

Appendix 13.1

Glossary of Acoustic Terminology

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dB (decibel): The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10⁻⁵Pa).

dB(A): A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq,T}: Defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{Amax}: The maximum A-weighted sound pressure level recorded over a particular period. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{Aeq,T} noise level, but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response, denoted L_{AFmax} or L_{Amax,F}.

L₁₀ and L₉₀: If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L₁₀ is the level exceeded for 10% of the time, and the L₉₀ is the level exceeded for 90% of the time. Unless described otherwise, they are measured using the 'fast' sound level meter response, denoted L_{AF10} and L_{AF90}.

Free-field Level: A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and at least 3.5m away from buildings.

Façade Level: A sound field determined at a distance of 1 m in front of a large sound reflecting object such as a building façade.

Ambient Noise Level: The all-encompassing noise level measured in L_{Aeq,T}. The Ambient Noise Level incorporates background sounds as well as the industrial source noise under consideration (BS 4142).

Background Noise Level: The noise level exceeded for 90% of the time, the LA90 noise index, in the absence of sound of an industrial and/or commercial nature (BS 4142).

Specific Sound Level, L_s = L_{Aeq,T}: The term used in BS 4142 to describe the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time period.

Rating Level, L_{Ar,T}: The term used in BS 4142 to describe the specific sound level plus any adjustment for the characteristic features of the sound.

Vibration

Vibration is defined as a repetitive oscillatory motion. Vibration can be transmitted to the human body through the supporting surfaces; the feet of a standing person, the buttocks, back and feet of a seated person or the supporting area of a recumbent person. In most situations, entry into the human body will be through the supporting ground or through the supporting floors of a building.

Vibration is often complex, containing many frequencies, occurring in many directions and changing over time. There are many factors that influence human response to vibration. Physical factors include vibration magnitude, vibration frequency, vibration axis, duration, point of entry into the human body and posture of the human body. Other factors include the exposed persons experience, expectation, arousal and activity.

Experience shows that disturbance or annoyance from vibration in residential situations is likely to arise when the magnitude of vibration is only slightly in excess of the threshold of perception.

Vibration Terminology

Peak Particle Velocity (PPV): The maximum instantaneous velocity of a particle at a point during a given time interval, usually stated in mm/s.

Peak Component Particle Velocity: The maximum value of any one of three orthogonal component particle velocities measured during a given time interval.

Appendix 13.2

Legislation, Policy and Guidance

Appendix 13.2: Legislation, Policy and Guidance

Legislation

Environmental Protection Act 1990

Section 79 of the EPA presents a number of matters which may be statutory nuisances, including noise. Under the provisions of the EPA, the Local Authority is required to inspect its area periodically to detect any nuisance and, where a valid complaint of a statutory nuisance is made by a person living within its area, to take such steps as are reasonably practicable to investigate the complaint.

Section 80 of the EPA (Summary proceedings for statutory nuisances) provides Local Authorities with powers to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence.

Control of Pollution Act 1974

The principal legislation covering demolition and construction noise is the Control of Pollution Act 1974, Part III. Sections 60 and 61 of the Act give the local authority special powers for controlling noise arising from construction and demolition works, regardless of whether a statutory nuisance has been caused or is likely to be caused. Works within the scope of these provisions include repair and maintenance work and road works. These powers may be exercised either before works start or after they have started.

Section 60 enables a local authority in whose area work is going to be carried out, or is being carried out, to serve a notice of its requirements for the control of site noise on the person who appears to the local authority to be carrying out the works. Such a notice may also be served on others appearing to the local authority to be responsible for, or to have control over, the carrying out of the works.

This notice can:

- Specify the plant or machinery that is or is not to be used.
- Specify the hours during which the construction work can be carried out.
- Specify the level of noise that can be emitted.
- Provide for any changes of circumstances.

Section 61 of the Act provides a mechanism for the contractor or developer to take the initiative and approach the local authority to ascertain its noise requirements before construction work starts. If a formal application for 'prior consent' is received by the local authority it is obliged to give a decision within 28 days; failure to do so or the attachment of unnecessary or unreasonable conditions are grounds for appeal by the applicant.

In cases where the local authority determines that the proposals for minimising the noise of the construction activities are adequate it will issue a consent although this may be subject to conditions limiting certain aspects of the consent such as hours of use, noise levels for particular activities, etc. Provided that the applicant takes all reasonable steps to operate within the terms of the consent, even if the local authority subsequently decides to take proceedings under section 60(8), the applicant should be able to rely on the defence provided in the Act and prove that the alleged contravention amounted to the carrying out of works in accordance with a consent given under section 61.

National Planning Policy

Noise Policy Statement for England (NPSE)

The NPSE was published on 15 March 2010. It sets out the long-term vision for government noise policy, to promote good health and a good quality of life through the management of noise.

The policy ensures that noise issues are considered at the right-time during the development of policy and decision making, and not in isolation. It highlights the underlying principles on noise management already

found in existing legislation and guidance. The NPSE should apply to all forms of noise, including environmental noise. It sets out the long-term vision of Government noise policy as follows:

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

This long-term vision is supported by the following 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; and*
- *where possible, contribute to the improvement of health and quality of life."*

To assist in the understanding of the terms "significant adverse" and "adverse", the NPSE acknowledges that there are two concepts being applied to noise impacts, for example, by the World Health Organization. They are:

- 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; and
- LOAEL - Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

The NPSE introduces a third concept:

- SOAEL - Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

However, the NPSE goes on to state that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

National Planning Policy Framework (NPPF)

Last updated in July 2021, the NPPF sets out the Government's planning policies for England and how these are expected to be applied. The NPPF superseded Planning Policy Guidance Note (PPG) 24: Planning and noise amongst other PPG's and Planning Policy Statements (PPS's). In contrast to PPG 24, reference to noise is scant within the NPPF. Noise is referenced within the document as follows:

"174. Planning policies and decisions should contribute to and enhance the natural and local environments by...[a number of points including]...

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;"

"185. 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 life⁶⁵;*
- 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;...*"

Reference number 65 of the above quotation points to the Explanatory Note to the Noise Policy Statement for England (NPSE).

Additional reference is made to noise with respect to mineral extraction Sites but this is not applicable to this assessment.

The NPPF also includes the following statement:

"187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Whilst this paragraph does not explicitly reference noise, being 'overarching' in nature, in previous versions of the NPPF, similar text was included within the noise related paragraphs of the document.

Planning Practice Guidance (PPracG)

Last updated on 22 July 2019, this web-based resource was issued for use by the Department for Communities and Local Government (DCLG). The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies

The section on noise was published on 06 March 2014, but was last updated 22 July 2019. The guidance includes a table which summarises "the noise exposure hierarchy based on the likely average response of those affected" and which offers "examples of outcomes" relevant to the NOEL, LOAEL and SOAEL effect levels described in the NPSE. The term Unacceptable Adverse Effect (UAE) level is introduced which equates to noise perceived as "present and very disruptive". It is stated that UAEs should be prevented.

These outcomes are in descriptive form and there is still no numerical definition of the NOEL, LOAEL and SOAEL (or UAE), or detailed advice regarding methodologies for their determination. There is also no reference to the further research that is identified as necessary in the NPSE. There is reference to a number of other information sources, including British Standards, and it is confirmed that 'Some of these documents contain numerical criteria.' (albeit not that seek to define to the NOEL, LOAEL or SOAEL), and it is then advised that 'These values are not to be regarded as fixed thresholds and as outcomes that have to be achieved in every circumstance'.

The noise exposure hierarchy table is duplicated below **Table 13.1**.

Table 13.1: Noise Exposure hierarch based on the likely average response

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude or other physiological response.	No Observed Adverse Effect	No specific measures required

Response	Examples of outcomes	Increasing effect level	Action
	Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.		
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise	Unacceptable Adverse Effect	Prevent

Response	Examples of outcomes	Increasing effect level	Action
	leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.		

Local Planning Policy

Manchester City Council's Core Strategy 2012-2027

Manchester City Council's (MCC) Core Strategy Development Plan Document 2012-2027 (the Core Strategy) was adopted in July 2012 and is the key document in the Manchester Local Development Framework and it sets out the long term strategic policies for Manchester's future development and will form the framework that planning applications will be assessed against.

Pertinent to this development, and with regards to noise and vibration, is Policy DM1 Development Management, which states the following: "All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:

- Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions, such as noise."

Citywide Development Control Policies -26 Development and Noise

The Core Strategy replaces significant elements of MCC's Unitary Development Plan (UDP); however, UDP policies DC26.1 – DC26.6 have been saved and are relevant to noise and vibration. These are summarised as follows:

- DC26.1 - The Council intends to use the development control process to reduce the impact of noise on people living and working in, or visiting, the City.
- DC26.2 - New noise-sensitive developments (including large-scale changes of use of existing land or buildings), such as housing, schools, hospitals or similar activities, will be permitted subject to their not being in locations which would expose them to high noise levels from existing uses or operations, unless the effects of the noise can realistically be reduced. In giving effect to this policy, the Council will take account both of noise exposure at the time of receiving a planning application and of any increase that may reasonably be expected in the foreseeable future.
- DC26.3 - Developments likely to result in unacceptably high levels of noises will not be permitted:
 - a) in residential areas;
 - b) near schools, hospitals, nursing homes and similar institutions; and
 - c) near open land used frequently for recreational purposes.
- DC26.4 - Where the Council believes that an existing noise source might result in an adverse impact upon a proposed new development, or where a new proposal might generate potentially unacceptable levels of noise, it will in either case require the applicant to provide an assessment of the likely impact and of the measures he proposes to deal satisfactorily with it.
- DC26.5 - The Council will control noise levels by requiring, where necessary, high levels of noise insulation in new development as well as noise barriers where this is appropriate.
- DC26.6 - Exceptions to the general policy will be considered on their merits. The Council accept, as an example, that the occasional use of outdoor facilities such as sports stadia for concerts can be acceptable in certain circumstances. Any such proposal will be considered in the light of consultation with local residents and others, and the practicability of appropriate conditions on any approval.

Guidance

BS 5228-1:2009+A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1: Noise

BS 5228-1 sets out techniques to predict and assess the likely noise effects from construction works, based on detailed information on the type and number of plant being used, their location, and the length of time they are in operation. The noise prediction method is used to establish likely noise levels in terms of the $L_{Aeq,T}$ over the core working day. This Standard also documents a database of information, comprising previously measured sound power levels for a variety of different construction plant undertaking various common activities.

Three example methods are presented for determining the significance of construction noise impacts. In summary, these methods adopt either a series of fixed noise level limits, are concerned with ambient noise level changes as a result of the construction operations or a combination of the two.

With respect to absolute fixed noise limits, BS 5228-1 discusses those included within Committee on the problem of noise – Final Report. These limits are presented according to the nature of the surrounding environment, for a 12-hour working day. The presented limits are:

- 70 dB(A) L_{eq} in rural, suburban and urban areas away from main road traffic and industrial noise; and
- 75 dB(A) L_{eq} in urban areas near main roads and heavy industrial areas.

The above noise level limits are applicable at the façade of the receptor in question (i.e. not free-field).

The Standard goes on to provide methods for determining the significance of construction noise levels by considering the change in the ambient noise level that would arise as a result of the construction operations. Two example assessment methods are presented, these are the 'ABC method' as summarised within Table 2-5 and the '5 dB(A) change' method under that table.

Table 13.2: Example Threshold of Potential Significance Effect at Dwellings – ABC Method

Assessment category and threshold value period	Threshold value, in decibels $L_{Aeq,T}$ (dB)		
	Category (A) ^(A)	Category (B) ^(B)	Category (C) ^(C)
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends ^(D)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.			
NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due to site noise.			
NOTE 3: Applied to residential receptors only.			
^(A) Category A: threshold values to use when ambient levels (when rounded to the nearest 5dB) are less than these values.			
^(B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.			
^(C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.			
^(D) 19.00-23.00 weekdays, 13.00-23.00 Saturdays and 07.00-23.00 Sundays			

With respect to the '5 dB(A) change' method, the guidance states:

"Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject

to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$, from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect."

