Appendix 7.1

GLOSSARY OF ACOUSTIC TERMINOLOGY

NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20Hz (deep bass) to 20,000Hz (high treble) and over the audible range of 0dB (the threshold of perception) to 140dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc, according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

ACOUSTIC TERMINOLOGY

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 ($2x10^{-5}$Pa).

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 $L_{Amax,F}$.

L_{10} and L_{90}: 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 L_{10} is the level exceeded for 10% of the time, and the L_{90} 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 1m 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 L_{A90} 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, $L_{Ar,Tr}$: 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 7.2

LEGISLATION, POLICY AND GUIDANCE

LEGISLATION, POLICY AND GUIDANCE

LEGISLATION

CONTROL OF POLLUTION ACT 1974

Sections 60 and 61 of the COPA give local authorities 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. These powers may be exercised either before works start (Section 61) or after they have started (Section 60). Section 61 is a prior consent process whereby approval is sought for the completion of construction works following prescribed methods, whilst Section 60 affords Local Authorities means of control of construction noise where a Section 61 has not previously been agreed.

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.

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 Organisation. 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 February 2019, 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:

> *"170. 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;"

> *"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[60];

- 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 60 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:

> "*182. 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.

LOCAL PLANING POLICY

NORTH WARWICKSHIRE BOROUGH COUNCIL LOCAL PLAN 2021

The North Warwickshire Local Plan was adopted on 29 September 2021. It sets out the main policies to govern and manage development across the Borough including housing, commercial and industrial property, community facilities and services.

Policy LP29, Criterion 9 (*Development Considerations) states that "development should avoid and address unacceptable impacts upon neighbouring amenities through, inter alia, noise and other pollution'*.

GUIDANCE

PLANNING PRACTICE GUIDANCE (PRACG)

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 in Table 7.2-1.

Table 7.2-1 - Noise exposure hierarchy 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. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
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.	Significant Observed Adverse Effect	Avoid

Response	Examples of outcomes	Increasing effect level	Action
	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.		
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

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 7.2-2 and the '5 dB(A) change' method under that table.

Table 7.2-2 - 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 7.2-3.

Table 7.2-3 - 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 7.2-4. It should be noted that the values presented within Table 7.2-4 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 7.2-4 - 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	
	4Hz to 16Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at Hz and above	50mm/s at Hz and above

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4Hz to 16Hz	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.		

BS 4142:2014+A1:2019: METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND

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: +2 dB for a 'just perceptible' tone, +4 dB for a 'clearly perceptible' tone, and rising to +6 dB for a 'highly perceptible' tones;
- Impulsivity (rapidity of change and overall change in level): +3 dB for 'just perceptible' impulsivity, +6 dB 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 +10 dB or more is likely to be indicative of significant adverse impact, depending on context;
- A difference of around +5 dB 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 in 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 residuals purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
- Façade insulation on treatment;
- Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
- Acoustic screening.

NOISE ADVISORY COUNCIL. A GUIDE TO MEASUREMENT AND PREDICTION OF THE EQUIVALENT CONTINUOUS SOUND LEVEL LEQ (NAC)

The NAC presents general procedures to be followed for the measurement and prediction of L_{eq} noise levels from a number of different sources. Section 2.5 of the document details a method for calculating the L_{eq} noise level from the combined effect of a number of events (e.g. HGV pass-bys) with their own single event noise exposure level (L_{AX}, also commonly referenced as the SEL).

The calculation is used in conjunction with Fig 4.1.4 of the document, duplicated in the diagram below, to determine the L_{AX} (SEL) at a distance of 10m from the nearside kerb edge, for heavy and light vehicles travelling at different speeds.

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 DMRB categorises operational road traffic noise into magnitude of change bands. The short and long term classification scales are provided in the tables below.

Table 7.2-5 - Magnitude of change – short term

Short term magnitude	Short term noise change (dB $L_{A10,18h}$ or L_{night})
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 7.2-6 - Magnitude of change – long term

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

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.

CALCULATION OF ROAD TRAFFIC NOISE (CRTN) MEMORANDUM 1988

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 $L_{A10,18hr}$ or $L_{A10,1hr}$ 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.

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B1 1RT

Appendix 7.3

NOISE SURVEY

NOISE SURVEY

Baseline conditions at locations representative of the closest noise sensitive receptors have been determined by noise survey. The locations and durations were agreed with North Warwickshire Borough Council's (NWBC) Environmental Health department. The results of the baseline noise survey are considered to be representative and robust.

EQUIPMENT

The survey was carried out using Class 1 measurement equipment, as detailed in Table 7.3-1. The equipment was calibrated at the start and end of the survey with no significant drift in calibration noted. Measurement locations are described in Table 7.3-2 and shown in **Figure 7.1 - Noise measurement locations and sensitive receptors**.

Table 7.3-1 – Summary of Equipment

WSP Equipment ID	Description	Manufacturer & Type	Serial No.	Calibration Due Date
DUO 3	Sound Level Meter	01 dB-Metravib DUO	10617	13 October 2021
	Pre-amplifier	01 dB Metravib PRE 22	10180	
	Microphone	GRAS 40CD	162036	
	Calibrator	01 dB-Stell CAL 21	34924010	24 July 2021
DUO 4	Sound Level Meter	01 dB-Metravib DUO	10636	13 May 2021
	Pre-amplifier	01 dB Metravib PRE 22	10183	
	Microphone	GRAS 40CD	162036	
	Calibrator	01 dB-Stell CAL 21	34924015	18 February 2021
Norsonic 140	Sound Level Meter	Norsonic Nor140	1403761	18 November 2020
	Pre-amplifier	Norsonic Pre-amplifier	1209/13003	
	Microphone	Norsonic Condenser Microphone	1225/106921	
	Calibrator	Norsonic Type 1251 Calibrator	32541	08 January 2021

Table 7.3-2 – Summary of Measurement Locations and Receptors

Location	Latitude & Longitude	Equipment ID	Description/Identified Receptor	Purpose
MP1	52.608925, -1.631480	DUO3	Unattended measurement position. Located on the northern application boundary, approximately 5m from the garden of dwellings on Birch Grove.	To determine baseline sound levels representative of Birchmoor Village.
MP2	52.601819, -1.631074-	DUO4	Unattended measurement position. Located outside of the Site boundary but within applicant owned land, approximately 40m from the garden of dwellings on A5, Watling Street and 15m from the A5 carriageway edge.	To determine baseline sound levels representative of dwellings adjacent to the A5.
MP3	52.609149, -1.634097	NOR140	Attended measurement position located at the north western area of the Site, approximately 20m from the garden of dwellings on Birch Grove.	To determine any differences of background sound levels between the unattended measurement position and dwellings situated closer to the M42
MP4	52.606188, -1.631047	NOR140	Attended measurement position located at the eastern boundary of the Site at the corner of the public bridleway.	To obtain sound levels in order to establish background noise levels at dwellings off Birchmoor Road.
MP5	52.605972, -1.629927	NOR140	Attended measurement position approximately 80m further east to MP4.	To obtain sound levels in order to establish background noise levels at dwellings off Birchmoor Road.

