieved at NSR A.

6. Noise Impact Assessment

6.1. Building Services Plant Noise Limits

Any items of fixed plant associated with the operation of the development would have the potential to generate noise. At this stage in the design of the development, specific details of the type, number and configuration of building services plant have not been fixed and therefore it is not possible to accurately predict plant noise emission levels. Consequently, suitable limits to which plant should adhere have been set.

Based on the results of the baseline noise survey (Section 5) and MCC's plant noise policy (Section 3), suitable noise limits to which fixed building services plant should adhere have been set and are presented in Table 6.1. Emergency plant noise limits are proposed at a level 5 dB above the typical background noise levels at the NSR, which is considered to be a reasonable relaxation for noise which only would occur for short periods during occasional testing or for rare emergency scenarios.

Table 6.1 Plant Noise Limits at Nearest Noise Sensitive Premises

Location	Period	Plant Noise Emission Limit (dB L_{Aeq})	Emergency Plant Noise Emission Limit (dB L_{Aeq})
NSR A	Daytime (07:00 to 23:00)	53	63
	Night-time (23:00 to 07:00)	45	55

The plant noise limits apply to the total contribution of noise from all new plant items associated with the proposed development that may run during any particular period and are to be met 1 m from the nearest habitable window of the NSRs detailed in Section 2.

To ensure the emission limits in Table 6.1 are not exceeded by the cumulative noise emissions from all building services plant, plant selection, installation and noise attenuation measures will need to be considered during the detailed and technical design of the project.

The plant specification is sufficiently flexible to ensure that suitably quiet, non-tonal plant can be procured and/or practical, cost-effective mitigation options incorporated into the design to ensure that guideline noise criteria are met. During the detailed design of the development efforts will focus on optimising the layout of plant and procuring high quality, quiet and efficient plant items before considering applying individual noise control measures (e.g. silencers, louvres), where assessed as necessary.

6.2. Operational Noise Breakout

Operation of the restaurant/bar will generate operational noise from activities and patrons which in turn will break out of the building via the facade. The degree of noise breakout from this use should be sufficiently controlled in order to meet the requirements set by MCC at the identified NSR. Consideration would need to be given to noise break-out prior to occupation and operation to ensure that the amenity of surrounding uses is protected and to ensure that office uses within the building itself are not adversely affected.

Noise break-out from the restaurant/bar use is expected, however to be negligible provided adequate sound insulation is afforded by the building fabric and by the separating partitions between the restaurant/bar use and the vertically adjacent office spaces. To control breakout to NSRs, the limits given in Table 6.2 should be achieved by any incoming tenants at 1 m from the

nearest habitable window of the NSRs identified in Section 2. These are based on the MCC standard criteria for entertainment noise and the measured background noise levels in each octave band (see Appendix B).

Table 6.2 Restaurant/Bar Noise Limits at Nearest Noise Sensitive Premises

Period	Maximum L_{Aeq} at NSR A from Entertainment Noise							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Daytime	58	50	45	44	43	40	30	16
Night-time	47	45	40	38	36	32	23	9

The restaurant/bar location at ground floor, the intervening buildings affording shielding, and the distance from the NSR location all factor into a view that the limits given in Table 6.2 should be easily achievable for the development and any incoming tenants. Suitable sound insulation to achieve the limits in Table 6.2 is assumed to be inherent in the building design for the purpose of this assessment, and it is on this basis that the assessment has been made. The design will be monitored moving forward with the above breakout limits in mind. Necessary design measures will be implemented where possible, and may be combined with the setting of maximum operational noise limits for inclusion into the tenant handbooks.

7. Conclusions

A noise impact assessment has been undertaken for the 38 Mosley Street site to determine the potential impacts of the proposed refurbishment of the building upon nearby sensitive receptors.

A baseline noise survey was carried out at the site, which showed the noise climate to be dominated by noise from the Metrolink tramline running along Mosley Street adjacent to the façade of the building. Background noise levels were influenced by distant and local road traffic noise, and building services plant from the surrounding commercial buildings. From a review of historical background noise survey data obtained from the MCC planning portal, the background levels measured at the site are considered to correlate well with background noise levels experienced at the identified noise sensitive receptor, positioned 50 m from the proposed development.

Noise emissions limits applicable to the new permanent building services items have been set in accordance with MCC's plant noise policy. All fixed plant will need to be designed to achieve the set limits. In addition, noise limits have been proposed for emergency building services operation.

Noise from activities of the proposed restaurant/bar use are considered likely to be negligible at surrounding sensitive receptors. To ensure the scheme design controls noise breakout from these uses to appropriate levels, limits have been provided based on the MCC requirements.

A gym is to be located at basement level. At basement level there is little risk of breakout noise to surrounding uses. Associated impacts have therefore not been considered in detail in this report.

Based on assessment findings, it is considered that noise impact from the development on surrounding noise sensitive premises can be satisfactorily controlled to achieve MCC requirements. The noise emissions limits set will be taken forward and used as a basis of design.

Appendix A – Acoustic Terminology

The table below provides a layperson's explanation of the acoustics terms that commonly appear in reports. It is not intended to give full scientific definitions and explanations or go into detail on how and why things are as they are. Some obsolete terms and abbreviations have been included as they still appear in documents from time to time.