BS 5228-2:2009+A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 2: Vibration

This Standard provides recommendations for basic methods of vibration control relating to construction and open sites. The legislative background to vibration control is described and guidance is provided concerning methods of measuring vibration and assessing its effects on the environment.

Guidance criteria are suggested for the assessment of the significance of vibration effects; such criteria are provided in terms of Peak Particle Velocities (PPV) and are concerned with both human and structural responses to vibration. Those applicable to human perception and disturbance are presented within **Table 13.3** below.

Table 13.3: Guidance Criteria for the Assessment of Significance of Vibration for Human Perception and Disturbance (from BS 5228-2:2009+A1:2014)

Vibration level ^{A), B), C)} (PPV)	Effect
0.14 mms ⁻¹	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mms ⁻¹	Vibration might be just perceptible in residential environments.
1.0 mms ⁻¹	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mms ⁻¹	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.
^{A)} The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient. ^{B)} A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available. ^{C)} Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS6472-1 or BS6472-2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.	

The Standard goes on to present guidance criteria applicable to the vibration response limits of buildings in terms of the component PPV. These are presented within **Table 13.4**. It should be noted that the values presented within **Table 13.4** are applicable to cosmetic damage only. It is stated within BS 5228-2 that minor damage is possible at vibration magnitudes which are greater than twice those given in the table.

Table 13.4: Guidance Criteria for the Assessment of Significance of Transient Vibration for Cosmetic Building Damage (from BS 5228-2:2009+A1:2014)

Type of Building	Peak component particle velocity in frequency range of predominant pulse	Type of Building
	4Hz to 16Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at 4Hz and above	50mm/s at 15Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above
NOTE 1: Values referred to are at the base of the building. NOTE 2: At frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) is not to be exceeded.		

Calculation of Road Traffic noise (CRTN) memorandum

Published by the Department of Transport and the Welsh Office in 1988, CRTN sets out standard procedures for calculating noise levels from road traffic. The calculation methods use a number of input variables, including traffic flow volume, average vehicle speed, percentage of heavy duty vehicles (HDVs), type of road surface, site geometry and the presence of noise barriers or acoustically absorbent ground. CRTN predicts the $L_{A10,18h}$ or $L_{A10,1h}$ noise level for any receptor point at a given distance, up to 300m, from the road.

CRTN also documents procedures for the measurement of road traffic noise. Three methods of road traffic noise measurement are described, the first entitled 'The Measurement Method', for direct measurement of the $L_{A10,18hr}$ noise level, the second entitled the 'Shortened Measurement Procedure', for measurement of the $L_{A10,3hr}$ noise level from which the $L_{A10,18hr}$ level can be derived and the third entitled 'Comparative Measurements' which is a procedure to establish noise levels from a single road traffic route at various points, provided that the route remains the dominant source. CRTN states that if the Shortened Measurement Procedure is followed, a correction of -1dB can be applied to the determined $L_{A10,3hr}$ noise level to approximate the $L_{A10,18hr}$ noise level.

Design Manual for Roads and Bridges (DMRB): LA 111, 'Noise and vibration'

This document sets out procedures for undertaking the environmental assessment of new road schemes, including the assessment of noise impacts from road traffic. In undertaking a DMRB assessment, the calculation of traffic noise levels uses the methodology contained within the CRTN document as described below.

Although the DMRB strictly applies to new road schemes, the principles can also be applied to the assessment of noise from road traffic in general. The Proposed Development has the potential to affect road traffic noise levels along existing roads, hence the need for this assessment.

The significance of effect depends upon a number of factors, including the magnitude of change, the sensitivity of the receptor, the absolute noise level and the acoustic context.

The DMRB categorises operational road traffic noise into magnitude of change bands. The construction noise traffic and long term classification scales are provided in **Table 13.5** and **Table 13.6** below.

Table 13.5: Magnitude of impact at noise sensitive receptors of construction traffic (as taken from Table 3.13 of LA 111)

Short term magnitude	Increase in BNL of closest public road used for construction traffic (dB)
Major	Greater than or equal to 5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9
Negligible	Less than 1.0

Table 13.6: Magnitude of Change – Long Term (as taken from Table 3.45b of LA111)

Long term magnitude	Long Term noise change (dB $L_{A10,18h}$ or L_{night})
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3.0 to 4.9
Negligible	Less than 3.0

BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound (BS 4142)

BS 4142 describes methods for assessing sound of an industrial and/or commercial nature, including sound from fixed installations (such as mechanical and electrical plant). It provides a method of determining the 'rating level' for sources of industrial or commercial sound for the purposes of investigating noise impact, assessing sound from new, modified, or additional sources of sound, and assessing sound affecting new residential premises.

BS 4142 uses several terms to define the various parameters / indicators used in assessments, including:

- Specific sound – the commercial / industrial noise source under consideration;
- Residual sound – the sound level at the noise-sensitive receivers in the absence of the specific sound;
- Ambient sound – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e. ambient = residual + specific);
- Background sound level – the sound pressure level which is exceeded by the residual sound for 90% of the measurement period; and,
- Rating level – the specific sound, corrected for acoustically distinguishing characteristics.

BS 4142 states it is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:

- Tonality: +2dB for a 'just perceptible' tone, +4dB for a 'clearly perceptible' tone, and rising to +6 dB for a 'highly perceptible' tones;
- Impulsivity (rapidity of change and overall change in level): +3dB for 'just perceptible' impulsivity, +6dB for 'clearly perceptible' impulsivity, rising to +9dB for 'highly perceptible' impulsivity; and,
- Intermittency: if the on/off-time of the specific sound is readily distinctive at the noise-sensitive receivers, +3dB.

Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context-specific.

BS 4142 states that an initial estimate of the impact can be obtained by subtracting the background sound level from the rating level, and that:

- Typically, the greater the difference the greater the magnitude of the impact;
- A difference of around +10dB or more is likely to be indicative of significant adverse impact, depending on context;

- A difference of around +5dB or more is likely to be indicative of adverse impact, depending on context;
- The lower the rating level relative to the background sound level, the less likely it is that the specific sound will have an adverse impact, depending on context. Where the rating level does not exceed the background sound level, this is an indication that the specific sound will have a low impact, depending on context.

This initial estimate of impact can then be modified to take account of context, including reference to factors such as:

- The absolute level of the sound;
- The character and level of the residual sound compared to the character and level of the specific sound;
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
 - Façade insulation;
 - Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
 - Acoustic screening.

Professional Planning Guidance (ProPG): Planning and Noise

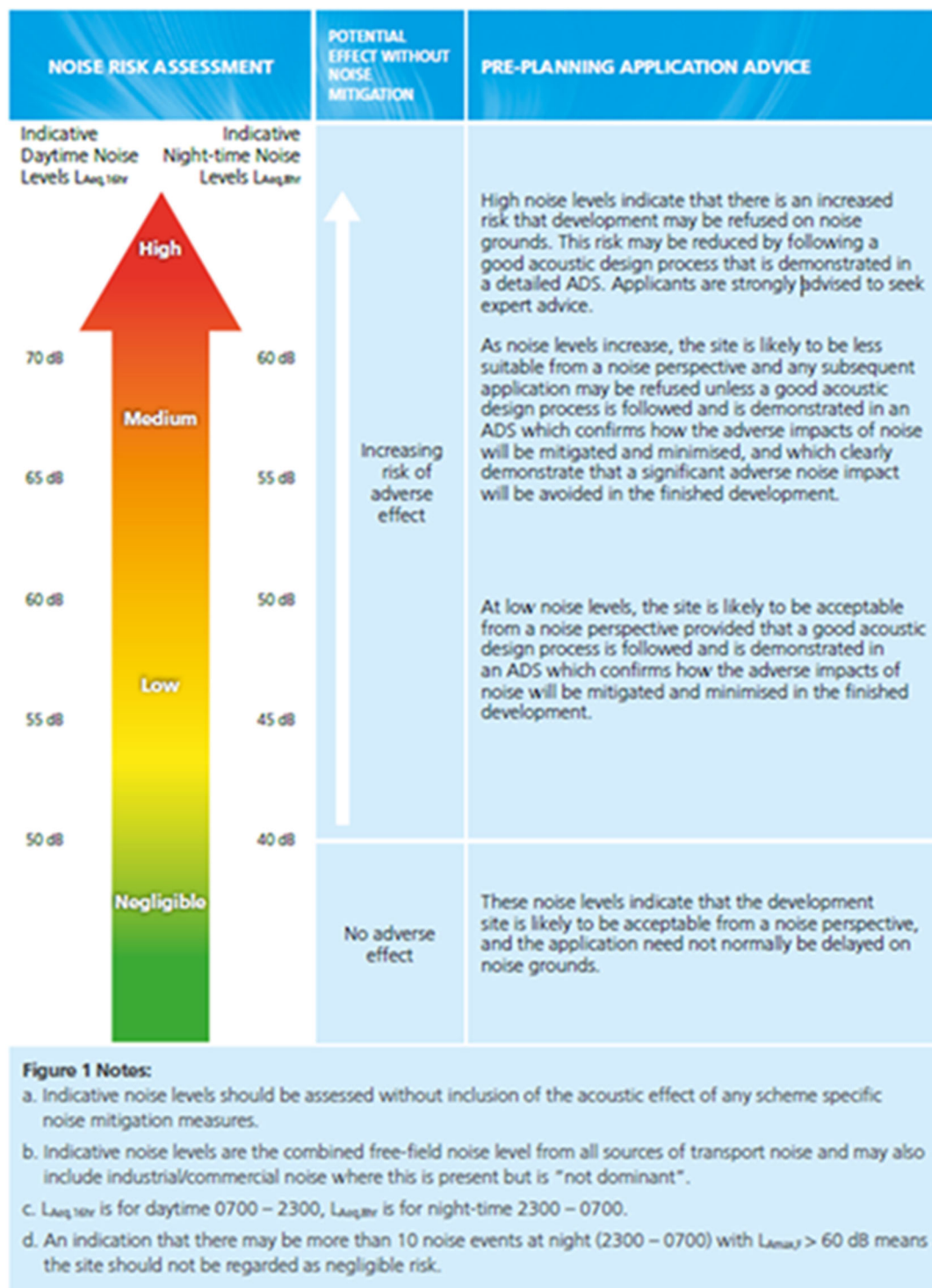
The joint Institute of Acoustics (IoA) / Acoustics and Noise Consultants (ANC) / Chartered Institute of Environmental Health (CIEH) publication: Professional Practice Guidance (ProPG) on planning & noise was published in May 2017. This document provides guidance and a recommended approach to managing transportation noise effects on proposed new residential developments within the planning system in England.

The ProPG aims to complement Government planning and noise policy and guidance, and in particular it strives to:

- *"advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;*
- *encourage the process of good acoustic design in and around new residential developments;*
- *outline what should be taken into account in deciding planning applications for new noise-sensitive developments;*
- *improve understanding of how to determine the extent of potential noise impact and effect; and*
- *assist the delivery of sustainable development."*

As set out in **Figure 13.2**, the ProPG provides a Figure to assist with the undertaking of initial site risk assessments for Proposed Development sites. The Figure provides a scale of daytime and night-time noise levels for negligible, low, medium and high risk categories for application sites with guidance as to how noise levels may need to be mitigated.

Figure 13.2: ProPG Initial Site Noise Risk Assessment



The ProPG also states that:

"In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,F}$ more than 10 times a night."

The guidance discusses in detail how the 45 dB $L_{Amax,F}$ value was derived and provides a rationale for adopting the 10th highest L_{Amax} maximum event level during the night-time period as the 'typical' level.

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings (BS 8233)

This standard provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

The guidance provided includes appropriate internal and external noise level criteria which are applicable to dwellings exposed to steady external noise sources. It is stated that it is desirable that the internal ambient noise level does not exceed the following criteria set out in **Table 13.7**.

Table 13.7: Summary of internal ambient noise levels to be achieved in habitable rooms when assessed in accordance with BS 8233

Activity	Location	Period	
		0700 to 2300 Hours, i.e. Daytime	2300 – 0700 Hours, i.e. Night-time
Resting	Living Room	35 dB $L_{Aeq, 16 \text{ Hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq, 16 \text{ Hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ Hour}}$	30 dB $L_{Aeq, 8 \text{ Hour}}$

Whilst BS 8233 recognises that a guideline value may also be set in terms of SEL or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated. Notwithstanding the internal noise limits stated within BS 8233, reference has also been made in this assessment to the World Health Organisation (WHO) 1999: *Guidelines for Community Noise*.