UNATTENDED HISTOGRAM CHARTS

Figure 7.3-1 - MP1 Daytime (07:00 - 23:00) $L_{A90,1hr}$ histogram

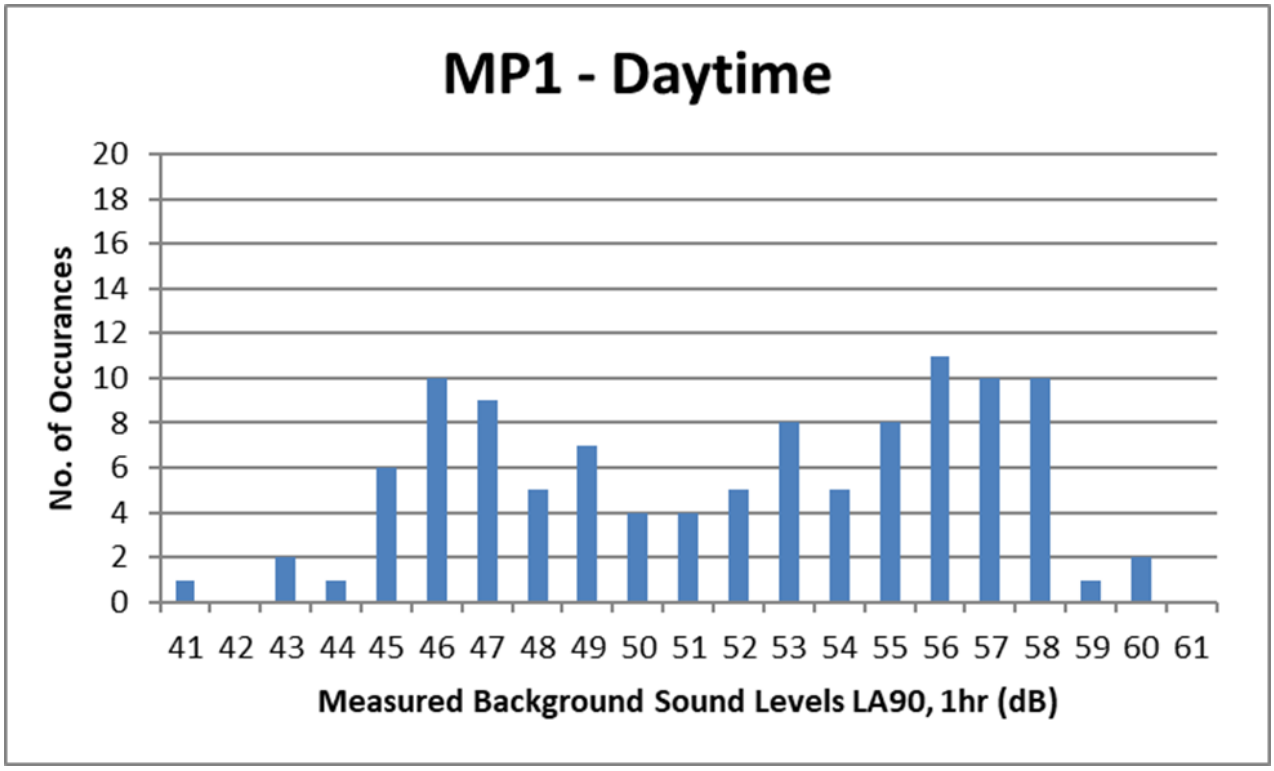


Figure 7.3-2 – MP2 Daytime (07:00 - 23:00) $L_{A90,1hr}$ histogram

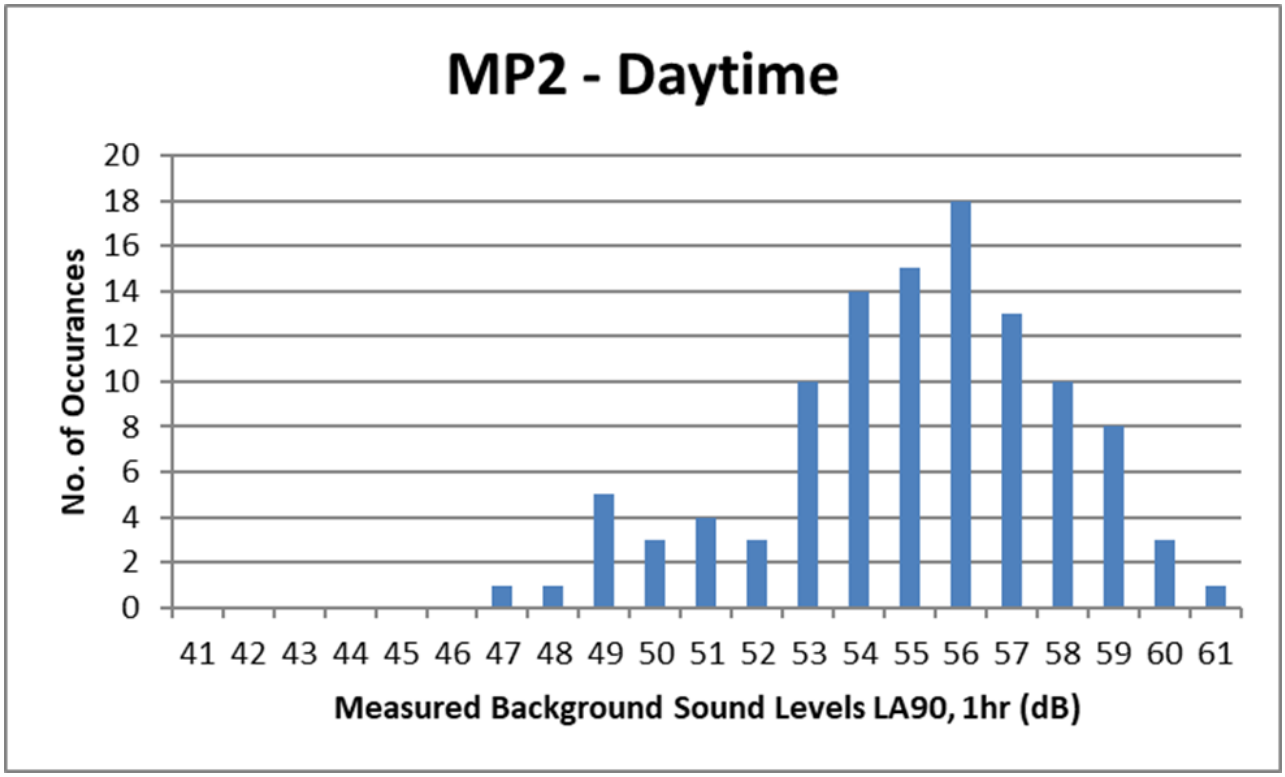


Figure 7.3-3 – MP1 Night-time (23:00 - 07:00) $L_{A90,15mins}$ histogram

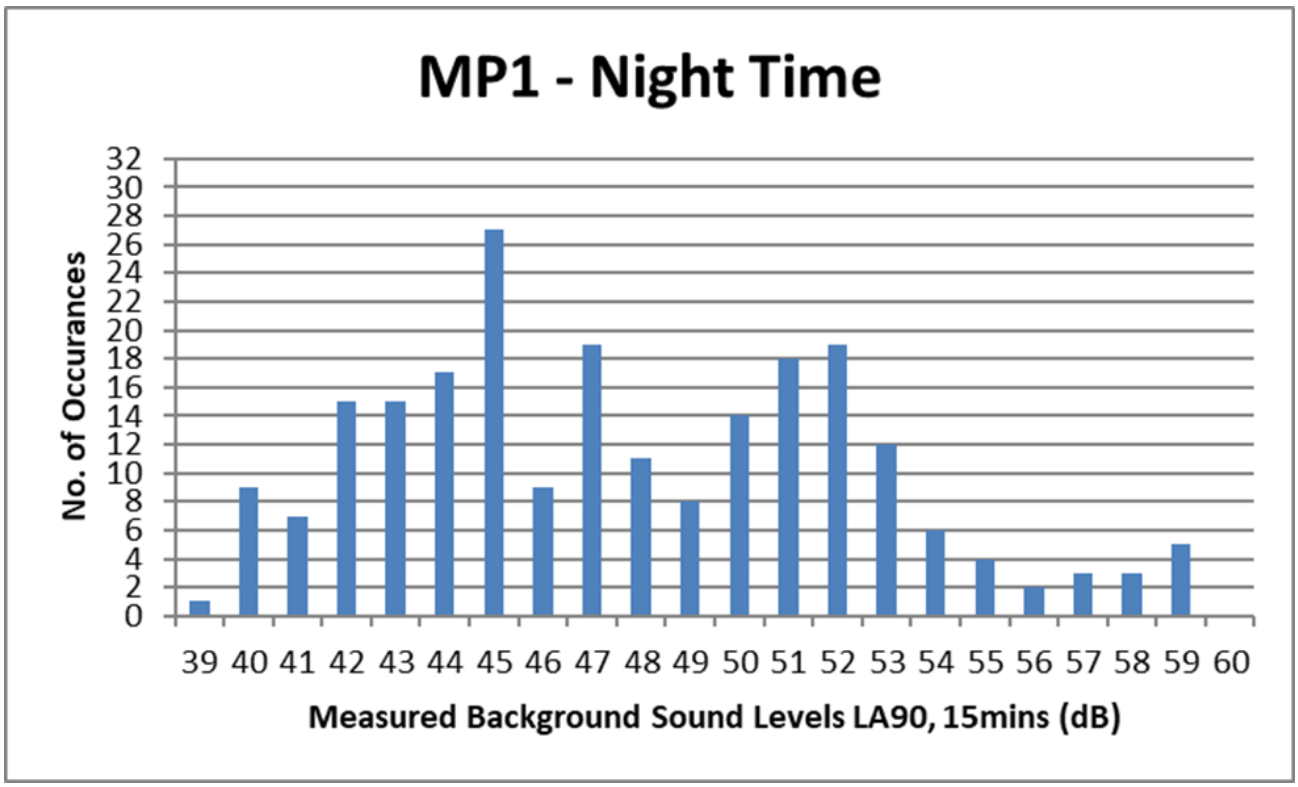
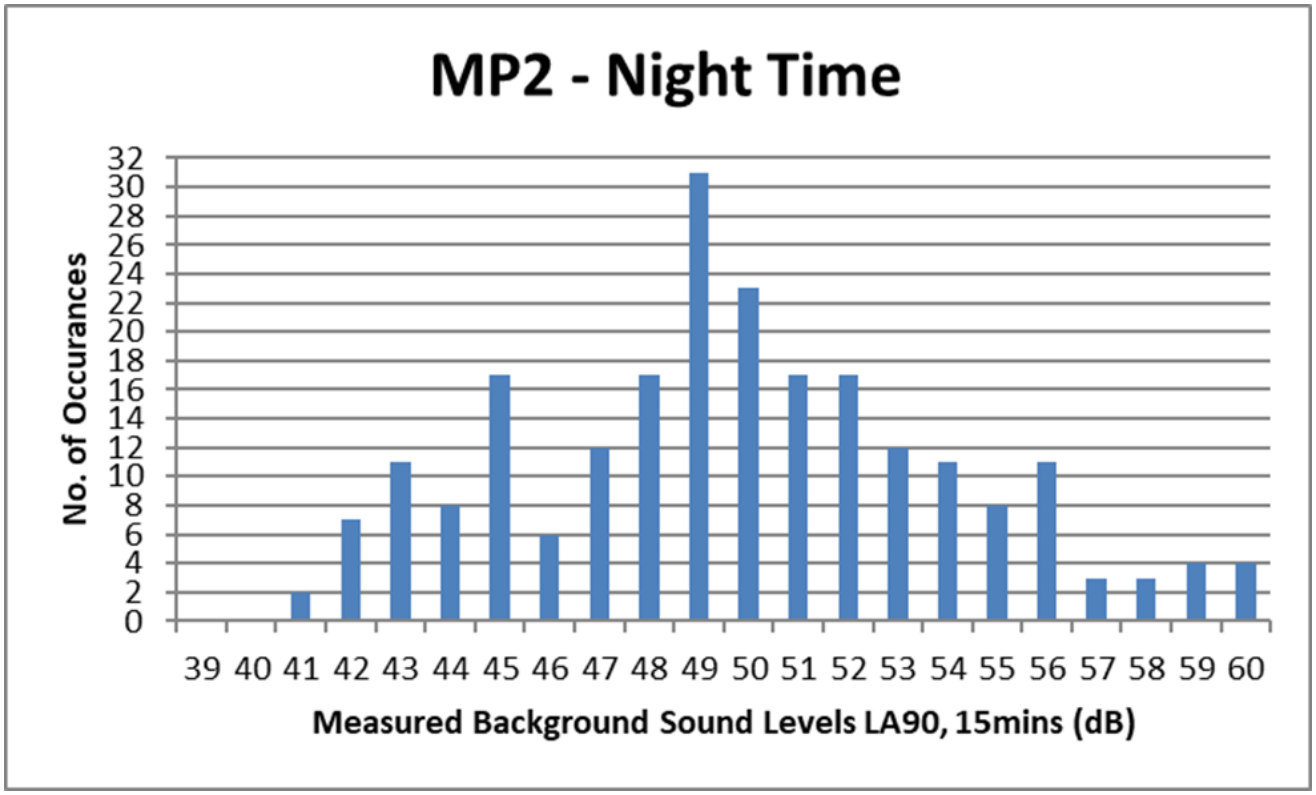


Figure 7.3-4 – MP2 Night-time (23:00 - 07:00) $L_{A90,15mins}$ histogram



BACKGROUND SOUND LEVEL DATA ANALYSIS

The measured noise levels have been analysed to determine the day and night-time background sound level for weekday and weekend periods. The methodology used follows the statistical approach presented in BS 4142. The noise indices in Error! Reference source not found. and Error! Reference source not found., in conjunction with the spread of noise levels (Error! Reference source not found. to Error! Reference source not found.), are used to determine the representative background sound level.

Table 7.3-3 – MP1 Background Sound Levels, dB(A)

Noise Index/Indicator	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Maximum $L_{90,\,T}$[1]	60	59
Minimum $L_{90,\,T}$[1]	41	39
Log Average $L_{90,\,T}$[1]	54	50
Linear Average $L_{90,\,T}$[1]	52	48
Most Commonly Occurring $L_{90,\,T}$[1]	56	45
Selected Representative Value	**46**[2]	**45**

[1] T = 1 hour for the daytime and 15 minutes for the night-time.