Term	Description
Decibel, dB	The decibel is a logarithmic unit of measurement used for quantifying sound. It is derived from the logarithm to base 10 of the ratio of two quantities. Use of a logarithmic scale has the advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers.
Frequency, Hz	In sound, the number of cycles per second of a pressure fluctuation and frequency in sound is proportional to its pitch. Different frequencies are divided into octave and one third octave bands.
Sound Pressure Level, *Lp*	This is the unweighted or linear level which is measured prior to any weightings being applied. The sound pressure level is 20 times the logarithm to base 10 of the ratio of the reference sound pressure ($2x10^{-5}$) and the measured sound pressure.
Sound Power Level, L_W	This is the total sound energy radiated from a given source. The sound power Level is 10 times the logarithm to base 10 of the ratio of the reference sound power level ($1x10^{-12}$) and the measured power.
Frequency Weightings	Weightings can be applied to a spectrum of sound and act as a filter to account for different sensitivities and conditions.
Time Weightings	A time weighting to denote the response of the sound level meter. For most measurements the Fast time weighting is selected (F) however, a slow time weighting (S) is often used to for the measurement train noise and vibration.
A-weighted sound pressure level, L_{pA}	The sound pressure level with the A-weighting applied. The A-weighting is used for most environmental noise measurements and is used to weight a spectrum of sound to match the sensitivity of the human ear.
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	The L_{Aeq} is an energy average and defined as the level of sound which, over a given period of time, would equate to the same A-weighted sound energy as the actual fluctuating sound.
Octave Bands	A band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.
Maximum noise Level, L_{AFmax}	The maximum instantaneous noise level measured during a given period of time. The time weighting to which the meter is set for this measurement parameter is always indicated by either an F or S.
Minimum Noise level, L_{AFmin}	The minimum instantaneous noise level measured during a given period of time. The time weighting to which the meter is set for this measurement parameter is always indicated by either an F or S.
Percentile level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting F, which is exceeded for N% of a specified time interval. An example of this is background noise which is quantified with the L_{A90} descriptor, which is the A-weighted level which is exceeded for 90% of the measurement period.
Sound exposure level L_{AE}	A level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.
Rating Level, $L_{Ar,Tr}$	The equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Ambient Noise Level	The noise level in a given environment whilst it is subject to all of its normal sources of noise.

Background Sound / Noise Level, L_{A90}	These are amongst the lowest noise levels measured over a given period of time and exclude short term, intermittent noise sources. The background noise level is quantified by the L_{A90} descriptor and is therefore the level which is exceeded for 90% of a given period of time.
Reverberation Time, *T*	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor *T,* often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Absorption, A	The acoustic absorption derived from the multiplication of the absorption coefficient by the surface area of a given material.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
Sound Reduction Index, *R*	The laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
Weighted Sound Reduction Index, R_w	A single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
Weighted Level Difference, D_w	The weighted level difference between a pair of rooms, stated as a single figure.
Standardized Weighted Level Difference, $D_{nT,w}$	The standardized, weighted difference in sound level between a pair of rooms, stated as a single figure. The level difference in octave bands is first normalized to a reference reverberation time and then plotted against a set of reference curves to establish a single figure value.
Weighted, Normalised Flanking Level Difference, D_{nFw}	The normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
Normalised Element Level Difference D_{ne}	The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
Weighted, Normalised Element Level Difference, D_{new}	The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	A correction term applied to the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$). Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking on a floor structure.
Weighted standardized impact sound pressure level, $L_{nT,w}$	A single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.

Cross-talk	Noise transmission between one room and another room or space via a duct or other path.
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
Dynamic Insertion Loss, DIL	The reduction of noise level due to the presence of a noise control device such as an attenuator, including any regeneration noise created by its presence.
NR	The Noise Rating level. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.
Vibration	The vibratory motion of a surface can be characterised by: (a) displacement (m), (b) velocity (m/s), or (c) acceleration (m/s^2). The magnitude of the vibration can be quantified in several ways: **Peak to Peak** - The total excursion of the oscillation about the zero datum. **Peak** - This value gives the maximum excursion of the oscillation above or below the zero datum. **r.m.s.** - This value gives the root mean square of the time history over a specific time interval (time constant). **dB** - Vibration levels can be expressed in dB. A reference level of 10-6 m/s^2 r.m.s. is usually used for acceleration.
Ground borne noise	Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground
Structure borne noise	Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.
V.D.V,	The VDV is the Vibration Dose a person is expected to be exposed to over the course of the day or night. The VDV is given by the fourth root of the time integral of the fourth power of the acceleration after it has been frequency-weighted.
eVDV	The estimated vibration dose value based on short duration measurements of transients with known durations and occurrences

Appendix B – Octave Band Background Noise Levels

The measured background noise levels for each octave band at position LT1 are presented in Table B.1.

Table B.1: Measured Background Noise Levels

Period	Measured Modal $L_{90,15min}$ dB							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Daytime	68	60	55	54	53	50	40	26
Night-time	57	55	50	48	46	42	33	19