With respect to external amenity space such as gardens and patios it is stated that it is desirable that the noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. It is then confirmed that higher external noise criteria may be appropriate under certain circumstances such as within city centres urban areas, and locations adjoining the strategic network, where it may be necessary to compromise between elevated noise levels and other factors such as convenience of living, and efficient use of land resource.

World Health Organisation (WHO):1999: Guidelines For Community Noise

The internal ambient L_{Aeq} noise level criteria in BS 8233 is concordant with the guidance contained within the World Health Organisation (WHO) 1999: *Guidelines for Community Noise*. The WHO guidelines also provide guidance on suitable L_{Amax} noise levels during the night-time period. Specifically it is stated that:

"Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for single sound events."

The L_{AFmax} criteria detailed within this document draws upon guidance from Vallet and Vernet, which states:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB LAmax more than 10-15 times per night".

Building Bulletin (BB) 93: Acoustic Design of Schools (2015) (BB93)

BB93 sets out acoustic performance standards for schools, including for:

- indoor ambient noise levels;
- sound insulation between internal spaces (airborne and impact sound transmission);
- reverberation times;
- speech intelligibility within open plan spaces; and
- rain noise.

BB93 details maximum indoor ambient noise levels (IANL) requirements to be achieved within the various spaces in a school. These can be found in **Table 13.8** below and are expressed in terms of the $L_{Aeq,30min}$ parameter.

Table 13.8 Noise Activity and Sensitivity Levels and Upper Limits for Indoor Ambient Noise Levels

Type of Room	Room classification for the purpose of airborne sound insulation in Tables 3a and 3b		Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB	
	Activity noise (Source room)	Noise tolerance (Receiving room)	New build	Refurbishment
Nursery school rooms Primary school: classroom, class base, general teaching area, small group room Secondary school: classroom, general teaching area, seminar room, tutorial room, language laboratory	Average	Medium	35	40
Open plan: Teaching area Resource/breakout area	Average	Medium	40	45
Primary music room	High	Medium	35	40
Secondary music classroom Small and large practice/group room Performance/recital room	Very High	Low	35	40
Ensemble room Recording Studio	Very High	Low	30	35
Control room – for recording Control room – not for recording	High Average	Low Medium	35	40
Lecture room	Average	Medium	35	40
Teaching space intended specifically for students with special hearing and communication needs	Average	Low	30	35
SEN calming room	High	Low	35	35
Study room (individual study, withdrawal, remedial work, teacher preparation)	Low	Medium	40	45
Libraries: Quiet study area Resource area	Low Average	Medium Medium	40 40	45 45
<i>Design and technology:</i> Resistant materials, CAD/CAM area Electronics/control, textiles, food, graphics, design/resource area, ICT room, art	High Average	High Medium	40 40	45 45
Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music)	High	Low	35	40
Atrium, circulation space not intended for teaching and learning	Average	Medium	45	50
Sports Hall Dance Studio Gymnasium/Activity studio	High	Medium	40	45

Type of Room	Room classification for the purpose of airborne sound insulation in Tables 3a and 3b		Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB	
	Activity noise (Source room)	Noise tolerance (Receiving room)	New build	Refurbishment
Swimming pool	High	High	50	55
Meeting room, Interviewing/counselling room, video conference room	Low	Medium	40	45
Dining room	High	High	45	50
<i>Administration and ancillary spaces:</i>				
Kitchen	High	High	50	55
Office, medical room, staff room				
Corridor, stairwell, coats and locker area	Low	Medium	40	45
Changing area				
Toilet	Average	High	45	55
	High	High	50	55
	Average	High	50	55

In addition, it is stated that for regular discrete noise events, e.g. aircraft or trains, indoor ambient noise levels should not exceed 60dB $L_{A1,30min}$. This parameter describes the noise level not exceeded for more than 1% of the time during a 30 minute period, expressed in decibels.

It should be noted that the above criteria apply to the combined contribution of both external noise break-in and building services noise. When considering only noise break-in (as is the case for this assessment), to allow for the potential contribution of building services noise, an appropriate downward correction should be applied, e.g. a 35 dB(A) criterion could be reduced to 32 dB(A) to allow the same level of noise (32 dB(A)) to be generated by building services without giving rise to an exceedance of the original combined 35 dB(A) criterion.

BB93 allows for various relaxations which can be applied to the IANL design target depending upon the ventilation solution adopted and the required ventilation rate. For example, a 5 dB reduction can be applied where the teaching space is to be naturally ventilated (e.g. from openable windows rather than mechanical provision). However, for the purpose of this assessment, no such relaxations have been applied, representing a worst case.

BB93 doesn't state any external criteria for outdoor teaching spaces, however the corresponding design guide, entitled *Acoustics of Schools – a design guide* November 2015, states the following:

“Noise levels in unoccupied playgrounds, playing fields and other outdoor areas should not exceed 55 dB $L_{Aeq,30min}$ and there should be at least one area suitable for outdoor teaching activities where noise levels are below 50 dB $L_{Aeq,30min}$. If this is not possible, due to lack of suitably quiet sites, acoustic screening should be used to reduce noise levels in these areas as much as practicable, and an assessment of noise levels and options for reducing these should be carried out. Noise levels can be reduced by up to 10 dBA at positions near an acoustic screen.”

Appendix 13.3

Determining the Magnitude of Impact

Appendix 13.3: Determining the Magnitude of Impact

Demolition and Construction

Construction Noise

For construction noise, the magnitude of impact and effect level criteria have been determined based upon the margin by which predicted construction noise levels will comply or exceed the receptor construction noise assessment criteria when following the ABC assessment method detailed within BS 5228-1 **Error! Bookmark not defined.. Table 13.9** details the resulting magnitude of impact and effect level criteria that have been applied.

Table 13.9: Construction Noise – Magnitude of Impact and Effect Level Criteria

Construction noise level (x) (L _{Aeq,T} , dB)	Magnitude of Impact	Effect Level
x < Receptor ABC assessment criteria	Negligible	NOEL
Receptor ABC assessment criteria ≤ x < Receptor ABC assessment criteria +5dB	Low to Medium	LOAEL to SOAEL
Receptor ABC assessment criteria +5 ≤ x	Medium to High	Above SOAEL

Construction Vibration

For construction vibration, the magnitude of impact and effect level criteria have been determined according to the guidance contained within BS 5228-2 for human perception. **Table 13.10** details the resulting magnitude of impact and effect level criteria that have been applied.

Table 13.10: Construction Vibration – Magnitude of Impact and Effect Level Criteria

Vibration level (x) (PPV, mm/s)	Magnitude of Impact	Effect Level
x < 0.3	Negligible	NOEL
0.3 < x < 1.0	Low to Medium	LOAEL to SOAEL
1.0 < x	Medium to High	Above SOAEL

Construction Phase Development Generated Traffic

For construction traffic noise, the magnitude of impact criteria have been determined based upon the classification of noise level changes for construction traffic as detailed within the LA 111 (see Appendix 13.2). The terminology used within this scale has been updated to reflect that being used in this assessment. The resulting magnitude of impact criteria are detailed in **Table 13.11**.

Table 13.11: Construction Traffic Noise – Magnitude of Impact Criteria

Noise change (L _{A10,18h}), dB	Impact Magnitude
0.1 to 0.9	Negligible
1.0 to 2.9	Low
3.0 to 4.9	Medium
≥5.0	High

The effect levels have been determined based on the BNLs in accordance with the scale presented in **Table 13.12**, which is also consistent with the guidance contained within LA 111 (see **Appendix 13.2**).

Table 13.12: Construction Traffic Noise – Effect Level Criteria

External Daytime Façade Noise Level ($L_{A10,18h}$), (x), dB	Effect Level
$x < 54.5 \text{ dB}^1$	NOEL
$54.5 \text{ dB} \leq x < 67.5 \text{ dB}^2$	LOAEL to SOAEL
$67.5 \text{ dB} \leq x$	Above SOAEL
¹ Equivalent to a criterion of to 50 dB $L_{Aeq,16h}$ free-field, detailed within World Health Organisation and BS 8233 guidance Error! Bookmark not defined. for external living spaces. ² The level, when rounded to the nearest whole dB, that equals the 'specified level' as defined within the <i>Noise Insulation Regulations 1975</i> , and which is one of the qualifying criteria for the provision of noise insulation measures, or a grant in respect thereof, under these regulations.	

Operational Stage

Development generated commercial and fixed plant noise

For fixed/mechanical plant noise that would be introduced as a result of the Proposed Development (e.g. ground floor commercial uses), the magnitude of impact and effect level criteria has been determined based upon the guidance contained within BS 4142 i.e. by consideration of the difference between the sound from the plant/commercial source under assessment (including any correction(s) for noticeable acoustic characteristics - the rating level) and the prevailing background sound levels, but also taking into account context and the sound levels in absolute terms. **Table 13.13** details the resulting magnitude of impact and effect level criteria that have been applied.

Table 13.13: Fixed/Mechanical Plant Noise – Magnitude of Impact and Effect Level Criteria

Difference Between Rating Level ($L_{Ar,Tr}$) and Background Sound Level ($L_{AF90,T}$) (x)	Impact Magnitude	Effect Level
$x \leq 0$	Negligible	NOEL
$0 < x \leq 3$	Low	NOEL to LOAEL
$3 < x \leq 8$	Medium	LOAEL to SOAEL

Changes in road traffic noise as a result of operational phase development generated traffic

For development generated traffic noise, the magnitude of impact has been determined based upon the long-term magnitude of change classification scale detailed within LA 111 **Error! Bookmark not defined.** (see **Appendix 13.2**). The terminology used within this scale has been updated to reflect that being used in this assessment. The resulting magnitude of impact criteria are detailed in **Table 13.14**.

Table 13.14: Development Generated Traffic Noise – Magnitude of Impact Criteria

Noise change ($L_{A10,18h}$), dB	Impact Magnitude
0.1 to 2.9	Negligible
3.0 to 4.9	Low
5.0 to 9.9	Medium
≥ 10.0	High

The effect levels have been determined based on the absolute road traffic noise levels in the same manner as for construction traffic, accordance with the scale presented in **Table 13.12**.

Noise sources contributing to the prevailing sound environment across the Site

Proposed Residential Uses

Through consultation with MCC Environmental Health Department, it has been identified that their key requirement for the residential aspects of the Proposed Development is compliance with noise assessment criteria adopted from BS 8233 **Error! Bookmark not defined.** and WHO guidance **Error! Bookmark not defined.** Based on these guidance documents, the following assessment criteria have been adopted:

Internal Criteria:

- Living Rooms and Bedrooms, Daytime: 35 dB $L_{Aeq,16hr}$ (07:00 to 23:00);
- Bedrooms, Night-time: 30 dB $L_{Aeq,8hr}$ (23:00 to 07:00); and
- Bedrooms, Night-time: 45 dB L_{AFmax} , to typically be achieved (23:00 to 07:00).

External Criteria:

- External Living spaces, daytime (e.g. primary gardens/balconies): 55 dB $L_{Aeq,16hr}$ (07:00 to 23:00).

Compliance with these criteria will depend upon both the prevailing on-site noise levels and the layout and design of the Proposed Development including mitigation measures (e.g. Site boundary acoustic screening, layout design and building fabrication considerations etc.).

Table 13.15 details the magnitude of impact and effect level criteria that have been applied in the assessment of noise impact on the residential aspects of the Proposed Development.

Table 13.15: Existing Noise Environment on Proposed Residential Development - Magnitude of Impact and Effect Level Criteria

Proposed Residential Development Noise Levels dB(A)	Impact Magnitude	Effect Level
Below assessment criteria	No Change to Negligible	NOEL to LOAEL
Above assessment criteria but can be achieved through scheme design	Low to Medium	LOAEL to SOAEL
Above assessment criteria and cannot be achieved through scheme design	Medium to High	Above SOAEL

Proposed School

For the Proposed School, the following key assessment criteria have been adopted in accordance with the guidance contained within BB93.