[2] A conservative background sound level has been selected based on the statistical analysis, this value is lower than both the logarithmic and arithmetic average for the period.

Table 7.3-4 – MP2 Background Sound Levels, dB(A)

Noise Index / Indicator	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Maximum $L_{A90,T}$[1]	61	60
Minimum $L_{A90,T}$[1]	47	41
Log Average $L_{A90,T}$[1]	56	52
Linear Average $L_{A90,T}$[1]	55	50
Most Commonly Occurring $L_{A90,T}$[1]	56	49
Selected Representative Value	**56**	**49**

[1] T = 1 hour for the daytime and 15 minutes for the night-time

UNATTENDED AMBIENT SOUND LEVEL RESULTS SUMMARY

Table 7.3-5 – MP1 Ambient Sound Levels during construction periods, dB(A)

Date	Weekdays (07:00 – 19:00) $L_{Aeq, 12hr}$	Weekends (0700 – 13:00) $L_{Aeq, 6hr}$
Friday 9 October[1]	59	-
Saturday 10 October	-	59
Sunday 11 October	-	53
Monday 12 October	59	-
Tuesday 13 October	56	-
Wednesday 14 October	49	-
Thursday 15 October	51	-
Friday 16 October[2]	51	-
Logarithmic Average	**56**	**57**

[1] Measurement commenced at 09:00, T = 10hrs

[2] Measurement ended at 11:00, T = 4hrs

Table 7.3-6 – MP2 Ambient Sound Levels during construction periods, dB(A)

Date	Weekdays (07:00 – 19:00) $L_{Aeq, 12hr}$	Weekends (0700 – 13:00) $L_{Aeq, 6hr}$
Friday 9 October[1]	64	-
Saturday 10 October	-	63
Sunday 11 October	-	62
Monday 12 October	64	-
Tuesday 13 October	65	-
Wednesday 14 October	65	-
Thursday 15 October	65	-
Friday 16 October[2]	65	-
Logarithmic Average	**65**	**63**

