	level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.
$L_{Amax,T}$	$L_{Amax,T}$ is the maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast) - $L_{AFmax,T}$, or S (slow) - $L_{ASmax,T}$.
Meteorological effects	Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.
Peak particle velocity (PPV)	Peak Particle Velocity (PPV) is the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position. PPV is the simplest indicator of both perceptibility and the risk of damage to structures.
Reflection	When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, they are reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.
Screening and diffraction	If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation, however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land immediately beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.
Sound	The physical vibration in the air, propagating away from a source, whether heard or not.

Appendix 10.2

LEGISLATION, PLANNING POLICY AND GUIDANCE

Appendix 10.2: Legislation, Planning Policy and Guidance

Table 10.2: Legislation Relevant to Noise and Vibration

Legislation	Description
Planning Act 2008	The Planning Act 2008 grants statutory authority unless there is a provision in a granted DCO to the contrary, with regard to noise nuisance. The Act also provides powers to modify legislation.
Land Compensation Act 1973 (LCA)	The Land Compensation Act 1973 provides for depreciation of an interest in land value caused by noise as a physical factor from public works (highway or aerodrome) to be compensated by the responsible authority. Compensation is payable where the noise either arises from activity on land taken (injurious affection) (Part II of the Act), or is physically unconnected to the land interest (Part 1 claims). The Act provides powers to sound-proof (noise insulate) buildings from noise arising from highways and aerodromes, and to pay expenses of persons moving temporarily during construction works (due to noise).
Noise Insulation Regulations 1975 and Noise Insulation (Amendment) Regulations 1988. Regulations under the LCA 1973.	The Noise Insulation Regulations 1975 set out the requirements under which buildings may qualify for noise insulation or to receive grants in relation to noise from new or altered roads. The Regulations also provide discretionary powers to provide noise insulation or temporary rehousing with regard to the construction of new or altered roads.
Control of Pollution Act 1974	The Control of Pollution Act 1974 provides the definition of Best Practicable Means (BPM) to minimise noise (including vibration), the basis for defence against noise abatement action taken by a local authority (section 60). The Act also provides for i) persons responsible to seek prior consent for works on construction sites including BPM steps to minimise noise and ii) the basis for defining codes of practice (applies to BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites, Part 1: Noise and Part 2: Vibration').
Environmental Protection Act (EPA) 1990	The Environmental Protection Act 1990 sets out the duty for local authorities to investigate and, where identified, take abatement action against noise nuisance. The Act provides the definition of Best Practicable Means (BPM) to minimise noise (including vibration), the basis for defence against noise abatement action taken by a local authority (section 80). The Act also provides for individuals to seek for abatement action to be taken by a magistrate's court against noise nuisance (section 82).
The Environmental	The Environmental Noise Regulations 2006 implement the EU Environmental Noise Directive (END) 2002/49/EC relating to the assessment and management of environmental noise. The regulations set

Noise (England) Regulations 2006	out the requirement to undertake strategic noise mapping, on a five-year cycle, and implement Noise Action Plans for agglomerations and major roads, railways and airports.
Noise and Statutory Nuisance Act 1993	The Noise and Statutory Nuisance Act 1993 provides an extension of powers to abate noise nuisance to a wider range of sources than the Environmental Protection Act 1990.

Table 10.3: Legislation Relevant to Noise and Vibration

Policy	Description
National Planning Policy Framework (NPPF), Ministry of Housing, Communities and Local Government (MHCLG), February 2021	The NPPF states the following in relation to noise: That 'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.' (Paragraph 185). The NPPF also states that 'Planning policies and decisions should contribute to and enhance the natural and local environment by: e) 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' (Paragraph 174).
Noise Policy Statement for England (NPSE), Department for Environment, Food and Rural Affairs (Defra), March 2010	The Noise Policy Statement for England sets out the long-term vision of Government noise policy to 'Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.' (para 1.6) '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: 1. Avoid significant adverse impacts on health and quality of life 2. Mitigate and minimise adverse impacts on health and quality of life 3. Where possible, contribute to the improvement of health and quality of life.' (para 1.7) 'There are two established concepts from toxicology that are currently 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 LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected.' (para 2.20) 'Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed negative effect level. SOAEL – Significant Observed

	Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.' (para 2.21) 'The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise negative effects on health and quality of life while also considering the guiding principles of sustainable development (para 1.8). This does not mean that such negative effects cannot occur.' (para 2.24) '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 negative 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.' (para 2.22)
The Cherwell Local Plan 2011 - 2031 (incorporating re-adopted policy Bicester 13) (adopted July 2013)	Policy PSD 1: 'Presumption in Favour of Sustainable Development' sets out the Council's framework to guide development that creates positive, sustainable growth. Namely: When considering development proposals the Council will take a proactive approach to reflect the presumption in favour of sustainable development contained in the National Planning Policy Framework. The Council will always work proactively with applicants to jointly find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social and environmental conditions in the area. Planning applications that accord with the policies in this Local Plan (or other part of the statutory Development Plan) will be approved without delay unless material considerations indicate otherwise. Where there are no policies relevant to the application or relevant policies are out of date at the time of making the decision then the Council will grant permission unless material considerations indicate otherwise – taking into account whether: * any adverse impacts of granting permission would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework taken as a whole; * or specific policies in the Framework indicate that development should be restricted.
Mid-Cherwell Neighbourhood Plan 2018-2031 (May 2019)	Policy PC1: Local Employment Continued commercial use of premises providing local employment within the neighbourhood area or otherwise benefiting the local economy will be encouraged. Proposals for the establishment of new small businesses will be considered favourably where they:… c)are unlikely to generate a volume of goods traffic that would have a significantly harmful effect on road safety or congestion or cause unacceptable noise and disturbance for local residents or to the rural environment and would not adversely affect on-street residential parking.