Internal Criteria:

- Teaching and learning spaces etc: 32 dB $L_{Aeq,30mins}$ (07:00 to 23:00) .

External Criteria

- At least one external teaching area to achieve 50 dB $L_{Aeq,30mins}$ and more to meet 55 dB $L_{Aeq,30mins}$ (07:00 to 23:00).

Table 13.16 details the Impact Magnitude and Effect Level criteria that have been applied in the assessment of noise impact on the proposed School.

Table 13.16: Existing Noise Environment on Proposed Residential Development - Magnitude of Impact and Effect Level Criteria

Proposed School Development Noise Levels dB(A)	Impact Magnitude	Effect Level
Below assessment criteria	No Change to Negligible	NOEL to LOAEL
Above assessment criteria but can be achieved through scheme design	Low to Medium	LOAEL to SOAEL
Above assessment criteria and cannot be achieved through scheme design	Medium to High	Above SOAEL

Appendix 13.4

Baseline Noise Survey

Appendix 13.4: Baseline Noise Survey

Method of Baseline Data Collation

Desk Study

A desktop review has identified the existing key noise sources in the vicinity of the Site and the closest noise sensitive receptors.

The following data sets were reviewed:

- Google and ESRI online mapping and aerial photography; and
- Street-view photography.

Site Visit and Surveys

Overview

A baseline noise survey has been completed to establish the prevailing noise climate across the Site. At the time of the survey, commercial premises were operating within areas of the Application 4 and Application 5 sites. In addition, it was not considered secure to leave equipment unattended or to carry out attended measurements in certain areas of the Site during night-time hours. A series of short duration attended measurements were therefore undertaken at various representative locations on and immediately surrounding the Site during daytime and night-time periods, including 11 November 2021 (daytime only), 25 November 2021 (daytime), 07 December 2021 (daytime and night-time), 31 March 2022 (daytime and night-time) and 01 April 2022 (daytime and night-time). The measurement locations are described below and shown in **Figure 13.1**.

- Measurement Location 1: To the northeast of the Site. This measurement location was selected to establish the levels of road traffic noise on Collyhurst Road and Dantzik Street. Attended daytime measurements were carried out in accordance with the CRTN shortened measurement procedure. Attended night-time measurements were carried out during peak traffic flows, i.e. between 0500 and 0700 hours. Road traffic noise dominated the prevailing noise environment at this location. Distant noise from operational activities of the premises of HMG/IG Paints Ltd on Collyhurst Road were only just audible during lulls in traffic.
- Measurement Location 2: To the west of the Site. This measurement location was selected to establish the levels of road traffic noise on Red Bank. Attended daytime measurements were carried out in accordance with the CRTN shortened measurement procedure. Attended night-time measurements were carried out during peak traffic flows, i.e. between 0500 and 0700 hours. Road traffic noise dominated the prevailing noise environment at this location. Distant train movements and construction noise was audible during lulls in the traffic.
- Measurement Location 3: In the north-eastern part of the Site. This measurement location was selected to obtain representative measurement data of operational activities of the premises of HMG/IG Paints Ltd on Collyhurst Road. Mixed sources contribute to the prevailing daytime noise measurements including road traffic, distant rail movements on the Victoria Station railway line and distant noise from fixed plant associated with the HMG/IG Paints Ltd. This location was not considered secure to undertake unattended or attended night-time measurements.
- Measurement Location 4: In the northern part of the Site. This measurement location was selected to obtain representative measurement data of operational activities of the units on Collingham Street. Mixed sources contribute to the prevailing daytime noise measurements including distant road traffic, distant rail movements on the Victoria Station railway line, occasional distant noise from the direction of the units on Collingham Street and birdsong. This location was not considered secure to undertake unattended or attended night-time measurements.

- Measurement Location 5: In the northern part of the Site. This measurement location was selected to obtain representative measurement data of operational activities of the units on Collingham Street and Honey Street. Mixed sources contribute to the prevailing daytime noise measurements including distant road traffic, distant construction noise, occasional distant noise from the direction of the units on Collingham Street and birdsong. This location was not considered secure to undertake unattended or attended night-time measurements.
- Measurement Location 6: To the southeast of the Site. This measurement location was located off Rimworth Drive and was selected to establish the noise levels generated by passenger and freight train movements on the railway line to the south of the site.
- Measurement Location 7: In the southwestern part of the Site. This measurement location was selected to obtain representative measurement data of operational activities of the units within Red Bank Court. Mixed sources contribute to the prevailing daytime and night-time noise measurements including road traffic, rail movements on the Victoria Station railway line and distant construction noise (daytime only). At the time of the survey, operational activities associated with the units within Red Bank Court were not notable audible from with the RB10 development plot of the Application 4 site.

Noise Monitoring Equipment and Personnel

Monitoring equipment was set up by competent, trained WSP staff and all measurements were carried out in free-field conditions, with a sound level meter fitted with an environmental kit and a microphone extended at 1.5 m above ground. The meter was field-calibrated before and after the measurements were taken, with drift levels noted within acceptable tolerances (within 0.3 dB).

Noise measurements were undertaken using class 1 precision sound level meters, in accordance with BS 7445:2003 and BS 61672-1:2013. Equipment calibration information is presented in **Table 13.17** below, while laboratory calibration certificates are available on request.

Table 13.17: Survey Equipment Details

Measurement Location	Equipment	Make and model	S/N
ML1 to ML6 (Daytime)	Sound Level Meter	01dB-METRAVIB Black Solo 'Datalogging Integrating Sound Level Meter'	65303
	Pre-amplifier	01dB-Metravib PRE 21 S	15976
	Microphone	01dB Metravib MCE 212 Microphone	142812
	Calibrator	01dB-Stell Cal 21	34213780
ML1 and ML2 (Night-time)	Sound Level Meter	01dB-METRAVIB Blue Solo 'Datalogging Integrating Sound Level Meter'	61331
	Pre-amplifier	01dB-METRAVIB PRE 21 S	14575
	Microphone	01dB Mereavib MCE 212 Microphone	92344
	Calibrator	Norsonic type 1251 Sound Calibrator	31460

Measurement Location	Equipment	Make and model	S/N
ML7	Sound Level Meter	01dB-Metravib Fusion Sound Level Meter	10797
	Pre-amplifier	01dB PRE22 Preamplifier	10870
	Microphone	GRAS Type 40CD Condenser Microphone	207593
	Calibrator	01dB-Stell Cal 21	34254631

Baseline Measurement Results

Table 13.18 shows a summary of the day and night-time measured noise levels at the attended short-term measurement locations

Table 13.18: Summary of Measurement Results, free-field levels

Measurement Location	Date	Measurement Period	L _{Aeq,T} dB	L _{A90, T} dB	L _{Amax} dB (nights only)
ML1	11/11/2021	1145-1200	59.5	46.1	-
		1245-1300	62.6	46.5	-
		1339-1354	62.5	46.9	-
	07/12/2021	0503-0514	45.0	44.0	58.1
		0548-0609	57.0	46.4	78.4
		0642-0704	61.9	49.1	79.0
		0737-0759	66.4	50.2	-
		0832-0853	64.9	50.9	-
ML2	11/11/2021	1308-1323	68.4	51.4	-
		1409-1424	66.1	51.6	-
		1524-1539	67.7	53.6	-
	07/12/2021	0521-0543	58.9	46.3	81.5

Measurement Location	Date	Measurement Period	L _{Aeq,T} dB	L _{A90, T} dB	L _{Amax} (nights only) dB
		0615-0636	63.0	50.0	82.1
		0710-0730	69.8	53.4	-
		0806-0827	71.3	55.0	-
ML3	25/11/2021	1124-1140	41.7	39.1	-
		1432-1449	45.3	41.7	-
ML4	25/11/2021	1145-1202	46.5	44.1	-
		14.53-15.09	45.1	40.2	-
ML5	25/11/2021	1210-1227	43.0	41.0	-
		15.10-15.27	45.6	43.2	-
ML6	25/11/2021	12.52-12.53	67.0	46.3	-
ML7	31/03/2022	0646-0710	56.6	49.8	71.5
		0713-0730	58.7	52.1	-
		1421-1621	58.9	52.5	-
	01/04/2022	0634-0900	58.0	50.6	76.7

Typical Background Noise Levels

Representative background noise levels have been derived from the results at the short-term attended measurement locations ML3 to ML5 at the Site for the daytime periods. These levels have been used to set the external noise emission limits for fixed plant associated with the Proposed Development, discussed in **Chapter 13** of the ES.

In the absence of measurements during the night-time period at these locations, the typical difference between the background noise levels during daytime and night-time periods at ML1, ML2 and ML7 has been applied to the representative background noise levels derived for the daytime period.

Appendix 13.5

Demolition / Construction Stage Noise and
Vibration Assessment

Appendix 13.5 Demolition / Construction Stage Noise and Vibration Assessment

Construction Noise

The assessment of construction noise has been undertaken in accordance with BS 5228-1 and with reference to the results of the baseline noise survey. Construction noise level predictions and assessments have been completed at a selection of noise sensitive receptors within 300m of the Proposed Development, as described below:

- NSR1 (Application 4 and 5): Representative of existing residential receptors situated of the Fairholme Caravan Site on Collingham Street to the north of the Site.
- NSR2 (Application 4 only): Representative of the Eden Boys Leadership Academy situated on Rayburn Way to the north-west of the Site.
- NSR3 (Application 4 and 5): Representative of existing residential receptors of Emmeline Tower flats situated on Dalton Street to the east of the Site.
- NSR4 (Application 4 and 5): Representative of existing residential receptors of No 19 to 35 Dalton Street to the east of the Site.
- NSR5 (Application 4 and 5) : Representative of existing residential receptors of Sylvia Tower flats situated on Dalton Street to the east of the Site.
- NSR6 (Application 4 only): Representative of existing residential receptors of Christabel Tower flats on Dalton Street to the east of the Site.
- NSR7 (Application 4 and 5): Representative of future residential receptors of the Victoria Riverside development situated on Dantzig Street to the west of the Site (application ref: 126944/FO/2020).
- NSR8 (Application 4 and 5): Representative of future residential receptors of The Gas Works development situated on Gould Street to the south of the Site (application ref: 128248/FO/2020).
- NSR9 (Application 4 and 5): Representative of future residential receptors of the Victoria Meadows development situated on Aspin Lane to the southwest of the Site (application ref: 116366/FO/2017).
- NSR10 (Application 4 and 5): Representative of the King of Kings School situated on Aspin Lane to the southwest of the Site.
- NSR11 (Application 4 Only): Representative of the Homes for Students accommodation situated on Dantzig Street to the southwest of the Site.
- NSR12 (Application 4 only): Representative of existing residential receptors of the Vallea Court flats on Red Bank Road to the west of the Site.
- NSR13 (Application 4 only): Representative of existing residential receptors of the Masson Place flats on Red Bank Road to the west of the Site.
- NSR14 (Application 4 and 5): Representative of existing residential receptors of the Melia House flats on Red Bank Road to the west of the Site.
- NSR15 (Application 4 and 5): Representative of existing residential receptors of the Lincoln Gate flats on Red Bank Road to the west of the Site.
- NSR16 (Application 4 only): Representative of future residential receptors of Phase 1 of the Proposed Development, i.e. Application 5.
- NSR17 (Application 4 only): Representative of future residential receptors of Phase 2 of the Proposed Development, i.e. RB06, RB07, RB10, RB16 and RB17 of Application 4.

The approximate locations of the above receptors are shown in **Figure 13.1**.

Standard construction working hours are assumed to be:

- Monday to Friday: 07:30 to 18:00 hours;
- Saturday: 08:30 to 14:00 hours; and
- No working on Sundays or Bank Holidays.

In order to determine the ambient noise level applicable at the assessment locations, a baseline model was calibrated against short-term attended daytime sound levels measured at location ML1 and ML2. This

approach is considered reasonable as road traffic noise is dominant for receptors located along Red Bank Road and Dantzic Street.

Daytime construction noise thresholds have subsequently been determined for each receptor in accordance with the BS 5228-1 'ABC method', as shown in **Table 13.19**.