[1] Measurement commenced at 10:00, T = 9hrs

[2] Measurement ended at 11:15, T = 4hrs

ATTENDED BACKGROUND SOUND LEVEL RESULTS SUMMARY

Table 7.3-7 – Attended Background Sound Level Results Summary, dB(A)

Measurement Position/Noise Index	Friday 9 October 2020 (Daytime)	Tuesday 13 October 2020 (Night-time)	Friday 16 October 2020 (Daytime)
MP1 - $L_{90, 15min}$	56	43	43
MP3 - $L_{90, 30min}$	58	44	50
MP4 - $L_{90, 30min}$	55	42	49
MP5 - $L_{90, 30min}$	53	40	48

ATTENDED AMBIENT SOUND LEVEL RESULTS SUMMARY

Table 7.3-8 – Attended Ambient Sound Level Results Summary, dB(A)

Measurement Position/Noise Index	Friday 9 October 2020 (Daytime)	Tuesday 13 October 2020 (Night-time)	Friday 16 October 2020 (Daytime)
MP1 – $L_{Aeq, 15min}$	59	45	45
MP3 – $L_{Aeq, 30min}$	60	48	52
MP4 – $L_{Aeq, 30min}$	57	44	51
MP5 – $L_{Aeq, 30min}$	56	42	50

ATTENDED OBSERVATIONS

During the attended surveys the following subjective impressions were noted:

Table 7.3-8 – Attended Observations

Date & Time	Location	Observations
Friday 9 October 2020 10:02 – 10:32	MP4	▪ Steady road traffic noise from the M42 to the south west; ▪ Wind rustling in trees.
Friday 9 October 2020 10:52 – 11:22	MP5	▪ Steady road traffic noise from the M42 to the south west; ▪ Wind rustling in trees.
Friday 9 October 2020 11:30 – 12:00	MP3	▪ Road traffic noise from the M42 to the west; ▪ Birdsong.

Date & Time	Location	Observations
Friday 9 October 2020 12:03 – 12:18	MP1	▪ Road traffic noise from the M42 to the west; ▪ Dogs barking throughout duration of measurement in the distance towards the north.
Tuesday 13 October 2020 23:00 – 23:30	MP4	▪ Road traffic noise from the M42 to the north-west; ▪ Wind rustling in trees.
Tuesday 13 October 2020 23:32 – 00:02	MP5	▪ Road traffic noise from the M42 and Birchmoor road to the north.
Wednesday 14 October 2020 00:16 – 00:46	MP3	▪ Road traffic noise from the M42 to the north, west and from the A5 to the south.
Friday 16 October 2020 09:07 – 09:37	MP4	▪ Road traffic noise from the M42 to the north and the A5 to the south; ▪ Low rumble from J10 of M42; ▪ Farm work/plant audible in field to north-east.
Friday 16 October 2020 09:40 – 10:10	MP5	▪ Road traffic noise from the M42 to the north and the A5 to the south; ▪ Birdsong.
Friday 16 October 2020 10:15 – 10:45	MP3	▪ Road traffic noise from M42 to the west; ▪ Helicopter overhead for approximately 2 minutes.

WEATHER CONDITIONS

Weather conditions throughout the survey have been observed through the Met Office. The nearest weather station to the Site is Polesworth, approximately 1.3km to the north-east. Wind speeds were between 0-3m/s, with a changing wind direction. There were several periods of light rain recorded during the survey period, however, these did not affect the measured noise levels.

NOISE DATA COMPARISONS

At all locations road traffic noise is the dominant source. The survey results have been reviewed and compared against Defra Strategic Noise Mapping and against results published in nearby Environmental Statements. Monitored noise levels are consistent with expected road traffic noise propagation across the Site.

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Appendix 7.4

CONSTRUCTION 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.

Standard construction working hours are assumed to be 07:00 to 19:00 hours, with no working on Saturdays, Sundays or Bank Holidays. Drawing on the results of the baseline noise survey, daytime construction noise thresholds have been determined for each receptor in association with the BS 5228-1 'ABC method'.

Table 7.4-1 - Construction noise thresholds

Receptor	Ambient sound level ($L_{Aeq,T}$) in dB(A)	Construction threshold ($L_{Aeq,T}$) in dB(A)
Birchmoor Village	56	65 (Category A)
Dwellings on A5	65	70 (Category B)
Dwellings off Birchmoor Road	53	65 (Category A)

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 professional experience of similar developments.

The key construction stages are:

- Site Setup;
- Earthworks;
- Piling;
- Building construction; and
- Roadworks.

Construction phases 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.

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 7.4-2. The table details the source information and sound pressure level attributed to each plant item.

Table 7.4-2 - Construction working stages and plant items

Plant Item	BS 5228-1 Ref.	SPL @ 10m (dBA)	No. of Items Operating in Parallel	On-Time (% of working day)
Site Setup				
Hiab	C2.27	80	1	50
Excavator	C2.5	76	2	50
2T Dumper	C4.9	77	2	50
Fork Lift	WSP Library	72	2	25
Sweeper	C4.90	76	1	20
Pick Up	WSP Library	67	2	25
Tractor/Post Hole Digger	D10.199	75	2	40
Wheel-wash	WSP Library	65	3	10
Excavation				
Tracked Excavator	C1.13	86	1	60
Tipper Lorry	C8.20	80	1	50
Excavator	C2.3	78	1	50
Vibratory Roller	C2.40	67	2	10
Wheel-wash	WSP Library	65	3	10
Piling				
10T Dumper	C4.7	77	2	50
Mobile Crane	C4.46	67	1	40
Rotary Bored Piling Rig	C3.14	84	1	75
Excavator	C4.64	75	2	50
Concrete Pump	C3.25	78	2	50
Wheel-wash	WSP Library	65	3	10

Plant Item	BS 5228-1 Ref.	SPL @ 10m (dBA)	No. of Items Operating in Parallel	On-Time (% of working day)
Building construction				
Tower Crane	C4.48	77	1	20
Concrete Pump	C3.25	78	2	20
Compressor & Vibrator Poker	C4.33	79	3	10
Goods Hoists	C4.61	68	2	95
Personnel Hoists	C4.62	66	2	55
Mobile Platform	C4.57	67	4	50
4-tool Compressor	C3.19	75	2	20
Wheel-wash	WSP Library	65	3	10
Roadworks				
Breaker	C5.3	82	1	33
Surfacer	C5.30	76	2	33
Compactor/Roller	C5.20	75	2	33
Hiab	C2.27	80	1	33
Wheel-wash	WSP Library	65	1	10

Construction noise level calculations and assessment has completed at the closest noise sensitive receptors:

- Receptor R01 - Birchmoor Village;
- Receptor R02 - Dwellings on A5 Watling Street; and
- Receptor R03 - Dwellings off Birchmoor Road.

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 30m inside the Site boundary, closest to each receptor. This approach is considered to represent a realistic worst-case scenario because due to the size and orientation of the site, the majority of the construction works will occur further away.

Construction noise at sensitive receptors is calculated using the BS 5228-1 method, using the following assumptions:

- 100% soft ground between source and receiver;
- No screening between source and receiver;
- Source height 1.5m above ground;
- Receiver height 4.0m above ground (first floor height); and
- Predicted levels are quoted as free-field (i.e. 3dB façade reflection correction is not added).

Table 7.4-3 sets out the resulting construction noise levels calculated for each receptor.

Table 7.4-3 - Predicted construction noise levels, $L_{Aeq, 12hr}$ dB

Receptor	Construction working stage				
	Site Setup	Excavation	Piling	Building construction	Roadworks
R01 Birchmoor Village	61	64	63	59	60
R02 Dwellings on A5	44	47	45	42	43
R03 Dwellings off Birchmoor Road	63	66	65	61	62

The predicted construction noise levels have been compared against threshold criteria for each receptor. The results are given in Table 7.4-4, a negative value represents compliance, a positive value represents an exceedance.