Table 10.4: Other Important and Relevant Matters to Noise and Vibration

Guidance Document	Description
Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (2014)	The IEMA Guidelines provide key principles and methodological guidance on environmental noise impact assessment and how to effectively integrate noise impacts into the consenting process of all types of development.
World Health Organisation (WHO) Guidelines for Community Noise, 1999	The WHO Guidelines for Community Noise are partially superseded by the WHO Environmental Noise Guidelines for the European Region, 2018. However, the guideline values for internal noise and maximum noise levels from regular noise events remain relevant in the 1999 WHO guidelines.
WHO Night Noise Guidelines for Europe, 2009	The Night Noise Guidelines for Europe recommend a lowest observed adverse effect level (LOAEL) for night-time noise and an Interim Target.
WHO Environmental Noise Guidelines for the European Region, 2018	The Environmental Noise Guidelines for the European Region provide recommendations for protecting human health from exposure to environmental noise originating from various sources including road traffic, railway and aircraft noise. The 2018 Guidelines partially superseded the WHO Guidelines for Community Noise 1999 (see earlier entry in this table) but do not supersede the Night Noise Guidelines for Europe, 2009 (see earlier entry in this table). The recommendations include guideline values for aircraft noise, road traffic noise and railway noise using Lden and L_{night} metrics in terms of the onset of health effects.
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)	Part 1 of BS 5228:2009+A1:2014 relates to the potential effects of existing noise sensitive human receptors as a result of noise arising from construction activities. This includes construction vehicles travelling on haulage routes to and from the construction site.
BS 5228-2 Code of Practice for Noise and Vibration Control on Open Construction Sites – Part 2: Vibration	Part 2 of BS 5228:2009+A1:2014 relates to the potential effects of existing noise sensitive human receptors as a result of vibration arising from construction activities. This includes construction vehicles travelling on haulage routes to and from the construction site.
BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings: 1-Vibration sources other than blasting 2-Blast-induced vibration	BS 6472-1 provides best available information on the application of methods of measuring and evaluating vibration in order to assess the likelihood of adverse comment. BS 6472-2 gives guidance on human exposure to blast-induced vibration in buildings.

BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground-borne vibration	BS 7385-2 gives guidance on the assessment of the possibility of vibration-induced damage in buildings due to a variety of sources, and identifies the factors which influence the vibration response of buildings.
BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound	BS 4142:2014+A1:2019 is the principal assessment methodology used to carry out assessments of sound of an industrial and/or commercial nature. It provides guidance on how to undertake the monitoring, modelling and assessment of industrial and commercial sound sources affecting noise sensitive receptors.
BS 8233:2014 Guidance on sound insulation and noise reduction for buildings	Provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.
BS 7445-1:2003. Description and measurement of environmental noise. Guide to quantities and procedures	BS 7445-1 defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.
Planning Practice Guidance Noise – PPG(N) 2014	Planning Practice Guidance Noise states that 'Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment.' (Para 001) PPG(N) aligns with the NPSE and is based on the observed effect levels approach. PPG(N) introduces Unacceptable Adverse Effect Levels (UAELs) 'At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring.' (Para 005) Paragraph 005 provides the noise exposure hierarchy table based on the likely average response which underlies the assessment for this Scheme. (Para 005) PPG(N) sets out factors that influence whether noise may be a concern. 'The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any situation'. (Para 006)
ProPG Planning & Noise – Professional Practice Guidance on Planning & Noise, 2017	Professional Practice Guidance: Planning & Noise - New Residential Development (ProPG, 2017) is a joint publication by the Chartered Institute of Environmental Health (CIEH), the Association of Noise Consultants (ANC) and the Institute of Acoustics (IoA). The primary goal of ProPG is "to assist the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise".

	The guidance has been produced to assist practitioners in matters relating to noise and new residential development. It focusses on existing transportation noise sources and has been developed to consider the Government's overarching noise policy, planning policy and policy guidance. It has also been developed to consider other authoritative sources of guidance such as British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' (BS 8233:2014). The guidance provides advice for Local Planning Authorities (LPAs) and developers, and practitioners. ProPG aims to: • Advocate the full consideration of the acoustic environment from the earliest possible stage of the development control process; • Promote and encourage the process of good acoustic design in and around new residential developments; • Set out the considerations which should be taken into account in deciding planning applications for new noise-sensitive developments; • Promoting the use of appropriate noise exposure standards and policies in assessment; and • Aid in the delivery of sustainable development.
Calculation of Road Traffic Noise (CRTN) (DfT, 1988)	The Calculation of Road Traffic Noise provides a methodology for the measurement and prediction of road traffic noise. CRTN was prepared to determine entitlement under the Noise Insulation Regulations 1975, but it is stated in the document, that the guidance is equally appropriate to the calculation of traffic noise for land use planning purposes.
Design Manual for Roads and Bridges: Sustainability & Environment Appraisal LA 111 Noise and vibration (LA 111) (2020)	LA 111 provides guidance on undertaking noise and vibration assessments on the impact of road projects. This includes assessing changes in traffic on existing roads, where it outlines the magnitude of impact in the short term and long term.
Transport Research Laboratory (TRL) Report 53 'Ground vibration caused by civil engineering works', 1986	This TRL paper addresses the problem of the specification, measurement and control of ground vibration which is caused by civil engineering works. In summary, the paper provides: a methodology for trial blasting, with recommendations for the deployment and specification of the equipment; data processing and presentation format and a 'site specific' scaling method which provides improved correlation between peak particle velocity and scaled distance; discussion on the use of peak particle velocity as a damage-hazard in relation to other dynamic parameters which also effect damage to structures; consideration to options regarding the distribution of vibration associated risks between Employer and Contractor in the context of legal and contractual obligations.