Table 13.19: Construction Noise Thresholds

Receptor	Location Description	Construction noise threshold (L _{Aeq,T}) in dB(A)
NSR1	Fairholme Caravan Site, Collingham Street	Category A
NSR2	Eden Boys Leadership Academy, Rayburn Way	Category A
NSR3	Emmerline Tower flats, Dalton Street	Category A
NSR4	No 19 to 35 Dalton Street	Category A
NSR5	Sylvia Tower flats, Dalton Street	Category A
NSR6	Christable Tower flats, Dalton Street	Category A
NSR7	Victoria Riverside, Dantzic Street	Category A
NSR8	The Gas Works, Gould Street	Category A
NSR9	Victoria Meadowside, Aspin Lane	Category A
NSR10	King of Kings School, Aspin Lane	Category A
NSR11	Homes for Students accommodation on Dantzic Street	Category A
NSR12	Vallea Court flats, Red Bank Road	Category B
NSR13	Masson Place flats, Red Bank Road	Category B
NSR14	Malia House flats, Red Bank Road	Category B
NSR15	Lincoln gate flats, Red Bank Road	Category B
NSR16	Phase 1 of the Proposed Development, i.e. Application 5	Category A
NSR17	Phase 2 of the Proposed Development, i.e. RB06, RB07, RB10, RB16 and RB17 of Application 4	Category A

It is anticipated that the Proposed Development would be delivered in 3 phases, over a 9 year construction programme commencing in 2023. The phasing plan for the development can be seen on the Phasing Plan in Figure x.x, and the associated programme is summarised as follows:

- Phase 1: NT02-04: Quarter 4 2023 to Quarter 4 2029;
- Phase 2: RB01-05 and RB12b: Quarter 1 2025 to Quarter 4 2029; and
- Phase 3: RB16 / 17 / 06 / 07 / 10: Quarter 3 2027- Quarter 4 2032.

The nature of works to be undertaken in the delivery of the Proposed Development would be detailed within the Construction Environmental Management Plan (CEMP), but for the purpose of this assessment it has been assumed that, with the exception of the construction of the retaining wall adjacent to the railway viaduct, construction operations will be the same for each of the three phases and can be broadly split into the following works:

- Activity 1 – Site preparation and remediation.
- Activity 1a – Construction of the retaining wall against the operational railway viaduct and the movement of a main pressure gas main within Application 5 red line boundary.
- Activity 2 – Foundations and piling.
- Activity 3 – Erection of structure.
- Activity 4 – External and internal fitting out.
- Activity 5 - Groundworks and landscaping.

Construction phases and works are assumed to be undertaken separately. It is appreciated that some of the construction phases may overlap. However, the approach adopted is representative of predicting likely significant effects given that, in the case of any such overlapping operations, it will be the closest operations to the receptor that will generally dictate the resulting noise levels.

At this stage, the type and number of construction plant items, the programme and working methodologies to be applied are not known; these would be dependent upon the Contractor, who would be appointed after planning approval. To inform this assessment, it has been necessary to make assumptions regarding the plant likely to be used, their number and 'on-time' (i.e. the percentage of time in operation). These assumptions are based on information provided by the Applicant and professional experience of similar developments.

In practice, the plant items identified for each phase will move around the site, operating at different times, for different durations and at different locations on any one day. Consequently, noise levels at any receptor may vary considerably day-on-day. It is necessary to rationalise the geographic and temporal spread of activities to obtain a meaningful prediction (and subsequent assessment).

The assumed type and number of plant items associated with key construction working stages are presented in **Table 13.20**. The table details the source information and sound pressure level attributed to each plant item.

Table 13.20: Construction Working Stages and Plant Items

[illegible]

Plant	BS 5228 Reference	Construction Activity												Plant Sound Power Level, dBA
		1		1a		2		3		4		5		
		No.	% On Time	No.	% On Time	No.	% On Time	No.	% On Time	No.	% On Time	No.	% On Time	
Concrete Mixer Truck		-	-	1	20	-	-	-	-	-	-	-	-	108
Concrete Pump		-	-	1	20	-	-	-	-	-	-	-	-	106
Diesel Generator		-	-	1	60	-	-	-	-	-	-	-	-	102
		-	-	1	10	-	-	-	-	-	-	-	-	96
Lorry (with Lifting boom)		-	-	1	20	-	-	-	-	-	-	-	-	105
Roller	Table C 2-38	-	-	1	40	-	-	-	-	-	-	-	-	101
Hand-held pneumatic breaker	Table C 1-06	-	-	1	20	-	-	-	-	-	-	-	-	111

In practice, activities would take place at different times and durations, and would move around the Site; consequently, construction noise at any receptor is likely to vary. It is necessary to rationalise the geographic and temporal spread of activities to obtain a meaningful prediction and subsequent appraisal. The most important assumptions relate to the type and number of plant items, operational on-time and location of equipment.

Calculations have been undertaken based on all plant items positioned at a single location for the closest phase of work and at points considered to be the 'worst' and 'average' locations undertaken for each receptor. The worst case assumes all plant items for each construction activity are located at the nearest development plot of the closest phase of development. The average case considers that all plant are located at the approximate centre of that phase of development. The calculations for the construction of the retaining wall against the operational railway viaduct assume all plant items are located at the closest point for these works.

The high level construction programme indicates that some of the Phases of works will overlap. For the purpose of this assessment it is assumed that the construction works taking place in the phase closest to the noise sensitive receptors will dominate the construction noise levels generated. Therefore, for each receptor location, the predicted construction noise levels are presented for the works within the closest proposed phase of development.

Table 13.21 and **Table 13.22** sets out the range of construction noise levels calculated for each adopted receptor location for Application 4 and Application 5. The range extends from the average case to the worst-case scenarios as described above.

Table 13.21: Predicted 'Average' and 'Worst' Case Construction Noise Levels for Application 4– Façade $L_{Aeq,10h}$ (dB)

Receptor	Construction Phase Considered	Activity 1: Site Preparation and Remediation	Activity 2: Foundations and Piling	Activity 3: Erection of Structure	Activity 4: External and internal fitting out	Activity 5: Groundworks and landscaping
NSR1	3	62-65	70-73	63-66	53-56	62-65

NSR2	3	55-57	63-64	56-57	46-48	55-57
NSR3	2	55-56	62-64	55-57	46-47	55-56
NSR4	2	54-55	62-63	55-56	45-46	54-55
NSR5	2	52-54	60-61	53-55	43-45	52-54
NSR6	2	52-54	60-61	53-54	43-44	52-54
NSR7	2	65-67	72-75	65-68	55-58	65-67
NSR8	2	62-63	69-71	62-64	53-54	62-63
NSR9	2	60-63	68-70	61-63	51-53	60-62
NSR10	2	60-62	67-70	60-63	50-53	59-62
NSR11	2	54-65	61-72	54-65	44-55	54-65
NSR12	2	56-70	63-78	56-71	46-61	56-70
NSR13	2	59-70	67-78	60-71	50-61	59-70
NSR14	2	59-60	67-68	60-61	50-51	59-60
NSR15	2	61-64	69-72	62-65	52-55	61-64
NSR16	2	62-74	70-82	63-75	53-65	62-74
NSR17	2	62-70	70-78	63-71	53-61	62-70

Table 13.22: Predicted 'Average' and 'Worst' Case Construction Noise Levels for Application 5- Façade L_{Aeq,10h} (dB)

Receptor	Activity 1: Site Preparation and Remediation	Activity 1: Construction of Retaining Wall	Activity 2: Foundations and Piling	Activity 3: Erection of Structure	Activity 4: External and internal fitting out	Activity 5: Groundworks and landscaping
NSR1	53-54	49	60-61	53-54	43-44	52-53
NSR3	56-65	66	64-72	57-65	47-55	56-65
NSR4	56-63	70	64-70	57-63	47-53	56-62
NSR5	52-54	55	60-61	53-55	43-45	52-54
NSR7	60-82	78	67-90	60-83	50-73	59-82
NSR8	67-72	63	74-79	67-72	57-62	66-71
NSR9	55-59	60	63-67	56-60	46-50	55-59
NSR10	53-55	56	60-63	53-56	43-46	52-55
NSR14	51-53	52	58-60	51-53	41-44	51-53
NSR15	51-53	52	59-61	52-54	42-44	51-53

The predicted construction noise levels have been compared against threshold criteria for each receptor for Application 4 and Application 5. The results are given in **Table 13.23** and **Table 13.24** respectively. A negative value represents compliance, a positive value represents an exceedance.

Table 13.23: Construction Noise Compliance for Application 4, dB

Receptor	Activity 1: Site Preparation and Remediation	Activity 2: Foundations and Piling	Activity 3: Erection of Structure	Activity 4: External and internal fitting out	Activity 5: Groundworks and landscaping
Average Case					
NSR1	-3	+5	-2	-12	-3
NSR2	-10	-2	-9	-19	-10
NSR3	-10	-3	-10	-19	-10
NSR4	-11	-3	-10	-20	-11
NSR5	-13	-5	-12	-22	-13

NSR6	-13	-5	-12	-22	-13
NSR7	0	+7	0	-10	0
NSR8	-3	+4	-3	-12	-3
NSR9	-5	+3	-4	-14	-5
NSR10	-5	+2	-5	-15	-6
NSR11	-11	-4	-11	-21	-11
NSR12	-14	-7	-14	-24	-14
NSR13	-11	-3	-10	-20	-11
NSR14	-11	-3	-10	-20	-11
NSR15	-9	-1	-8	-18	-9
NSR16	-3	5+	-2	-12	-3
NSR17	-3	5+	-2	-12	-3
Worst Case					
NSR1	0	+8	+1	-9	0
NSR2	-8	-1	-8	-17	-8
NSR3	-9	-1	-8	-18	-9
NSR4	-10	-2	-9	-19	-10
NSR5	-11	-4	-10	-20	-11
NSR6	-11	-4	-11	-21	-11
NSR7	+2	+10	+3	-7	+2
NSR8	-2	+6	-1	-11	-2
NSR9	-2	+5	-2	-12	-3
NSR10	-3	+5	-2	-12	-3
NSR11	+3	+7	0	-10	0
NSR12	0	+8	+1	-9	0
NSR13	0	+8	+1	-9	0
NSR14	-10	-2	-9	-19	-10
NSR15	-6	+2	-5	-15	-6
NSR16	+9	+17	+10	0	+9
NSR17	+5	+13	+6	-4	+5

Table 13.24: Construction Noise Compliance for Application 5, dB

Receptor	Activity 1: Site Preparation and Remediation	Activity 1: Construction of Retaining Wall	Activity 2: Foundations and Piling	Activity 3: Erection of Structure	Activity 4: External and internal fitting out	Activity 5: Groundworks and landscaping
Average Case						
NSR1	-12	-	-5	-12	-22	-13
NSR3	-9	-	-1	-8	-18	-9
NSR4	-9	-	-1	-8	-18	-9
NSR5	-13	-	-5	-12	-22	-13
NSR7	-5	-	+2	-5	-15	-6
NSR8	+2	-	+9	+2	-8	+1
NSR9	-10	-	-2	-9	-19	-10
NSR10	-12	-	-5	-12	-22	-13
NSR14	-19	-	-12	-19	-29	-19
NSR15	-12	-	-5	-12	-22	-13
Worst Case						
NSR1	-11	-16	-4	-11	-21	-12
NSR3	0	+1	+7	0	-10	0

NSR4	-2	+5	+5	-2	-12	-3
NSR5	-11	-10	-4	-10	-20	-11
NSR7	+17	+13	+25	+18	+8	+17
NSR8	+7	-2	+14	+7	-3	+6
NSR9	-6	-5	+2	-5	-15	-6
NSR10	-10	-9	-2	-9	-19	-10
NSR14	-17	-18	-10	-17	-26	-17
NSR15	-17	-13	-9	-16	-26	-17

Construction Vibration

At this stage, the type and number of vibration-generating construction plant items, the programme and working methodologies to be applied are not known; these would be based on the final design, the ground conditions, and selected by the Contractor, who would be appointed after planning approval

Percussive piling techniques can generate relatively high levels of ground-borne vibration. With the potential exception of limited driven piles associated with the river works, it is understood that non-percussive techniques such as continuous flight auger (CFA) will be employed across the majority of the Proposed Development. As such, vibration from piling will not be considered further.