Table 7.4-4 - Construction noise compliance, dB

Receptor	Construction working stage				
	Site Setup	Excavation	Piling	Building construction	Roadworks
R01 Birchmoor Village	-4	-1	-2	-6	-5
R02 Dwellings on A5	-26	-23	-25	-28	-27
R03 Dwellings off Birchmoor Road	-2	+1	0	-4	-3

It can be seen from Table 7.4-4, that for all working stages and receptors, the construction noise assessment criteria are met, with the exception of excavation out works at receptor R03, where an exceedance of +1dB is identified.

Where the predicted noise levels do not exceed the assessment thresholds (during all works at receptors R01 and R02), there will be a direct, temporary, local adverse **negligible** impact**.** This effect is **not significant**. In addition, the NPSE classification is NOEL.

For receptor R03, during excavation works (30m from the Site boundary), an exceedance of +1dB above the threshold is predicted. The magnitude of impact is **minor** and the NPSE Classification is LOAEL. The effect would be short-term, direct and temporary. It is assumed that the duration of exceedance would be short, i.e. not in excess of a period of 10 or more days in 15 consecutive days or for a total number of days exceeding 40 in a six month period. The effect is therefore **not significant.**

It is recognised that occasionally, higher construction noise level could arise, for example, if works are required within 30m of the site boundary at the closest point to sensitive receptors. However, such works would be occasional, of short duration and therefore not significant.

It is also recognised that the noise levels would be dependent upon the final masterplan that is brought forward. For example, higher noise levels could arise if buildings are moved closer to the R03 group of receptors or if extended night-time working is required.

WEEKEND WORKS

It is understood that North Warwickshire Borough Council (NWBC) do not normally permit weekend working. However, the results of the assessment show it is likely that construction noise thresholds could be met without stringent mitigation measures.

For works required to be completed outside normal hours the appointed Contractor may apply for prior consent under Section 61 of the Control of Pollution Act 1974. Applications would include details of the works, locations, timings, plant and mitigation measures.

MITIGATION

Significant adverse effects are not predicted, however, consideration has been given to mitigation measures to reduce impact of construction noise and which would allow greater margins of compliance.

The adoption of Best Practicable Means (BPM), as defined in Section 72 of the *Control of Pollution Act 1974*, is usually the most effective means of controlling noise from construction sites. Such measures would be included within a Construction Environmental Management Plan (CEMP), to which the appointed contractor will be required to comply. Appropriate measures include:

- The contractor and their sub-contractors will at all times apply the principle of BPM as defined in Section 72 of the Control of pollution act 1974 and carry out all work in such a manner as to avoid or reduce any disturbance from noise (and vibration) as far as is practicable.
- Guidance given in BS 5228-1 (Section 8: *Control of noise and Annex B: Noise sources, remedies and their effectiveness*) will be followed as far as is practicable and advice and training on noise minimisation given to staff during Site induction procedures.
- All plant brought on to Site will comply with the relevant EC/UK noise limits applicable to that equipment or should be no noisier than would be expected based on the noise levels quoted in BS 5228-1. Each plant item will be well maintained and operated in accordance with manufacturers' recommendations and in such a manner as to minimise noise emissions.

- Electrically powered plant will be preferred, where practicable, to mechanically powered alternatives.
- The use of sound reduced plant fitted with suitable silencers, or operated within enclosures will be preferred.
- Pneumatic tools will be fitted with silencers or mufflers.
- Deliveries to Site will be programmed and routed to minimise disturbance to local residents.
- Items of plant operating intermittently will be shut down in the periods between use.
- Where feasible, all stationary plant will be located so that the noise effect at receptors is minimised and, if practicable, every item of static plant, when in operation, will be noise attenuated using methods based on the guidance and advice given in BS 5228-1.
- Careful selection of construction methods and plant will be implemented and utilised, for example, breaking-out of concrete structures using, where possible, low noise methods such as munching or similar, rather than percussion breaking.
- Temporary acoustic barriers and other noise containment measures such as screens, sheeting and acoustic hoarding at the Site boundary (and where required around individual plant) will be erected where appropriate to minimise noise breakout and reduce noise levels at potentially affected receptors.
- There will be a considerate and neighbourly approach to relations with local residents.
- The site manager, or other appointed site representative, will be responsible for logging all received environmental noise and vibration comments/complaints, as well as the action that is taken in response to each point raised, and whether this was successful. Where not successful, supplementary actions will be carried out and resulting effects logged. The contact details for the site representative will be openly advertised so that local residents have a point of contact in case of any issues arising. The site representative will be responsible for keeping an open line of contact with local residents and advising the timing and programming of potentially noisy works.

All of the above measures would be implemented through the Construction Environment Management Plan (CEMP) which would be prepared and submitted to NWBC for approval at condition discharge stage. If necessary, this could also include a requirement for the undertaking of a revised construction noise assessment once the construction contractor has been appointed and the final confirmed construction working methods and programme are known. The results of this re-assessment would be used to identify any areas where construction noise has the potential to give rise to significant effects as defined within this Appendix.

RESIDUAL

The impacts arising as a result of construction noise have been identified to be **negligible** without mitigation measures. The application of BPM will increase the margin it is predicted that noise levels at the receptors will be reduced further.

A **negligible** impact will remain with mitigation measures in place, as construction activities will be noise levels giving rise to the background sound levels at the receptor locations and therefore an impact of **no change** is not likely, however, the impact is temporary in nature.

At all receptors, once mitigation measures are considered, there is likely to be a direct, temporary, local, adverse **negligible** impact. This effect is considered **not significant**.

It is recognised that occasionally, higher construction noise levels could arise, for example, if particularly intensive works are required at the Site boundary closest to receptors, but that such works would not give rise to significant effects due to being occasional and of short duration.

With regards to NPSE, the worst-case construction noise impacts are predicted to be LOAEL.

CONSTRUCTION VIBRATION

The assessment of construction vibration has been undertaken in accordance with BS 5228-2. The construction vibration criteria, which are independent of time are presented in Table 7.4-5.

Table 7.4-5 - Construction vibration criteria

Construction Vibration (x) in PPV, mm/s	Magnitude of Impact	NPSE Classification
x < 0.3	Negligible to Minor	NOEL
0.3 < x < 1.0	Minor to Moderate	LOAEL to SOAEL
1.0 < x	Moderate to Major	Above SOAEL

The criteria are based on BS 5228-2 guidance on the effects of vibration levels:

- 0.3 mm/s - vibration might be just perceptible in dwellings;
- 1.0 mm/s - vibration will cause complaint in dwellings but can be tolerated if prior warning and explanation has been given; and
- 10.0 mm/s - vibration is likely to be intolerable for any more than a very brief exposure to this level.

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.

Groundborne 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 7.4-6 presents the distances at which vibration levels are predicted to meet the criteria thresholds, based on a specified confidence limit (where applicable).

Table 7.4-6 – 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	5
Vibratory Rollers - Steady State(1)	95	0.3	60
	95	1.0	25
	95	10	5

Vibration generating activity	Confidence Limit	PPV (mm/s)	Minimum distance between receptor and works (m) before PPV (mm/s) exceeded.
HGV Movement[2]	N/A	0.3	8
	N/A	1.0	2
	N/A	10	N/A
Percussive Piling[3] - driven through soft ground	N/A	0.3	85
	N/A	1.0	35
	N/A	10	N/A
Percussive Piling[4] – driven to refusal	N/A	0.3	N/A
	N/A	1.0	120
	N/A	10	15
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.

[3] Assumes piles driven through soft soil and not to refusal, pile power of 10kJ and a pile depth of 10m.