TRL Report 429 (TRL 429 'Ground-borne vibration caused by mechanised construction works', 2000	This TRL report provides data and advice against which objections to schemes may be judged, and methods for predicting the environmental impact of vibration caused by the operation of mechanised construction plant. Specific topics covered in the report are: a detailed review of the literature on ground vibrations from compaction, piling, tunnelling and other mechanised construction and ground improvement techniques; a review of national and European standards providing threshold values for damage and intrusion by ground-borne vibration; the acquisition of field data from construction sites for most types of vibratory site operations; l the execution of a full-scale trial to investigate ground-borne vibration caused by vibratory compaction plant; analysis of the vibration data acquired from construction sites, the full-scale trial and other research; prediction of vibration from mechanised construction operations. The proposed predictors allow the calculation of expected vibration levels of ground-borne vibration for the following activities: vibrating rollers; vibratory piling, including vibrated casings for bored piles; percussive piling; dynamic compaction; mechanised tunnelling; l vibratory ground treatment.

Appendix 10.3

CONSTRUCTION NOISE AND VIBRATION

Appendix 10.3: Construction Noise and Vibration

For the construction noise and vibration assessment the following spatial extents were considered:

- 300m: noise effects from construction activities, such as material movements, earthworks, ground improvement and piling, crushing and breaking;
- 100m: ground-borne vibration effects from high energy construction activities, including piling works; and
- 1dB change: noise effects from construction vehicle movements to and from the construction site likely to result in a change of 1 dB $L_{Aeq,T}$ or greater.

Assessment Criteria

The construction noise and vibration assessment is primarily based on the methodologies advocated within BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites Part 1: Noise and Part 2: Vibration'.

Part 1 relates to potential effects on existing and proposed noise sensitive human receptors resulting from noise and vibration from construction activities including construction vehicles which will be undertaken. Part 2 provides guidance on the assessment of ground-borne vibration associated with activities such as demolition and construction. Annex E BS 5228-2:2009+A1:2014, describes methods of estimating vibration emanating from proposed construction activities. Additional consideration is given to BS 7385-2:1993 'Evaluation and measurement for vibration in buildings. Guide to damage levels from ground borne vibration' (BS 7385-2, 1993).

The application of the thresholds of potential effect criteria for the purpose of assessing likely significant effects in terms of the EIA Regulations, and government noise policy defined significant effects on health and quality of life, is discussed in Section 10.3 of Chapter 10: Noise and Vibration.

Construction Noise – (Fixed and Mobile Plant)

The determination of effect thresholds for the construction noise assessment is based upon the methodologies presented within Annex E of BS 5228-1:2009+A1:2014 'ABC Method', as summarised in Table 10.1.

Table 10.1: Construction Noise (Fixed and Mobile Plant) – 'ABC Method' Noise Thresholds

Noise Source	Receptor	Period	Category A	Category B	Category C
Construction noise	Residential	Daytime	65 dB $L_{Aeq,12hr}$	70 dB $L_{Aeq,12hr}$	75 dB $L_{Aeq,12hr}$
	Residential	Evening	55 dB $L_{Aeq,4hr}$	60 dB $L_{Aeq,4hr}$	65 dB $L_{Aeq,4hr}$
	Residential	Night	45 dB $L_{Aeq,8hr}$	50 dB $L_{Aeq,8hr}$	55 dB $L_{Aeq,8hr}$
Clarifications and notes: Daytime: Weekdays (0700-1900hrs) and Saturdays (0700-1300hrs) Evening: Weekdays (1900-2300hrs), Saturdays (1300-2300hrs), Sundays and Bank Holidays (0700-2300hrs)					

Night-time: Weekdays, Weekends and Bank Holidays (2300-0700hrs)
*Rounded to the nearest 5 dB

The Category A noise thresholds are assumed to align with the Lowest Observed Adverse Effect Level (LOAEL) as they are the lowest threshold in the 'ABC Method' criteria.

The Category C noise thresholds are assumed to align with a Significant Observed Adverse Effect Level (SOAEL) and is an approach consistent with other major infrastructure projects, namely: Thames Tideway Tunnel; Crossrail; and High Speed 2 (HS2) Phase 1 and 2a.

The daytime Category C (SOAEL) threshold of 75 dB $L_{Aeq, 12hr}$ is taken from the Committee on the Problem of Noise: Noise report (Wilson, 1963) and was set to avoid interference with normal speech indoors.