Ground-borne vibration calculations have been performed for construction activities typically required for similar developments. The calculations are based on the empirical prediction procedures presented within BS 5228-2. **Table 13.25** presents the distances at which vibration levels are predicted to meet the criteria thresholds, based on a specified confidence limit (where applicable).

Table 13.25: Predicted groundborne vibration levels

Vibration generating activity	Confidence Limit	PPV (mm/s)	Minimum distance between receptor and works (m) before PPV (mm/s) exceeded.
Vibratory Rollers - start & end ⁽¹⁾	95	0.3	80
	95	1.0	30
	95	10	4
Vibratory Rollers - Steady State ⁽¹⁾	95	0.3	60
	95	1.0	25
	95	10	5
HGV Movement ⁽²⁾	N/A	0.3	7
	N/A	1.0	2
	N/A	10	N/A
Excavation	N/A	0.3	9
	N/A	1.0	3
	N/A	10	N/A
⁽¹⁾ Assumes 2 rollers, 0.5mm amplitude, drum width of 1.3m, e.g. heavy-duty ride on roller.			
⁽²⁾ Assumes PPV of 1 mm/s at 2m, referenced within TRL Report 53.			

The data presented in **Table 13.25** is general in nature and is not site specific. In addition, different vibration generating activities may be employed other than those listed.

The following sensitive receptors are those closest to the main phases of the construction works and have the greatest potential to be subject to significant effects:

- NSR1: Representative of existing residential receptors situated of the Fairholme Caravan Site located approximately 70m from the nearest development plot of Application 4.

- NSR3: Representative of existing residential receptors of Emmeline Tower located approximately 75m from the nearest development plot and 45m from the construction of the retaining wall of Application 5.
- NSR4: Representative of existing residential receptors of No 19 to 35 Dalton and located approximately 95m from the nearest development plot and 55m from the construction of the retaining wall of Application 5.
- NSR7: Representative of future residential receptors of the Victoria Riverside development located approximately 55m from the nearest development plot of Application 4 and approximately 10m from the nearest development plot of Application 5.
- NSR8: Representative of future residential receptors of The Gas Works development located approximately 60m from the nearest development plot of Application 5.
- NSR9: Representative of future residential receptors of the Angel Meadows development located approximately 95m from the nearest development plot of Application 4.
- NSR11: Representative of the Homes for Students accommodation located approximately 75m to from the nearest development plot of Application 4.
- NSR12: Representative of existing residential receptors of the Vallea Court located approximately 40m from the nearest development plot of Application 4.
- NSR13: Representative of existing residential receptors of the Masson Place located approximately 40m from the nearest development plot of Application 4.
- NSR15: Representative of existing residential receptors of the Lincoln Gate located approximately 80m from the nearest development plot of Application 4.
- NSR16: Representative of future residential receptors of Phase 1 of the Proposed Development, i.e. Application 5, located approximately 25m from the nearest development plot of Application 4.
- NSR17: Representative of future residential receptors of Phase 2 of the Proposed Development, i.e. RB06, RB07, RB10, RB16 and RB17 of Application 4, located approximately 40m from the nearest development plot within Phase 3 of Application 4.

Table 13.26 below presents the predicted magnitude of impact and NPSE classification at NSR7 (i.e. the closest sensitive receptor to the main phases of construction associated with Application 5) and NSR16 (i.e. the closest sensitive receptor to the main phases of construction associated with Application 4), for the vibration generating activities.

Table 13.26: Predicted impact magnitude and NPSE classification

Vibration generating activity	Magnitude of impact	NPSE classification
NSR7: Approximately 10m from the nearest development plot of Application 5		
Vibratory Rollers – start up	Medium to High	SOAEL
Vibratory Rollers – steady state	Medium to High	SOAEL
HGV Movements	Negligible	NOEL
Excavation	Negligible	NOEL
NSR16: Approximately 25m from the nearest development plot of Application 4		
Vibratory Rollers – start up	Medium to High	SOAEL
Vibratory Rollers – steady state	Negligible	NOEL

Vibration generating activity	Magnitude of impact	NPSE classification
HGV Movements	Negligible	NOEL
Excavation	Negligible	NOEL

Changes in road traffic noise as a result of construction phase development generated traffic

The results of the Transport Assessment have been used as the basis for determining the change in noise levels arising on existing roads as a result of construction traffic. Road traffic noise calculations have been carried out in accordance with CRTN, being undertaken for a notional receptor location 10 m from the edge of the carriageway of each road considered. A notional receptor has been used because the change in traffic noise level adjacent to any given road will be the same at all distances where noise from that route is dominant. Traffic noise calculations have been undertaken to establish the change in the daytime $L_{A10,18hr}$ noise level for the worst case number of daily trips for each construction route, i.e. Q1-Q2 in 2026 for construction traffic accessing the Site via Red Bank Road and Q1-Q2 in 2027 for construction traffic accessing the Site via Collyhurst Road.

Predictions have been undertaken for the following scenarios:

- Scenario C1: 2019 Baseline Without Proposed Development; and
- Scenario C2: 2019 Baseline With Proposed Development.

These changes in road traffic noise have been determined by subtracting the noise level determined for Scenario C1, from that determined for Scenario C2. The resulting change is therefore that associated with the additional construction traffic movements.

In practice, construction traffic will not occur until the year of commencement. Prevailing flows in that year are expected to be greater than the baseline year. Adopting the baseline year therefore represents a worst case in terms of the potential noise level changes that could arise. The assessment is also worst case in that it assumes that the full amount of construction traffic will occur on every link considered, rather than dispersing across the network.

In undertaking these calculations, traffic speeds have been set to the applicable speed limit for each route considered. The predicted road traffic noise levels are shown in **Table 13.27** for each considered link. The changes in road traffic noise due to worst-case numbers of construction traffic are shown in **Table 13.28** for each considered link.

Table 13.27: Predicted Road Traffic Noise Levels Resulting From Construction Traffic $L_{A10,18hr}$, dB

Route	Noise Level $L_{A10,18h}$ dB	
	Scenario 1	Scenario 2
Collyhurst Road	62.0	64.3
Cheetham Hill Road	69.7	70.3
A6010 Elizabeth St	68.5	68.7
A6010 Queens Rd	70.0	70.1
A665 Cheetham Hill Rd	69.2	69.5
Red Bank	66.2	67.4
A664 Rochdale Road	70.4	70.6

Table 13.28: Changes in Road Traffic Noise Levels Resulting From Construction Traffic, dB

Route	Noise Level Change
	Scenario 2 – Scenario 1
Collyhurst Road	2.3
Cheetham Hill Road	0.6
A6010 Elizabeth St	0.2
A6010 Queens Rd	0.1
A665 Cheetham Hill Rd	0.3
Red Bank	1.2
A664 Rochdale Road	0.2

Appendix 13.6

Operational Stage Noise Assessment

Appendix 13.6 Operational Stage Noise Assessment

Changes in road traffic noise as a result of operational phase development generated traffic

The assessment of development generated road traffic noise has followed the same principle of approach as the construction traffic noise assessment, only with the following scenarios considered:

- Scenario O1: 2019 Baseline Without Proposed Development.
- Scenario O2: 2029 Future Year With Application 5
- Scenario O3: 2029 Future Year With Application 5 and cumulative developments
- Scenario O4: 2032 Future Year With Application 4
- Scenario O5: 2021 Future Year With Application 4 and cumulative developments
- Scenario O6: 2032 Future Year With Proposed Development
- Scenario O7: 2032 Future Year With Proposed Development and cumulative developments

Scenarios 2 to 7 include flows arising from the development, natural traffic growth, and cumulative developments. None of these are represented within Scenario 1.

The changes in road traffic noise have been determined by subtracting the noise level determined for Scenario O1, from that determined for Scenario O2, Scenario O3, Scenario O4, Scenario O5, Scenario O6 and Scenario O7. The resulting change is therefore that associated with the additional development generated traffic movements.

In undertaking these calculations, traffic speeds have been set to the applicable speed limit for each route considered. The predicted road traffic noise levels are shown in **Table 13.29** for each considered link. The changes in road traffic noise due to construction traffic are shown in **Table 13.30** for each considered link.

Table 13.29: Predicted Road Traffic Noise Levels Resulting From Operational Stage Development Generated Traffic $L_{A10,18hr}$, dB

Route	Noise Level $L_{A10,18hr}$ dB						
	Scenario O1	Scenario O2	Scenario O3	Scenario O4	Scenario O5	Scenario O6	Scenario O7
A664 Rochdale Road	69.7	70.2	70.3	70.4	70.4	73.0	73.0
Collyhurst Road	62.0	62.5	62.6	62.5	62.6	68.3	68.3
A665 Great Ancoats Street	72.3	72.7	72.8	72.9	73.0	70.2	70.4
Ashton New Road	67.7	68.2	68.2	68.3	68.3	73.0	73.2
Cheetham Hill Road	69.7	70.1	70.3	70.2	70.4	72.6	72.9
Trinity Way	72.1	72.6	72.9	72.9	73.2	72.8	73.0
Trinity Way	71.7	72.2	72.5	72.5	72.7	69.4	69.4
Trinity Way	71.9	72.4	72.7	72.7	73.0	70.2	70.3
Bury New Road	68.7	69.2	69.2	69.3	69.4	72.6	72.9
A56 Bury New Road	69.6	70.0	70.1	70.2	70.2	64.4	65.2
Cheetham Hill Road	72.0	72.5	72.8	72.5	72.9	69.6	69.8
Corporation St	63.8	64.3	65.2	64.4	65.2	70.2	70.3
Miller St	68.9	69.3	69.6	69.6	69.8	69.2	69.2
A664 Rochdale Rd	69.7	70.1	70.3	70.2	70.3	65.9	66.0
Shudehill	68.7	69.1	69.2	69.2	69.2	69.2	69.2
Red Bank	63.6	64.6	64.8	65.5	65.6	70.5	70.5
A6010 Elizabeth St	68.5	68.9	69.0	69.2	69.2	69.7	69.9
A6010 Queens Rd	70.0	70.4	70.4	70.5	70.5	71.5	71.8
A665 Cheetham Hill Rd	69.2	69.6	69.8	69.7	69.9	73.2	73.3
A62 Oldham Rd	71.0	71.4	71.7	71.5	71.8	72.2	72.2
Great Ancoats St	72.5	73.0	73.0	73.1	73.2	67.1	67.2
A635 Ashton Old Road	71.7	72.1	72.1	72.2	72.2	62.7	62.7
Red Bank	66.2	66.8	66.9	67.1	67.1	67.1	67.1
Roger St	59.6	60.3	60.3	62.7	62.7	72.3	72.4
Lord St	65.2	65.9	65.9	66.9	66.9	67.3	67.7
Cheetham Hill Road	71.4	71.9	72.0	72.3	72.3	70.5	70.7
Corporation St	66.7	67.1	67.6	67.3	67.7	66.5	66.8

Route	Noise Level $L_{A10,18h}$ dB						
	Scenario O1	Scenario O2	Scenario O3	Scenario O4	Scenario O5	Scenario O6	Scenario O7
Corporation St	69.6	70.2	70.4	70.3	70.5	70.4	70.4
Dantzig St	64.6	65.7	66.0	66.1	66.3	71.1	71.2
Shudehill	69.8	70.3	70.3	70.4	70.4	71.5	71.6
Swan St	70.3	70.8	71.0	71.0	71.2	70.3	70.5
A664 Rochdale Rd	71.0	71.4	71.5	71.5	71.6	70.9	71.1
Angel St	69.6	70.1	70.3	70.2	70.5	71.3	71.4
Angel St	70.2	70.7	70.9	70.9	71.0	63.7	63.7
A664 Rochdale Rd	70.8	71.2	71.3	71.3	71.4	67.8	67.8
Bromley St	63.0	63.6	63.6	63.7	63.7	70.2	70.3
Livesey St	67.2	67.7	67.8	67.8	67.8	71.3	71.5
Bury New Road	69.6	70.0	70.1	70.2	70.2	73.9	73.9
A576 Middleton Road	70.8	71.2	71.4	71.3	71.4	73.8	73.9
A576 Middleton Road	73.4	73.8	73.9	73.9	73.9	68.5	68.5
A576 Middleton Road	73.2	73.6	73.7	73.8	73.9	71.1	71.1
Victoria Ave	67.9	68.4	68.4	68.5	68.5	83.5	83.5
A664 Rochdale Road	70.4	70.9	70.9	71.0	71.1	73.5	73.5
M60 Manchester Outer Ring Road	83.0	83.4	83.4	83.5	83.5	70.5	70.5
A663 Broadway	73.0	73.4	73.4	73.5	73.5	62.6	62.7
A62 Oldham Road	69.9	70.3	70.4	70.5	70.5	64.4	64.8
Dantzig St (East of Egress)	62.0	61.8	61.9	61.8	61.9	73.0	73.0
Dantzig St (West of Egress)	62.0	63.5	63.6	63.0	63.7	68.3	68.3