[4] Assumes piles driven to refusal, pile power of 10kJ and a pile depth of 10m

The data presented in Table 7.4-6 is general in nature and is not site specific. In addition, different vibration generating activities may be employed other than those listed. The groundborne vibration calculations assume percussive piling, which is the most vibratory generative piling method, and is therefore considered a worst-case scenario.

The following sensitive receptors are those closest to the Site boundary and have the greatest potential to be subject to significant effects:

- R01 - Birchmoor Village, approximate distance to site boundary 50 m;
- R02 - Dwellings on A5 Watling Street, approximate distance to site boundary 350 m; and
- R03 - Dwellings off Birchmoor Road, approximate distance to site boundary 290 m.

Due to the separating distances, only Birchmoor Village (R01) is considered within the construction vibration assessment. Table 7.4-7 below presents the predicted magnitude of impact and NPSE classification at Receptor R01, for the vibration generating activities.

Table 7.4-7 – Predicted impact magnitude and NPSE classification

Vibration generating activity	Magnitude of impact	NPSE classification
Receptor R03 - Birchmoor Village		
Vibratory Rollers – start up	Minor	LOAEL
Vibratory Rollers – steady state	Minor	LOAEL
HGV Movements	No Change	NOEL
Percussive Piling – soft ground	Minor	LOAEL
Percussive Piling – to refusal	Moderate	SOAEL
Excavation	No Change	NOEL

The results of the assessment show that for vibration to be just perceptible (PPV <0.3 mm/s), vibration generating works would need to take place at distances greater than 85 m from Birchmoor Village, excluding percussive piling when driven to refusal. For works that take place within 85 m AOEU Given that the boundary of Birchmoor Village is approximately 50 m north of the site, it is likely that this will be feasible assuming similar setback distances (30 m inside the Site boundary) given within the noise assessment.

For all vibration generating activities (excluding percussive piling driven to refusal) which occur at more than 85 m, vibration levels are predicted to not be perceptible (i.e. <0.3 mm/s). A direct, temporary, local, adverse **negligible** impact is predicted. The effect is not significant and the NPSE classification is NOEL.

For vibration generating activities (excluding percussive piling driven to refusal) which take place between 50 m and 85 m a direct, temporary, local, adverse **minor** impact is predicted. It is assumed that the duration of exceedance would be short, i.e. not in excess of a period of 10 or more days in 15 consecutive days or for a total number of days exceeding 40 in a six month period. The effect is therefore **not significant**. In addition, the NPSE classification is LOAEL.

At this stage, the method of piling, quantity, depth and location of piling works is unknown. To ensure that the assessment is robust, percussive piling has been assessed. For percussive piling when driven to refusal, a direct, temporary, local, adverse **moderate** impact is predicted at distances up to 120 m. In addition, the NPSE classification is SOAEL.

MITIGATION

In addition to adopting BPM and the relevant measures detailed in the construction noise mitigation section above, the following specific mitigation measures are recommended.

For vibration generating works (excluding percussive piling) which take place within 85 m of a sensitive receptor, residents are to be notified in advance and given details of the works, including the timing and duration. Works will be programmed to ensure that the following durations are not exceeded, a period of 10 or more days in 15 consecutive days or for a total number of days exceeding 40 in a six month period.

For percussive piling works (or similarly vibration generative construction operation), once the required locations are finalised, a revised predictive assessment of groundborne vibration impact will be undertaken. The revised assessment will reflect the nature/type of the works to be undertaken at the site, including the types of plant to be used, piles to be inserted and the local ground conditions.

Where the results of the revised assessment identify groundborne vibration levels in excess of 1.0 mm/s PPV, then the proposed working method shall be revisited (e.g. a low vibratory piling method such as auger bored piling shall be adopted where such an approach would result in the required pile performance).

Where adoption of a low vibratory working methods is not possible (e.g. due to pile performance requirements), receptors with predicted groundborne vibration in excess of 0.8 mm/s PPV will be notified. A groundborne vibration survey shall also be undertaken for the duration of those works, to provide confirmation of the levels that are generated in practice, either at the Site boundary or at the closest sensitive receptor. The measurement results shall be made available to the affected receptors.

In addition, works will be programmed to ensure that the following durations are not exceeded, a period of 10 or more days in 15 consecutive days or for a total number of days exceeding 40 in a six month period.

Where the live measurement results identify that groundborne vibration levels exceed 2.0 mm/s PPV are arising in practice, the works shall cease unless it can be demonstrated to NWBC that the works are being undertaken in accordance with the principles of BPM.

The above measures would ensure that where percussive piling works (or similarly vibration generative working operations) with the potential to give rise to a significant effect are required, these would be undertaken following a neighbourly approach and in accordance with the principles of BPM.

The above measures could be implemented through the CEMP which would be prepared and submitted to NWBC for approval.

RESIDUAL

With the application of mitigation measures, the worst-case construction vibration impacts, excluding percussive piling, are likely to be direct, temporary, local, adverse **minor**. The effect is **not significant**.

For percussive piling works, which have the potential to give rise to a significant effect, the application of the mitigation measures will control impacts to be no worse than direct, temporary, local, adverse **minor**. The effect is not significant.

It is recognised that occasionally, higher construction vibration levels could arise, for example, percussive piles driven to refusal, but that such works will be monitored and would not give rise to significant effects due to being short in duration.

With regards to NPSE, the worst-case construction noise impacts are predicted to be LOAEL.

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Appendix 7.5

NOISE MODEL PARAMETERS

An acoustic model of the site and proposed development was created in DataKusttik GmbH CadnaA 2019 MR2 (64-bit). The following approach was adopted in generating the noise model:

- The model was set to apply the following standards/guidance: Industrial sources: ISO 9613-2:1996: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (IOS 9613-2);
- 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;
- Indicative topographic data has replaced the above DTM data within the proposed development redline boundary;
- Building facades are set to be acoustically reflective and the model includes second order reflections from solid structures;
- Building eaves height for the proposed development building are set to be 21m;
- Existing buildings were incorporated based on Ordnance Survey (OS) mapping and aerial photography. Dwellings are set to 6m above local ground height;
- Globally, ground absorption was set to G = 1 (acoustically absorbent ground) with proposed areas of hardstanding (e.g. roads and service yards) included separately with ground absorption set to G=0 (acoustically reflective ground);
- The operational service yard noise sources have been modelled and calibrated using WSP's in-house database of measured noise sources, and typical manufacturers data as described in **Appendix 7.6**;
- HGVs arriving and departing the proposed development have been incorporated as line sources. The line source extends from the site boundary into the most northern HGV area on the site. The location of the line sources are based on a single inbound, a single outbound and a perimeter loop around the building and are based on WSP's history of similar projects. The HGV line source height is set at 0.5m above local ground;
- Line sources have also been included, along the same extents, for HGV trailer chillers. The chiller line source height is set at 3.5m above local ground;
- HGV arrivals, manoeuvres, air brakes, loading and unloading, cab idling, and departures have been entered as point sources with a height of 0.5m above local ground for the proposed HGV docking bays;
- Similar point sources have also been added for HGV parking spaces (but without the loading and unloading elements); and
- Idling trailer chillers have been added as point sources with a height of 3.5m above local ground. These point sources have been added for the docking bays and proposed HGV parking spaces.

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Appendix 7.6

INDUSTRIAL / COMMERCIAL NOISE ASSESSMENT

INDUSTRIAL / COMMERCIAL NOISE ASSESSMENT

MODELLED SCENARIOS

Noise levels generated by the operation of the proposed industrial/commercial units will depend upon their future occupants. Different occupants may have different operating hours and working patterns depending upon the nature of their business. For example, the use of HGV trailer chillers would be limited to occupants requiring the storage and distribution of chilled goods. For other 'ambient temperature' operators, HGV trailer chillers would not be required.

At this stage, the future occupants are not known, to model noise emissions from service yard operations, HGV movements and unloading/loading activities have been assumed based on professional experience and accounting for the size of the service yard areas and parking.