The evening Category C (SOAEL) is set at 10 dB lower than the day-time criteria, based upon advice presented within the Department of the Environment Advisory Leaflet 72 – Noise Control on Building Sites (AL 72, 1976).

The night-time Category C (SOAEL) of 55 dB $L_{Aeq, 8hr}$ is consistent with advice presented within the WHO Night Noise Guidelines for Europe (WHO NNG, 2009).

The UAEL thresholds were based upon the BS 5228-1 (2014) requirements for temporary rehousing, associated with construction activities of 10 of more days of working in any 15 consecutive days, or for 40 or more days in any six consecutive months, and set at 10 dB above the SOAEL.

The construction noise assessments thresholds of potential effect criteria are summarised in Table 10.2 below.

Table 10.2: Thresholds of Potential Effect Criteria (outdoor, free-field noise levels unless otherwise stated)

Noise Source	Period	LOAEL	SOAEL	UAEL
Construction Noise	Daytime	65 dB $L_{Aeq, 12hr}$	75 dB $L_{Aeq, 12hr}$	85 dB $L_{Aeq, 12hr}$
	Evening	55 dB $L_{Aeq,4hr}$	65 dB $L_{Aeq,4hr}$	75 dB $L_{Aeq,4hr}$
	Night	45 dB $L_{Aeq,8hr}$	55 dB $L_{Aeq,8hr}$	65 dB $L_{Aeq,8hr}$

Where development related noise exposures are shown to be lower than the LOAEL values in Table 10.2, a significant effect in terms of the EIA Regulations was not deemed to occur at residential receptors.

Development related noise exposures which fall between LOAEL and SOAEL have the potential to constitute a significant effect, subject to additional considerations, namely:

- The level of noise exposure;
- The change in the noise exposure as a result of the Development; and
- The population experiencing such change and exposure to noise as a result of the Development.

Noise Exposure Classifications

Table 10.3 provides noise level categories between the LOAEL and UAEL thresholds. Greater weight in terms of significance evaluation has been given to higher noise levels, even when occurring between the same thresholds, i.e. LOAEL and SOAEL.

Table 10.3: Noise Level Categories

Noise Level	Construction Noise		
	Daytime	Evening	Night-time
Very Low	<65dB $L_{Aeq, 12hr}$	<55dB $L_{Aeq, 4hr}$	<45dB $L_{Aeq, 8hr}$
LOAEL			
Low	66-68dB $L_{Aeq, 12hr}$	56-58dB $L_{Aeq, 4hr}$	46-48dB $L_{Aeq, 8hr}$
Medium	69-71dB $L_{Aeq, 12hr}$	59-61dB $L_{Aeq, 4hr}$	49-51dB $L_{Aeq, 8hr}$
High	72-74dB $L_{Aeq, 12hr}$	62-64dB $L_{Aeq, 4hr}$	52-54dB $L_{Aeq, 8hr}$
SOAEL			
Very High	>75dB $L_{Aeq, 12hr}$	>65dB $L_{Aeq, 4hr}$	>55dB $L_{Aeq, 8hr}$
UAEL			
Unacceptable	>85dB $L_{Aeq, 12hr}$	>75dB $L_{Aeq, 4hr}$	>65dB $L_{Aeq, 8hr}$

Magnitude of Change in Noise Exposure

The magnitude of change in noise exposure is not considered as part of the construction noise assessment given there are no permanent construction related activities associated with the Site.

Construction Vibration

Construction activities, such as vibratory compaction, have the potential to cause vibration induced adverse effects at residential receptors.

The effect of human exposure to vibration from sources other than blasting is covered in BS 6472:2008. The standard provides guidance for predicting human response to vibration in buildings over the frequency range of 0.5 Hz to 80 Hz. It presents frequency-weighting curves for humans exposed to whole-body vibration, advice on measurement methods and methods for assessing continuous, intermittent and impulsive vibrations.

BS 6472:2008 uses the vibration dose value (VDV ms-1.75) to determine the effect of vibration on human receptors within the buildings, as "[p]resent knowledge shows that this type of vibration is best evaluated with the vibration dose value (VDV)." As noted in BS 5228-2 (2014), for construction it is considered more appropriate to consider effects of vibration levels in terms of Peak Particle Velocity (PPV mms-1).

The use of the PPV metric is also consistent with the guidance within BS 7385:1993, which presents assessment criteria to be applied for the likelihood of cosmetic damage to buildings. Table 0.4 presents a summary of the assessment criteria given in terms of human building response, derived based on guidance within BS 5228-2 (2014) and BS 7385:1993.

Table 10.4: Vibration limits for human response and building (cosmetic) damage

Vibration Limit PPV mms-1	Effect	Magnitude of Impact
< 0.14	Vibration unlikely to be perceptible	None
0.14	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	Negligible
0.30	Vibration might be just perceptible in residential environments	Minor
1.00	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 the residents	Moderate
7.50	Guide value for cosmetic damage of residential buildings where dynamic loading may lead to resonance	Significant
10.00	Vibration is likely to be intolerable for any more than a very brief exposure to these levels in most building environments	Very Significant

A significant effect from construction vibration is deemed to occur where there is an exceedance of a magnitude of impact of 1.00 mms-1 PPV during the daytime, or 0.30 mms-1 PPV during the night-time periods.