Table 13.30: Changes in Road Traffic Noise Levels Resulting From Operational Stage Development Generated Traffic, dB

Route	Noise Level $L_{A10,18h}$ dB					
	Scenario O2 - Scenario O1	Scenario O3 - Scenario O1	Scenario O4 - Scenario O1	Scenario O5 - Scenario O1	Scenario O6 - Scenario O1	Scenario O7 - Scenario O1
A664 Rochdale Road	0.5	0.5	0.6	0.7	0.7	0.7
Collyhurst Road	0.6	0.7	0.6	0.7	0.7	0.8
A665 Great Ancoats Street	0.5	0.5	0.7	0.7	0.7	0.8
Ashton New Road	0.4	0.4	0.5	0.5	0.5	0.5
Cheetham Hill Road	0.4	0.6	0.5	0.7	0.5	0.7
Trinity Way	0.5	0.8	0.8	1.0	0.9	1.1
Trinity Way	0.5	0.9	0.8	1.1	0.9	1.2
Trinity Way	0.5	0.8	0.8	1.1	0.9	1.1
Bury New Road	0.4	0.5	0.6	0.6	0.7	0.7
A56 Bury New Road	0.5	0.5	0.6	0.6	0.6	0.7
Cheetham Hill Road	0.5	0.8	0.5	0.9	0.6	0.9
Corporation St	0.4	1.3	0.5	1.4	0.5	1.4
Miller St	0.4	0.7	0.7	0.9	0.7	0.9
A664 Rochdale Rd	0.4	0.5	0.5	0.6	0.5	0.6
Shudehill	0.4	0.5	0.5	0.6	0.5	0.6
Red Bank	1.0	1.2	1.9	2.0	2.3	2.4
A6010 Elizabeth St	0.4	0.5	0.7	0.7	0.7	0.7
A6010 Queens Rd	0.4	0.4	0.5	0.5	0.5	0.5
A665 Cheetham Hill Rd	0.4	0.7	0.6	0.7	0.6	0.8
A62 Oldham Rd	0.4	0.7	0.5	0.8	0.5	0.8
Great Ancoats St	0.5	0.5	0.7	0.7	0.7	0.8
A635 Ashton Old Road	0.4	0.4	0.5	0.5	0.5	0.5
Red Bank	0.6	0.7	0.9	0.9	0.9	1.0
Roger St	0.7	0.7	3.1	3.1	3.1	3.1
Lord St	0.8	0.8	1.7	1.7	1.9	1.9
Cheetham Hill Road	0.5	0.6	0.8	0.9	0.9	1.0

Route	Noise Level L _{A10,18h} dB					
	Scenario O2 -	Scenario O3 -	Scenario O4 -	Scenario O5 -	Scenario O6 -	Scenario O7 -
	Scenario O1	Scenario O1	Scenario O1	Scenario O1	Scenario O1	Scenario O1
Corporation St	0.5	1.0	0.6	1.0	0.6	1.0
Corporation St	0.6	0.8	0.7	0.9	0.8	1.0
Dantzic St	1.1	1.3	1.4	1.7	1.9	2.1
Shudehill	0.4	0.5	0.6	0.6	0.6	0.6
Swan St	0.5	0.7	0.7	0.9	0.7	0.9
A664 Rochdale Rd	0.4	0.5	0.6	0.6	0.6	0.6
Angel St	0.5	0.7	0.7	0.9	0.7	1.0
Angel St	0.5	0.7	0.6	0.8	0.7	0.9
A664 Rochdale Rd	0.4	0.5	0.6	0.6	0.6	0.6
Bromley St	0.6	0.6	0.7	0.7	0.7	0.7
Livesey St	0.5	0.5	0.6	0.6	0.6	0.6
Bury New Road	0.5	0.5	0.6	0.6	0.6	0.7
A576 Middleton Road	0.4	0.6	0.5	0.7	0.6	0.7
A576 Middleton Road	0.4	0.5	0.5	0.6	0.5	0.6
A576 Middleton Road	0.4	0.5	0.5	0.6	0.5	0.6
Victoria Ave	0.4	0.4	0.5	0.5	0.5	0.5
A664 Rochdale Road	0.4	0.5	0.6	0.6	0.7	0.7
M60 Manchester Outer Ring Road	0.4	0.4	0.5	0.5	0.5	0.5
A663 Broadway	0.4	0.4	0.5	0.5	0.5	0.5
A62 Oldham Road	0.4	0.4	0.5	0.5	0.5	0.5
Dantzic St (East of Egress)	-0.1	-0.1	-0.2	0.0	0.6	0.8
Dantzic St (West of Egress)	1.5	1.6	1.1	1.7	2.4	2.8

Appendix 13.7

Noise Model Parameters

Appendix 13.7 Noise Model Parameters

An acoustic model of the Site and Proposed Development was created in DataKusttik GmbH CadnaA 2021 MR2 (64-bit). The following approach was adopted in generating the noise model:

- Open source LIDAR Composite DTM (Digital Terrain Model) raster elevation data at 2m spatial resolution topographic data is incorporated into the model for the existing application site and surrounding area, extending to encompass the nearest receptors.
- Topographical data supplied by the applicant has replaced the above DTM data within the Proposed Development redline boundary for the purposes of assessing the operational impact.
- Building facades are set to be acoustically reflective and the model includes second order reflections from solid structures.
- Existing buildings were incorporated based on Ordnance Survey (OS) mapping and aerial photography.
- Globally, ground absorption was set to $G = 0$ (100% acoustically reflective ground).
- The scheme layout and redline boundary plan was overlaid based on fixed Ordnance Survey six figure grid references. The receiver positions used in the model were representative of the residential spaces on each façade of the building and positioned at each floor level.
- The model was set to apply the prediction methodology set out in CRTN for road traffic noise sources and CRN for rail movements.
- The traffic flows, speeds and percentage HDV's for the future baseline noise assessment was based on the traffic data provided by the Project Transport Consultants for the worst case scenario, i.e. Scenario O7: 2032 Future + Proposed Development + Cumulative Development, i.e. 'With Scheme - Application 4 and Application 5 + cumulative developments'. The alignments and widths of road traffic noise sources were set based on Ordnance Survey MasterMap®.
- Method 3 of the TRL Project Report PR/SE/451/02 has been used to convert the predicted $L_{A10,18h}$ to the $L_{Aeq,16 \text{ hour}}$ for the daytime period (07:00-23:00 hours) and $L_{Aeq, 8 \text{ hour}}$ for the night-time period (23:00-07:00 hours).

Appendix 13.8

Noise Sources Contributing to the Prevailing
Sound Environment Across the Site

Appendix 13.8 Noise sources contributing to the prevailing sound environment across the Site

Transportation noise sources, i.e. road traffic on the surrounding local road network and train movements on the Victoria Station railway line to the south of the site, are the dominant sources affecting the Site during both daytime and night time periods. To predict the impact from these sources in the vicinity of the Proposed Development on the future noise sensitive receptors, a computer based noise model has been produced using the CadnaA® noise prediction software. The daytime $L_{Aeq,16hr}$ and night time $L_{Aeq,8hr}$ noise levels at the external façades of the Proposed Development have been predicted using the 3D model. Predictions have also been used to establish the maximum noise levels (L_{AFmax}) that will arise at the external façades.

The receiver positions used in the model were representative of the residential spaces on each façade of the building and positioned at each floor level. Based upon the results of the 3D model, the noise levels expected to be incident on the façades of the building have been calculated. It should be noted that the model did include the buildings of the committed and proposed Victoria Riverside development (application ref: 126944/FO/2020) situated on Dantzic Street to the west of the Site which is currently under construction and will potentially screen the Proposed Development.

The highest calculated noise levels on each building façade, together with the minimum sound performance requirements to be achieved, are presented in **Table 13.31**. The calculated values are the highest free-field noise levels at 1 m from each façade for the day and night-time assessment scenarios.

Table 13.31: Predicted daytime and night-time noise levels at the external façades of sensitive areas of the Proposed Development and minimum sound insulation performance requirements, free-field

Development Plot	Façade with the Highest Noise Level	Day (0700 – 2300 hrs) $L_{Aeq, 16 \text{ hours}}$ dB	Night (2300 – 0700 hrs) $L_{Aeq, 8 \text{ hours}}$ dB	Typical Night-time Maximum Noise Level L_{AFMax} dB	Minimum Sound Reduction Required, dB
Application 4					
RB01	Northern	53	45	56	18
RB02	Southern	52	43	53	17
RB03	Southern	49	42	53	14
RB04	Southern	50	43	53	15
RB05A	Western	45	48	56	18
RB05B	Southern	54	46	52	19
RB05C	Southern	50	43	51	15
RB06	South-eastern	58	50	65	23
RB07	South-eastern	57	50	63	22
RB10	Southern	68	63	81	36
RB12B	North-western	65	57	79	34
RB16	Southern	62	54	74	29
RB17	Southern	62	54	74	29
Application 5					
NT02 Amenity Clubhouse	North	62	NA	NA	27
NT02 Tower 1	South	64	59	81	36
NT03 Tower 2	North	61	54	75	30
NT03 Midrise 3	South	62	60	78	33
NT03 Tail 3	North	58	51	75	30
NT03 Tower 3	South	62	58	75	30
NT04 Building 1	South	61	58	72	28
NT04 Building 2	South	62	59	75	30

Development Plot	Façade with the Highest Noise Level	Day (0700 – 2300 hrs) L _{Aeq} , 16 hours dB	Night (2300 – 0700 hrs) L _{Aeq} , 8 hours dB	Typical Night-time Maximum Noise Level L _{AFMax} dB	Minimum Sound Reduction Required, dB
NT04 Building 3	North	61	53	75	30

Details and specifications of the external cladding systems and other façade elements are not confirmed at this stage. However, from the early stages of the design process, the sound insulation performances of the façades have been, and continue to be, one of the key performance requirements for the façade design. The sound insulation performance of the glazing and method of ventilation, i.e. the weakest elements of the building façade, will therefore be particularly important.

Based on the Detailed Plans for Application 5, calculations have been undertaken to determine the minimum sound reduction required in order that the internal ambient noise limits can be achieved. The requirements are shown in the Mitigation section below.

Mitigation

Based on the results of the noise modelling exercise (**Table 13.31**), the sound insulation requirements of the building façade elements have been calculated. The noise break-in calculations have been undertaken in accordance with the methodology presented in BS 12354:2000 *Building acoustics – Estimation of acoustic performance of buildings from the performance of elements* and with consideration to the latest proposed internal layout details for room type and building elevations for the Proposed Development where available, i.e. as provided by Project Architects for Application 5. The calculations are based on a reverberation time of 0.5 seconds for each apartment, which is considered typical for the finished and furnished residential spaces.

The specification of appropriate façade constructions, glazing and ventilation systems will be critical to ensuring the internal noise criteria are achieved. The proposed dwellings are to be mechanically ventilated with the use of Mechanical Ventilation Heat Recovery (MVHR) units and will have no requirement for trickle / through wall ventilators for background ventilation. The weakest point in the façade is likely to be the glazed elements under normal ventilation conditions.