Two alternative scenarios have been modelled:

Scenario 1 - Ambient Goods Operation

- 25% of all docking bays and parking spaces subject to a 'turnover'; within the 1-hour assessment period;
- All docking bays and parking spaces subject to a 'turnover' would have an associated access road arrival and departure movement within a 1-hour assessment period' and
- No chilled goods operations.

Scenario 2 - Partial Chilled Goods Operation

- As Scenario 1, but where 30% of 'turnovers' have electric powered trailer chillers.

The source data used to inform this assessment is presented in Table 7.6-1 and has been adopted for service yard movements in and around the proposed development docking and parking bays.

This data has been adopted from WSP's library of in-house historic measurement data and manufacturers specifications used in similar facility assessments to that of the Proposed Development.

A 'turnover' (per docking bay/parking space) includes:

- 1 x HGV arrival;
- 1 x HGV manoeuvre;
- 1 x air brakes activated;
- 1 x cab engine idling;
- 30 minutes of unloading/loading (modelled within docking bays only); and
- 1 x HGV pulling away.

The source data presented in Table 7.6-1 has been adopted for service yard movements in and around the proposed service yard docking and parking bays. This data has been adopted from WSP's library of in-house historic measurement data for similar facilities to that proposed.

Table 7.6-1 - Service yard source noise data, dB

Activity	Sound Pressure Level (dB) in Octave Band Centre Frequency (Hz)								Time (s)	$L_{Aeq, T}$ @ 10m	L_{AFmax} @ 10m
	63	125	250	500	1k	2k	4k	8k			
HGV Arriving & Manoeuvring	71	66	65	66	69	65	58	50	109	72	78
HGV Engine Idling	75	58	66	60	62	59	52	42	37	66	-
HGV Pulling Away	71	65	64	65	63	62	56	46	15		-
Electric Powered Chiller	75	71	67	61	58	56	52	45	continuous	65	
Air Brakes	-	-	-	-	-	-	-	-	3	80	81
Unloading Activities	-	-	-	-	-	-	-	-	420	60	77

For HGV movements to and from the service yards, source data has been determined based upon the guidance contained within the Noise Advisory Council guide: *A guide to measurement and prediction of the equivalent continuous sound level Leq* (NAC)

OPERATIONAL NOISE LEVELS AT DWELLINGS

The noise model has been used to generate operational specific sound levels ($L_{Aeq,T}$) across the study area. The resulting noise contours are presented in **Figure 7.2: Noise contours - ambient goods operation** and **Figure 7.3 Noise contours - Partial chilled goods operation**. Noise contours are calculated at 4.0m above local ground height and are include the proposed development topography but exclude character corrections associated with the BS 4142 assessment.

Operational noise calculations and assessment have been completed at the closest sensitive receptors:

- Receptor R01 - Birchmoor Village[1];
- Receptor R02 - Dwellings on A5 Watling Street; and
- Receptor R03 - Dwellings off Birchmoor Road.

Operational noise emissions from the proposed development have been assessed using BS 4142. The significance is determined upon the margin by which the operational noise level exceed the background sound level and the context in which the sound occurs.

[1] For Receptor R01, multiple receptor points are modelled and the highest sound level is reported.

Acoustic character corrections are applied based on nature of the operations associated with each assessed scenario. Representative background sound levels are taken from the noise survey results. The assessment without mitigation is presented in Table 7.6-2 - Receptor R01 through

The operational BS 4142 assessment for Receptor R03, dwellings off Birchmoor Road is presented in Table 7.6-4.

Table 7.6-4 - Receptor R03 .

Values are presented in dB(A) with daytime taken at a receptor height of 1.5m and night-time at a receptor height of 4m above local ground level.

The BS 4142 assessment for Receptor R01, Birchmoor Village is presented in Table 7.6-2.

Table 7.6-2 - Receptor R01 BS 4142 assessment

Assessment step	Ambient goods operation		Partial chilled goods operation	
Period	Day	Night	Day	Night
Modelled Specific Sound Level [A]	39.2	41.1	42.0	43.6
Tonality [B]	-	-	+2	+2
Impulsivity [C]	-	-	-	-
Intermittency [D]	-	-	-	-
Rating level [E] = [A+B+C+D]	39.2	41.1	44.0	45.6
Background Sound Level ($L_{A90,T}$) [F]	46.0	45.0	46.0	45.0
Rating Level vs. Background Sound Level [E-F]	-6.8	-3.9	-2.0	+0.6
Magnitude of impact	No Change	No Change	No Change	Negligible
NPSE classification	NOEL	NOEL	NOEL	LOAEL

For ambient operation, the rating level is -6.8 dB below the daytime background sound level and -3.9 dB below the night-time background sound level. The most adverse magnitude of impact occurs during the night-time and is **no change**. The effect would be neutral, direct, long-term and **not significant**.

For partial (30% electric chilled goods) operation, the rating level is -2.0 dB below the daytime background sound level and +0.6 dB above the night-time background sound level. The most adverse magnitude of impact occurs during the night-time and is **negligible**. The effect would be adverse, direct, long-term and **not significant**.

The BS 4142 assessment for Receptor R02, Dwellings on A5 is presented in Table 7.6-3.

Table 7.6-3 - Receptor R02 BS 4142 assessment

Assessment step	Ambient goods operation		Partial chilled goods operation	
Period	Day	Night	Day	Night
Modelled Specific Sound Level [A]	42.8	44.4	45.3	46.7
Tonality [B]	-	-	+2	+2
Impulsivity [C]	-	-	-	-
Intermittency [D]	-	-	-	-
Rating level [E] = [A+B+C+D]	42.8	44.4	47.3	48.7
Background Sound Level ($L_{A90,T}$) [F]	56.0	49.0	56.0	49.0
Rating Level vs. Background Sound Level [E-F]	-13.2	-4.6	-8.7	-0.3
Magnitude of impact	No Change	No Change	No Change	No Change
NPSE classification	NOEL	NOEL	NOEL	NOEL

For ambient operation, the rating level is -13.2 dB below the daytime background sound level and -4.6 dB below the night-time background sound level. The most adverse magnitude of impact occurs during the night-time and is **no change**. The effect would be neutral, direct, long-term and **not significant**.

For partial (30% electric chilled goods) operation, the rating level is -8.7 dB below the daytime background sound level and -0.3 dB below the night-time background sound level. The most adverse magnitude of impact occurs during the night-time and is **no change**. The effect would be neutral, direct, long-term and **not significant**.

The operational BS 4142 assessment for Receptor R03, dwellings off Birchmoor Road is presented in Table 7.6-4.

Table 7.6-4 - Receptor R03 BS 4142 assessment

Assessment step	Ambient goods operation		Partial chilled goods operation	
Period	Day	Night	Day	Night
Modelled Specific Sound Level [A]	36.5	37.8	39.2	40.3
Tonality [B]	-	-	+2	+2
Impulsivity [C]	-	-	-	-
Intermittency [D]	-	-	-	-
Rating level [E] = [A+B+C+D]	36.5	37.8	41.2	42.3
Background Sound Level ($L_{A90,T}$) [F]	51.0	41.0	51.0	41.0
Rating Level vs. Background Sound Level [E-F]	-14.5	-3.2	-9.8	+1.3
Magnitude of impact	No Change	No Change	No Change	Negligible
NPSE classification	NOEL	NOEL	NOEL	LOAEL

For ambient operation, the rating level is -14.5 dB below the daytime background sound level and -3.2 dB below the night-time background sound level. The most adverse magnitude of impact occurs during the night-time and is **no change**. The effect would be neutral, direct, long-term and **not significant**.

For partial (30% electric chilled goods) operation, the rating level is -9.8 dB below the daytime background sound level and +1.3 dB above the night-time background sound level. The most adverse magnitude of impact occurs during the night-time and is **negligible**. The effect would be adverse, direct, long-term and **not significant**.