Construction Noise - Road Traffic

The assessment criteria used in the construction traffic assessment is consistent with the operational road traffic noise assessment, as summarised in Table 10.5.

Table 10.5: Thresholds of Potential Effect Criteria (outdoor, free-field noise levels unless otherwise stated)

Noise Source	Period	LOAEL	SOAEL	UAEL
Construction Road Traffic	Daytime	55 dB $L_{A10,18hr\ (f)}$	68 dB $L_{A10,18hr\ (f)}$	71 dB $L_{Aeq,16hr}$
	Night	40 dB L_{night}, outside	55 dB L_{night}, outside	66 dB $L_{Aeq,8hr}$

(f) - facade

Noise Exposure Classifications

Table 10.6 provides noise level categories between the LOAEL and UAEL thresholds. Greater weight in terms of significance evaluation has been given to higher noise levels, even when occurring between the same thresholds, i.e. LOAEL and SOAEL.

Table 10.6: Noise Level Categories

Noise Level	Construction Road Traffic	
Very Low	<55dB $L_{A10,18hr\ (f)}$	<40dB L_{night}, outside
	LOAEL	
Low	55-59dB $L_{A10,18hr\ (f)}$	40-45dB L_{night}, outside

Medium	60-63dB $L_{A10,18hr\ (f)}$	46-49dB L_{night}, outside
High	64-67dB $L_{A10,18hr\ (f)}$	50-54dB L_{night}, outside
SOAEL		
Very High	>=68dB $L_{A10,18hr\ (f)}$	>=55dB L_{night}, outside
Unacceptable	>=71dB $L_{Aeq,16hr}$	>=66dB $L_{Aeq,\ 8hr}$

Magnitude of Change in Noise Exposure

A beneficial change was deemed to occur where there was a reduction in noise level, and an adverse change was where there was an increase.

The road traffic change in noise level criteria are for both short term and long term impacts, derived from methodologies advocated in LA 111, as summarised in Table 10.7.

Table 10.7: Change in Noise Level Categories

Noise Change Category	Road Traffic Noise
Negligible	<1 dB
Low	1 – 2.9 dB
Medium	3 – 4.9 dB
High	5 – 10 dB
Very High	>10 dB

Assessment Methodology

The construction programme has start dates in 2022 and completion dates in 2025.

Modelling Inputs and Assumptions

A spreadsheet-based noise model, using source sound emission data based upon a list of indicative plant items and assumptions on the likely percentage on-time during the relevant daytime assessment period, has been used to determine the likely sound immissions at each receptor. Sound power levels for each source have been adopted based on those provided by a typical example in the absence of specific plant being finalised at this stage.

An indicative construction plant list, likely working methods and phasing has been developed for the purpose of undertaking this assessment. The following work stages have been considered:

Stage 1 – Enabling works;

Stage 2 – Foundations and drainage works;

Stage 3 – Superstructure works;

Stage 4 – Internal building fitout works; and

Stage 5 – External areas and reinstatement works.

Information on the construction phasing and the associated construction plant used is summarised in Table 10.8, Table 10.9, Table 10.10, Table 10.11 and Table 10.12. The associated sound power level information as required for the noise prediction have been taken from those detailed within Annex C of BS 5228-1 (2014) and are also presented. It is assumed the same items of plant will be for the same construction phases for the Eastern Development and Western Developments, and Development site.

Construction activities are proposed during core ('daytime') working hours, and this is the basis of the assessment. For activities taking place outside of these hours, prior approval from the Local Planning Authority will be sought.

Table 10.8: Stage 1 - Enabling Works Plant List

Item of Plant / Equipment	Activity	No. of Plant	% On-time	BS5228 Table Reference	dB LWA
Tracked Excavator	Excavating, Clearing Site and Loading	4	75	Table C.5.18	108
Excavator - breaking attachment	Breaking out Concrete Obstructions	1	50	Table D.8.13	110
Dozer	Earthworks	2	75	Table C.2.12	109
Articulated Dump truck	Removal of Material to on site store	2	75	Table C.4.1	109
5te Dumper	Removal of Material to on site store and general material movement	2	75	Table C.4.7	106
Tipper Truck	Visiting tipping material and muck away	3 /hr	n/a	Table D.3.112	113
Road Sweeper	Maintaining haul roads and perimeter roads	1	16	Table C.4.90	104
Hiab Trucks/ low-loaders	Delivery of materials and equipment	2 /hr	n/a	Table C.2.27	108
Concrete Trucks	Visiting for site establishment works	2 /hr	n/a	Table C.4.20	108
Roller/Compactor	Compacting haul roads, temporary parking and piling mat	2	50	Table C.2.42	106
Nail Gun	Used for installing hoarding	2	33.3	Table C.4.95	101
Power Tools/circular saw/still saw/ grinder	Used for installing, hoarding gates, etc	5	50	Table C.4.93	108

Chain Saw/ Shredder	Vegetation/tree removal	2	75	Table D.2.14	114
Diesel Generator	Power for Project Welfare and Offices and Tools	1	100	Table C.4.78	94
Diesel Generator	Power for Lighting and security	1	100	Table C.4.78	94