Table 13.32 provides possible façade configurations for the glazing, closed rapid purge vents (which are glazed) and external door units for habitable rooms, capable of meeting the sound insulation performances required to achieve the adopted internal criteria across the development. The glazing, closed rapid purge vent and external door performance requirements are primarily dictated by the calculated night time maximum (L_{AF,max}) noise levels.

It should be stressed that the proposed configurations are to demonstrate that the specified minimum sound reduction indices are achievable. It should be noted that other configurations could be used if preferred, providing that they meet the required minimum sound reduction indices.

Table 13.32: Required sound reduction indices and example façade configurations (for guidance only)

Development Plot	Façade components	Minimum sound reduction index (dB) at Octave Band Centre Frequency (Hz)								Single Figure R _w / D _{n,e} (C _{TR}) (dB)	Possible Products (Indicative Only)
		63	125	250	500	1k	2k	4k	8k		
Plots nearest to Victoria Railway line, i.e. Plots RB10 of Application 4 and	Glazing (R)	18	24	22	29	39	33	38	32	32 (29)	Saint Gobain 4mm / 12mm / 4mm
	External Wall (R)	30	43	36	41	49	54	55	55	46 (43)	Brick (103mm) plastered

Development Plot	Façade components	Minimum sound reduction index (dB) at Octave Band Centre Frequency (HZ)								Single Figure R _w / D _{n,e} (C _{TR}) (dB)	Possible Products (Indicative Only)
		63	125	250	500	1k	2k	4k	8k		
NT-02 Tower 1 of Application 5	Ventilator (D _{n,e})	MVHR unit									
All other facades	Glazing (R)	16	22	20	26	36	39	31	25	31 (26)	Saint Gobain 4mm / 12mm / 4mm
	External Wall (R)	32	37	36	45	52	59	62	63	49 (44)	100mm concrete
	Ventilator (D _{n,e})	MVHR Unit									

Overheating for Application 5

Introduction

Under normal conditions it is expected that it will be possible to achieve appropriate internal ambient noise levels within the development using appropriately specified glazing. Application 5 is to rely on open rapid purge vents to provide relief from overheating. During these periods, a reliance on open windows (or large vents) to provide relief from overheating could lead to higher noise levels than usual in dwellings, which has the potential to adversely impact residents.

The Acoustics Ventilation and Overheating Residential Design Guide (the AVO Guide) has been used to inform an initial assessment of noise and overheating for Application 5. The AVO Guide proposes that, providing overheating only occurs part of the time, occupants may accept a trade-off between acoustic and thermal conditions if they have some control over their environment and own level of comfort, i.e. they may be more willing to accept a short-term increase in noise levels in order to achieve better thermal comfort.

The noise assessment indicates that noise levels at the Site are in the medium to high risk categories, at worst, according to the methodology in the AVO Guide presented in Figure 13.3. Therefore, there is a considered to be a potential high risk of adverse effects due to noise, should open windows or vents be relied upon to provide relief from overheating.

The overheating and noise assessment is an iterative process and relies on several inputs including:

- the noise levels at the site;
- the design of the buildings (e.g. size of window / vent openings / rooms etc.); and
- the frequency of overheating events that require windows or vents to be opened.

For the purpose of this assessment, it is important to differentiate between the different ventilation types, as they are subject to different criteria:

- Whole building ventilation is intended to be continuous to remove moisture and pollutants from the building, in buildings with mechanical ventilation systems the windows can typically be assumed to be closed for the purposes of assessing noise.
- Purge ventilation is manually controlled ventilation of spaces at a relatively high rate to rapidly dilute pollutants and / or moisture – as this is an occasional and temporary event it is usually assumed that internal noise levels can be higher than usual and no criteria are applied.
- Ventilation provision to control overheating has a specific set of noise criteria which are applied, set out in the AVO Guide and discussed in this Appendix.

The technical guidance within the AVO Guide has been used to inform the initial overheating assessment in this Appendix. The AVO Guide proposes that, providing overheating only occurs part of the time, occupants may accept a trade-off between acoustic and thermal conditions if they have some control over their

environment and own level of comfort; i.e. they may be more willing to accept a short-term increase in noise levels in order to achieve better thermal comfort.

In the case of the overheating condition, the effect of increased internal ambient noise from external noise sources will depend both on the absolute noise level and the amount of time for which the overheating condition occurs. The AVO Guide recommends that priority is given to minimising heat gains via the building design, in order to reduce the amount and duration of ventilation required to control overheating and the consequential effect from increased ingress of noise.

Provisions for Meeting Overheating Criteria

A large openable 'rapid purge vent' will be provided in each room, to provide relief from overheating by natural means which is considered a low-carbon solution compared with mechanical cooling systems.

The overheating assessment has demonstrated that it will not be necessary for the purge vent to be open during the night time (23:00-07:00hrs).

Potential Sound Reduction of Vent

It is currently understood that the vent has a free area circa. 0.8m^2 , does not contain any specific acoustic materials and does not provide a specific level of sound attenuation. The noise level difference (from outside to inside) of the vent has been estimated as the element normalised level difference ($D_{n,e}$) of the opening, calculated using the methodology in Annex D of BS 12354-3. Based on a vent size of 0.7m^2 , the opening in the façade would provide a $D_{n,e}$ of 12dB.

Considering the volume and sound absorption in typical rooms, the outside-to-inside level difference is calculated to be approximately as follows in two 'typical' rooms:

Table 13.33: AVO Guide Assumptions

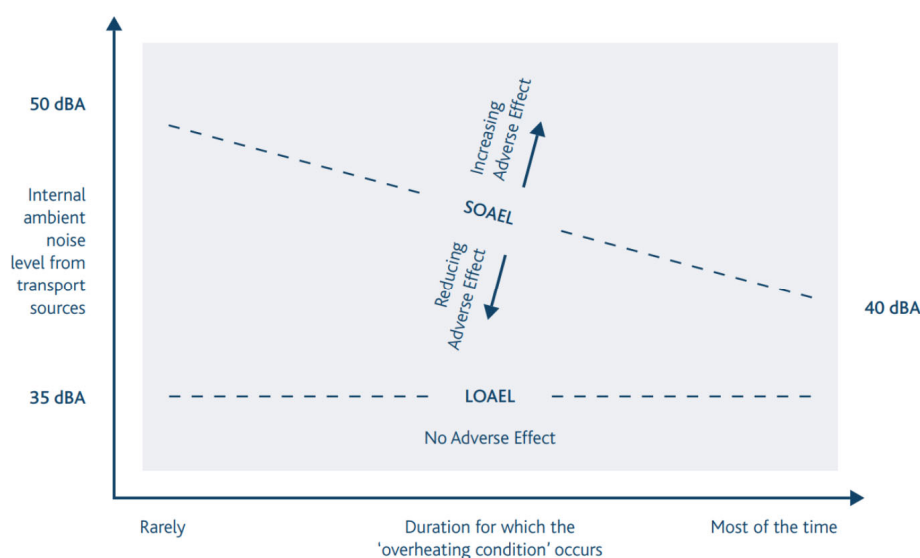
Room	Room volume (m^3)	Reverberation time (secs)	Vent open area (m^2)	Vent sound reduction ($D_{n,e}$ dB)	Outside-inside sound reduction with vent open (dB)
Living Rooms	120	0.5	0.8	11	-14
Bedroom	54	0.5	0.8	11	-10

Considering the low level of sound attenuation provided by the vent, noise breaking in through other elements of the façade would not contribute significantly to the internal noise level when the vent is open.

Daytime Assessment of Impact

The methodology described in the AVO Guide aims to weigh the internal noise level with vents open, against the duration that the vents are expected to be open. The method provides the graphs shown below, which are used to estimate the significance of the noise impact.

Figure 13.3: AVO Guide Assumptions of Adverse Impact - Daytime



Only daytime impacts are considered as the overheating assessment has demonstrated that it will not be necessary for the vent to be open between 23:00hrs and 07:00hrs.

For the purpose of this assessment, it has been assumed that the vents may need to be open for up to 15% of the daytime period, i.e. up to approximately 2.25 hours over the daytime period during the overheating period. Assuming the calculated sound reductions provided when the vent is open, and the opening durations, the suitability of the proposed vent has been determined for different ranges of external noise levels as follows (using the SOAEL graph in Figure 13.3 above).

Table 13.34: Suitability of Proposed Purge Vent Criteria

Suitability of proposed vent for providing relief from overheating	Predicted external noise level	
	Bedroom, dB $L_{Aeq,16hr}$	Living Room, dB $L_{Aeq,16hr}$
Purge vent suitable (internal levels < SOAEL)	≤ 59	≤ 63
Purge vent may be unsuitable based on current opening duration	60-65	64-69
Purge vent unsuitable regardless of opening duration	> 65	> 69

The categories in the table above can be interpreted as follows:

- Green - The purge vent is deemed suitable at these external noise levels, because internal noise levels would be below the SOAEL.
- Orange – Based on the current purge vent opening durations, the vent may not be suitable in this range of external noise levels because internal noise levels would be above the SOAEL. However, if the opening duration could be reduced, the vent may be suitable.
- Red - The vent is not suitable at these external noise levels because internal noise levels would be above the SOAEL regardless of the opening durations.

The above noise level ranges above have been mapped onto the various façades of the proposed residential buildings, to indicate the potential suitability of the proposed ventilation design for providing relief from overheating in the flats for different parts of the façades.

Table 13.35: Predicted daytime noise levels at the external façades of sensitive areas of the Proposed Development and Suitability of Proposed Purge Vent

Development Plot	Façade with the Highest Noise Level	Range of Predicted Daytime Noise Levels (0700 – 2300 hrs) $L_{Aeq, 16 \text{ hours}}$ dB	Suitability of proposed vent for providing relief from overheating in Bedrooms		Suitability of proposed vent for providing relief from overheating in Living Rooms	
			Floor at which Purge Vent suitable, i.e. predicted external noise levels are ≤ 59 dB $L_{Aeq, 16 \text{ hour}}$	Floors Purge Vents may be unsuitable i.e. predicted external noise levels are between 59 and 65 dB $L_{Aeq, 16 \text{ hour}}$	Floor at which Purge Vent suitable, i.e. predicted external noise levels are ≤ 63 dB $L_{Aeq, 16 \text{ hour}}$	Floors Purge Vents may be unsuitable i.e. predicted external noise levels are between 63 and 68 dB $L_{Aeq, 16 \text{ hour}}$
NT02 Tower 1	South	56-64	24+	Up to Floor 23	11+	Up to Floor 11
NT03 Tower 2	North	52-61	5+	Up to floor 5	All Floors	NA
NT03 Midrise 3	South	61-62	NA	All Floor	All Floors	NA
NT03 Tail 3	North	54-58	All Floors	NA	All Floors	NA
NT03 Tower 3	South	57-62	25+	Up to Floor 24	All Floors	NA
NT04 Building 1	South	55-61	20+	Up to Floor 19	All Floors	NA
NT04 Building 2	South	59-62	NA	All Floors	All Floors	NA
NT04 Building 3	North	54-61	4+	Up to Floor 3	All Floors	NA

Conclusions

The building design assumes that the purge vent will remain closed at night whilst providing acceptable thermal conditions internally, evidenced through thermal modelling. Therefore, any adverse impacts due to noise ingress during overheating conditions will be limited to the daytime. This is in line with the planning requirements of MCC (assuming the façade with closed windows provides a sufficient level of sound insulation).

For substantial proportions of the façades of Application 5, the purge vent is deemed suitable based on the predicted daytime external noise levels, because internal noise levels would be below the SOAEL.

There are portions of the residential façades, where, the rapid purge vents may not be suitable for providing relief from overheating according to the AVO Guide. When the vents are used for the required opening durations to mitigate overheating they could generate adverse effects for future occupants during the daytime, particularly in bedrooms.

In the most affected areas other methods of providing relief from overheating will be utilised. These methods may include internal blinds, the MVHR system operating in boost during peak summer periods and purge fans which will provide additional air volumes to a limited number of south facing dual aspect Living/Kitchen/Dining spaces. The intention is to enable acceptable thermal conditions to be provided through the year and minimise the need to open purge vents, maintaining acceptable internal noise levels for occupants during the overheating period. The details of this strategy will be developed during the detailed design stages.