FIXED PLANT AND EQUIPMENT

There is the potential for noise to be generated from fixed plant and equipment installed at the proposed development. As the requirement for fixed plant and equipment is unknown at this stage, noise level limits are specified in Table 7.6-5. Should the fixed plant be operational 24 hours a day, the night-time rating level takes precedence.

The noise limits are to be achieved at the closest receptors. The fixed plant noise level limits are sufficiently low that plant noise would not give rise to a change in the operational noise effect levels reported above.

Table 7.6-5 - Fixed plant and equipment noise limits

Receptor(s)	Rating Level	
	Daytime ($L_{Ar,1h}$ dB)	Night-time ($L_{Ar,15min}$ dB)
Receptor R01 Birchmoor Village	43	35
Receptor R02 Dwellings on A5	46	39
Receptor R03 Dwellings off Birchmoor Road	41	31

MITIGATION

For both operating scenarios, ambient and partial chilled goods, additional noise mitigation measures are not required.

Actual noise levels generated from site activities will be dependent upon the nature and intensity of the operations, the finalised layout and design, and the hours of operation. Notwithstanding this, there are a number of mitigation measures that can be employed to reduce and control operational noise emissions from the site, including:

- Noise barriers and/or earth bunds to screen noisy activities;
- Design the layout so that the development buildings screen noise generating activities;
- Maximise the distance between noise generating activities and sensitive receptors;
- Limit the areas where specific noise generating activities will be undertaken (e.g. the use of HGV trailer chillers could be contained within parts of the site that are fully screened from receptors by acoustic screening or the proposed development buildings themselves);
- Limit the operational working hours or delivery times;
- Select plant and equipment that is not tonal.

Once a detailed masterplan is finalised, a revised predictive assessment of operation noise emissions may be necessary. If the revised assessment predicts significant effects then appropriate mitigation measures will be developed. A planning condition could be used to ensure that the operational noise emissions from the detailed application are evaluated and reassessed if required.

A planning condition could be used to ensure that the noise level limits are complied with in practice.

RESIDUAL EFFECTS

For ambient operation, the most adverse magnitude of impact occurs at Receptor R03 during the night-time and is **no change**. The effect would be neutral, direct, long-term and **not significant**.

For partial chilled goods operation (30% electric chilled goods), the most adverse magnitude of impact occurs at Receptor R03 during the night-time and is **negligible**. The effect would be adverse, direct, long-term and **not significant**.

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Appendix 7.7

DEVELOPMENT GENERATED TRAFFIC NOISE ASSESSMENT

DEVELOPMENT GENERATED TRAFFIC NOISE ASSESSMENT

IMPACT

The results of the **Transport Assessment** have been used as the basis for determining the change in noise levels that would arise on the local road network as a result of development generated road traffic noise.

The study area for the development generated road traffic noise assessment includes all routes within the modelled road network. The **Transport Assessment** has generated traffic data for the years 2021, 2026 and 2031. The transport specialist has provided a growth factor, to enable 2041 flows to be generated. The assessment has considered the following scenarios:

- 2026 Do minimum[1] opening year[2] (DMOY);
- 2026 Do something[3] opening year (DMFY); and
- 2041 Do something future year (DSFY).

Basic Noise Level (BNL) calculations have been undertaken using traffic flow, speed and HDV percentage, as detailed in the *Calculation of road traffic noise memorandum* 1988 (CRTN) for each local road traffic link, and each of the above scenarios. The change in noise levels arising as a result of the Proposed Development in isolation (short-term), and in combination with natural traffic growth (long-term), have then been determined by making the following comparisons:

- Short-term = DSOY - DMOY; and
- Long-term = DSFY - DMOY.

The results are given in Table 7.7-1 below for road links which have a change equal to or greater than 1dB in the short-term (DSOY - DMOY).

Table 7.7-1 - Road traffic links with Noise Changes ≥1 dB(A) in the Opening Year

ID	Road	Noise level $L_{A10,18hr}$, dB		Noise level change, dB
		DMOY [A]	DSOY [B]	Short-term [B-A]
1	A5 Watling Street	76.9	75.6	-1.3
2	A5 Watling Street	74.9	73.0	-1.9
3	A5 Watling Street	75.9	73.7	-2.2

[1] 'Do minimum' means a scenario without the Proposed Development.

[2] First year of operation.

[3] 'Do something' means a scenario with the Proposed Development.

ID	Road	Noise level $L_{A10,18hr}$, dB		Noise level change, dB
		DMOY [A]	DSOY [B]	Short-term [B-A]
4	A5 Watling Street	75.8	74.2	-1.6
5	A5 Watling Street	76.9	72.6	-4.3
6	A5 Watling Street	73.7	72.7	-1.0
7	A5 Watling Street	74.9	72.3	-2.6
8	Mercian Way Roundabout	59.9	60.9	+1.0
9	Mercian Way Roundabout	56.3	58.0	+1.7

In the short-term, there are nine road links which have a change greater than or equal to 1dB (seven beneficial and two adverse). The seven beneficial changes all occur on the A5 Watling Street adjacent to the site entrance. Although the proposed development results in an increase in traffic flows and HDV numbers, there is a relative greater reduction in the average speed of vehicles which causes an overall decrease in noise.

The two adverse changes occur in the north of Tamworth, on the Mercian Way/Tamworth Road roundabout. Due to the location and approximate distance from the site, 3.4km north west, these changes are not considered to be associated with the proposed development.

In addition, there are five new road links in the opening year Do-something scenario, theses links are all on the proposed development access road.

Table 7.7-2 below presents road links which have a change equal to or greater than 3dB in the long-term (DSFY - DMOY).

Table 7.7-2 - Road traffic links with Noise Changes ≥3 dB(A) in the Future Year

ID	Road	Noise level $L_{A10,18hr}$, dB		Noise level change, dB
		DMOY [A]	DSFY [C]	Long-term [C-A]
10	A5 Watling Street	75.4	67.1	-8.3
11	Eagle Drive	53.4	57.5	+4.1
12	Eagle Drive	53.1	57.0	+3.9
13	Eagle Drive	55.4	59.3	+3.9

In the long-term, there are four road links which have a change greater than or equal to 3dB. The one beneficial change occurs on the A5 Watling Street 1.6km east of the site entrance. Based on the future year traffic model layout, the reduction in flow on this link is determined to be associated with a change to the road layout adjacent to this link, the road traffic noise change is not considered to be associated with the proposed development.

The three adverse changes all occur on Eagle Drive, Tamworth. Due to the location and approximate distance from the site, 2.2km north west, these road traffic noise changes are not considered to be associated with the proposed development.

There are 75 new road links and 26 road links removed in the future year scenarios, these changes are predominantly associated with a new road layout to the east of Gypsy Lane, more than 1.3km to the south east of the Site. With the exception of the Site access road, these new and removed links are not associated with the proposed development.

In the short term, the road traffic noise changes associated with the proposed development occur on A5 Watling Street, adjacent to the site entrance. The magnitude of impact is **minor** benefit and the NPSE classification is SOAEL. The effects would be beneficial, not significant, short-term, direct and permanent.

In the long term, the road traffic noise changes associated with the proposed development are less than 3dB. The magnitude of impact is **negligible** benefit and the NPSE classification is SOAEL

MITIGATION

Impacts associated with the proposed development are not significant, further consideration to mitigation is not warranted.

RESIDUAL

The worst-case changes on the existing network in the short and long term are **minor** adverse (not significant), however, these changes are not associated with the proposed development. The changes associated with the development are **negligible** adverse (not significant) at worse. In the short term, **minor** benefits (not significant) are predicted on the A5 Watling Street adjacent to the site entrance.

As significant adverse effects are not identified, mitigation is not considered warranted and the identified (not significant) effects would remain.

Road traffic noise level changes do not cause a shift in the NPSE Classification (a function of absolute noise level from one category to another).

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