Table 10.9: Stage 2 - Foundations and Drainage Works Plant List

Item of Plant / Equipment	Activity	No. of Plant	% On-time	BS5228 Table Reference	dB LWA
Piling Rig	Installing driven precast piles	3	100	Table C.12.37	111
5te Dumper	Removal of Material to on site store and general material movement	2	75	Table C.4.7	106
Forklift Truck	General Material movement	1	50	Table D.7.94	116
Tracked Excavator	Excavating, drainage trenches and Loading, lifting	4	75	Table C.5.18	108
Excavator - breaking/pile cropping attachment	Breaking out Concrete Obstructions and cropping piles	1	50	Table D.8.13	110
Tipper Truck	Visiting tipping material and muck away	3 /hr	n/a	Table D.3.112	113
Hiab Trucks/ low-loaders /General Trucks	Delivery of materials and equipment	2 /hr	n/a	Table C.2.27	108
Concrete Trucks	Visiting for foundation and drainage works	2 /hr	n/a	Table C.4.20	108
Roller/Compactor	Maintaining areas	2	50	Table C.2.42	106
Road Sweeper	Maintaining haul roads and perimeter roads	1	16	Table C.4.90	104
Power Tools/circular saw/still saw/ grinder	Used for formwork, drainage, etc	5	50	Table C.4.93	108

Diesel Generator	Power for Project Welfare and Offices and Tools	1	100	Table C.4.78	94
Diesel Generator	Power for Lighting and security	1	100	Table C.4.78	94

Table 10.10: Stage 3 - Superstructure Works Plant List

Item of Plant / Equipment	Activity	No. of Plant	% On-time	BS5228 Table Reference	dB LWA
Mobile Crane	Lifting steel frame, cladding packs, etc	2	75	Table C.3.29	98
Hiab Trucks/ low-loaders/ General Trucks	Delivery of materials and equipment	2 /hr	n/a	Table C.2.27	108
Diesel Scissor lift/Cherry pickers	Access to Steel installation and cladding installation	8	50	Table C.4.59	106
Concrete Pump	Visiting	1	100	Table C.3.25	106
Concrete Trucks	Visiting for site concrete slab works	3 /hr	n/a	Table C.4.20	108
Petrol Power Float (Overnight)	Visiting for concrete pours	2	75	Table D.6.44	100
Power Tools/circular saw/still saw/ grinder/ nut runner	Used for formwork, steel frame bolts, cladding installation, etc	8	83	Table C.4.93	108
Diesel Generator	Power for Project Welfare and Offices and Tools	1	100	Table C.4.78	94
Diesel Generator	Power for Lighting and security	1	100	Table C.4.78	94

Table 10.11: Stage 4 - Internal Building Fitout Works Plant List

Item of Plant / Equipment	Activity	No. of Plant	% On-time	BS5228 Table Reference	dB LWA
Mobile Crane	Lifting equipment	1	75	Table C.3.29	98
Hiab Trucks/ low-loaders/ General Trucks	Delivery of materials and equipment	2 /hr	n/a	Table C.2.27	108
Diesel Scissor lift/Cherry pickers	General access for external services	2	50	Table C.4.59	106
Forklift Truck	General Material movement	2	50	Table D.7.94	116
Diesel Generator	Power for Project Welfare and Offices and Tools	1	100	Table C.4.78	94
Diesel Generator	Power for Lighting and security	1	100	Table C.4.78	94

Table 10.12: Stage 5 - External Area & Reinstatement Works Plant List

Item of Plant / Equipment	Activity	No. of Plant	% On-time	BS5228 Table Reference	dB LWA
Mobile Crane	Lifting equipment	1	75	Table C.3.29	98
Hiab Trucks/ low-loaders/ General Trucks	Delivery of materials and equipment	2 /hr	n/a	Table C.2.27	108
Diesel Scissor lift/Cherry pickers	General access for external buildings and lighting posts	2	50	Table C.4.59	106
Forklift Truck	General Material movement	1	50	Table D.7.94	116
Power Tools/circular saw/still saw/ grinder/ nut runner	General construction all areas	20	83	Table C.4.93	108
5te Dumper	General Material Movement	1	75	Table C.4.7	106

Tracked Excavator	Excavating trenches and Loading, lifting, road works	2	75	Table C.5.18	108
Tipper Truck	Visiting tipping material and muck away	2 /hr	n/a	Table D.3.112	113
Concrete Trucks	Visiting for foundation and reinstatement works	2 /hr	n/a	Table C.4.20	108
Roller/Compactor	Maintaining areas, road works	2	50	Table C.2.42	106
Road Sweeper	Maintaining haul roads and perimeter roads	1	16	Table C.4.90	104
Diesel Generator	Power for Project Welfare and Offices and Tools	1	100	Table C.4.78	94
Diesel Generator	Power for Lighting and security	1	100	Table C.4.78	94

The assumed distances between each of the assessed receptors and the construction phasing is summarised in the following tables, and is considered to be the worst-case distance i.e. the boundary of the closest structure, assumed to be the main working area, is shown.

Table 10.13: Construction Phasing and Receptor Distances – Eastern

Receptor	Distance between Construction Working Area and Receptor, metres (W – worst-case distance to boundary of closest working area)				
	Enabling	Foundations and Drainage	Superstructure	Internal Building Fitout	External Areas and Reinstatement
R1	340	340	340	340	340
R2	160	160	160	160	160
R3	135	135	135	135	135
R4	135	135	135	135	135
R5	145	145	145	145	145
R6	160	160	160	160	160

Table 10.14: Construction Phasing and Receptor Distances – Western

Receptor	Distance between Construction Working Area and Receptor, metres (W – worst-case distance to boundary of closest working area)				
	Enabling	Foundations and Drainage	Superstructure	Internal Building Fitout	External Areas and Reinstatement
R1	140	140	140	140	140
R2	180	180	180	180	180
R3	130	130	130	130	130
R4	130	130	130	130	130
R5	480	480	480	480	480
R6	180	180	180	180	180

Table 10.15: Construction Phasing and Receptor Distances - Development

Receptor	Distance between Construction Working Area and Receptor, metres (W – worst-case distance to boundary of closest working area)				
	Enabling	Foundations and Drainage	Superstructure	Internal Building Fitout	External Areas and Reinstatement
R1	140	140	140	140	140
R2	160	160	160	160	160
R3	130	130	130	130	130
R4	130	130	130	130	130
R5	145	145	145	145	145
R6	160	160	160	160	160

Assessment of Effects

Construction Noise (Fixed and Mobile Plant)

Eastern Development

As shown in Table 10.16, when works are undertaken at the worst-case positions there are no predicted exceedances of SOAEL during any of the considered construction phases.

It is noted that whilst medium and high noise levels are likely to occur at R3, R4 and R5 during some activities associated with the Enabling Works, Foundations and Drainage and External Areas and Reinstatement phases, it is likely that the noise levels will be significantly lower than those reported, as:

- The construction activities are transient, and therefore plant is unlikely to be located at the closest point to the receptor for a prolonged period of time; and
- It is unlikely that all construction plant with the greatest noise emissions will be operated concurrently, with each phase likely to be broken down into sequential activities.

Considering these points, and accounting for the noise reductions associated with the good practice site measures to be detailed within the Construction Environmental Management Plan (CEMP), a significance outcome of 'Not Significant' is determined.

Table 10.16: Construction Noise Levels – Eastern Development

Receptor	Sound Pressure Level at Receptors, $L_{Aeq, T}$, dB				
	Enabling	Foundations and Drainage	Superstructure	Internal Building Fitout	External Areas and Reinstatement
R1	62.4	62.4	60.1	58.6	63.6
R2	69.9	69.5	67.1	65.6	70.6
R3	71.3	71.3	69	67.5	72.5
R4	71.3	71.3	69	67.5	72.5
R5	70.9	70.5	68.1	66.6	71.6
R6	69.9	69.5	67.1	65.6	70.6

Western Development

As shown in Table 10.17, when works are undertaken at the worst-case positions there are no predicted exceedances of SOAEL during any of the considered construction phases.

It is noted that whilst medium and high noise levels are likely to occur at R3, R4 and R5 during some activities associated with the Enabling Works, Foundations and Drainage and External Areas and Reinstatement phases, it is likely that the noise levels will be significantly lower than those reported, as:

- The construction activities are transient, and therefore plant is unlikely to be located at the closest point to the receptor for a prolonged period of time; and
- Not all construction plant will be operated concurrently, with each phase likely to be broken down into sequential activities.

Considering these points, and accounting for the noise reductions associated with the good practice site measures to be detailed within the Construction Environmental Management Plan (CEMP), a significance outcome of 'Not Significant' is determined.

Table 10.17: Construction Noise Levels – Western Development

Receptor	Sound Pressure Level at Receptors, $L_{Aeq, T}$, dB				
	Enabling	Foundations and Drainage	Superstructure	Internal Building Fitout	External Areas and Reinstatement
R1	70.9	70.5	68.1	66.6	71.6
R2	68.9	68.5	66.1	64.6	69.6
R3	71.9	71.5	69.1	67.6	72.6
R4	71.9	71.5	69.1	67.6	72.6
R5	59.1	58.7	56.2	54.6	59.7
R6	68.9	68.5	66.1	64.6	69.6

Development Site

As shown in Table 10.18, when works are undertaken at the worst-case positions there are no predicted exceedances of SOAEL during any of the considered construction phases.

It is noted that whilst medium and high noise levels are likely to occur at R3, R4 and R5 during some activities associated with the Enabling Works, Foundations and Drainage and External Areas and Reinstatement phases, it is likely that the noise levels will be significantly lower than those reported, as:

- The construction activities are transient, and therefore plant is unlikely to be located at the closest point to the receptor for a prolonged period of time; and
- It is unlikely that all construction plant with the greatest noise emissions will be operated concurrently, with each phase likely to be broken down into sequential activities.

Considering these points, and accounting for the noise reductions associated with the good practice site measures to be detailed within the Construction Environmental Management Plan (CEMP), a significance outcome of 'Not Significant' is determined.

Table 10.18: Construction Noise Levels - Development

Receptor	Sound Pressure Level at Receptors, $L_{Aeq, T}$, dB

	Enabling	Foundations and Drainage	Superstructure	Internal Building Fitout	External Areas and Reinstatement
R1	70.9	70.5	68.1	66.6	71.6
R2	69.9	69.5	67.1	65.6	70.6
R3	71.9	71.5	69.1	67.6	72.6
R4	71.9	71.5	69.1	67.6	72.6
R5	70.9	70.5	68.1	66.6	71.6
R6	69.9	69.5	67.1	65.6	70.6

Construction Vibration (and Cosmetic Damage)

The prediction of vibration levels requires an understanding of the many factors which contribute to its propagation characteristics. These generally include an understanding of the source, intermediate ground structure, and receiving structure properties.

The spatial extents of the construction vibration assessment are set at 100m, as at greater distances the levels of vibration from construction activities are unlikely to exceed the assessment thresholds.

As shown in Table 10.13, Table 10.14, and Table 10.15 the closest receptor to the construction works in the Eastern, Western and Development Sites are at a distance of more than 100m, and outside the spatial extents of the assessment.

Eastern Development

The closest receptor to the construction works is at a distance of 135m and therefore outside the extents of the construction vibration assessment.

Construction related vibration immissions from the Eastern Development are likely to be below 1.00 mms^{-1} PPV during the daytime, and therefore a significant effect in terms of the EIA Regulations is not deemed to occur at residential receptors.

Western Development

The closest receptor to the construction works is at a distance of 130m and therefore outside the extents of the construction vibration assessment.

Construction related vibration immissions from the Western Development are likely to be below 1.00 mms^{-1} PPV during the daytime, and therefore a significant effect in terms of the EIA Regulations is not deemed to occur at residential receptors.

Development

The closest receptor to the construction works is at a distance of 130m and therefore outside the extents of the construction vibration assessment.

Construction related vibration immissions from the Development Site are likely to be below 1.00 mms^{-1} PPV during the daytime, and therefore a significant effect in terms of the EIA Regulations is not deemed to occur at residential receptors.

Construction Noise - Road Traffic

Construction road traffic assumptions are derived by the transport consultants and included in Chapter 8: Transport and Access.

With reference to the construction road traffic noise change criteria, traffic flows would need to increase by at least 25% in order to result in a noise level change of approximately +/- 1 dB. Existing flows on the surrounding road network are relatively high, and therefore relatively high construction activity flows would be required in order to result in a noise level change greater than 'negligible'.

A specific comparison of the estimated HGV movements associated with the Enabling Works against those of the baseline levels on the A43 for the Enabling Works, Eastern Development, Western Development, and Development are set out in the following sections.

Enabling Works

Table 10.19: Percentage Increase in Daily HGV Movements During Construction (2023) – Enabling Works

Link	Baseline HGV Flows (2-way)	Predicted Increase in HGV Movements	% Increase
A43 (N)	4896	20	0.004%
A43 (S)	5439	20	0.004%

A construction traffic associated percentage change in flows of less than 25% is shown, and therefore a 'negligible' change in noise level, and a significance outcome of 'Not Significant'.

Eastern Development

Table 10.20: Percentage Increase in Daily HGV Movements During Construction (2023) – Eastern Development

Link	Baseline HGV Flows (2-way)	Predicted Increase in HGV Movements	% Increase
A43 (N)	4896	20	0.004%
A43 (S)	5439	20	0.004%

A construction traffic associated percentage change in flows of less than 25% is shown, and therefore a 'negligible' change in noise level, and a significance outcome of 'Not Significant'.

Western Development

Table 10.21: Percentage Increase in Daily HGV Movements During Construction (2023) – Western Development

Link	Baseline HGV Flows (2-way)	Predicted Increase in HGV Movements	% Increase
A43 (N)	4896	20	0.004%
A43 (S)	5439	20	0.004%

A construction traffic associated percentage change in flows of less than 25% is shown, and therefore a 'negligible' change in noise level, and a significance outcome of 'Not Significant'.

Development

Table 10.22: Percentage Increase in Daily HGV Movements During Construction (2023) – Development

Link	Baseline HGV Flows (2-way)	Predicted Increase in HGV Movements	% Increase
A43 (N)	4896	40	0.008%
A43 (S)	5439	40	0.008%

A construction traffic associated percentage change in flows of less than 25% is shown, and therefore a 'negligible' change in noise level, and a significance outcome of 'Not Significant'.

Proposed Management and Control Measures

No specific noise or vibration mitigation associated with the construction assessment is proposed beyond the good practice site measures to be detailed within the CEMP. The good practice site measures seek to minimise potentially adverse noise and vibration effects that result from development related construction activities. The CEMP will also outline the methodology to be adopted should a complaint be received regarding excessive noise and/or vibration levels.

Appendix 10.4

OPERATIONAL SOUND

Appendix 10.4: Operational Sound

To assess the effects of operational sound, the extents of the assessment include consideration of receptors where there is a likely indication of adverse impact.

Assessment Criteria

BS 4142 (2019) is the standard applicable to the assessment of sound of an industrial nature, such as that from the operation of the Development.

The BS 4142 (2019) methodology assesses the likely effects of sound on people and premises used for residential purposes, and provides an indication of the likely magnitude of impact. The BS 4142 (2019) magnitude of impacts, including where there is an indication of 'significant adverse impact' has been aligned with the effect levels in NPSE (2010), namely the SOAEL, which is the effect level above which significant adverse effects on health and quality of life occur.

For residential receptors during the daytime and night-time periods, the SOAEL threshold is set at 10 dB greater than the background sound level, when determined in accordance with the BS 4142 (2019) assessment procedure. When this threshold is exceeded it indicates that a significant adverse effect in EIA terms is likely to occur, subject to factors relating to context.

The LOAEL threshold is exceeded where the rating level is equal to or exceeds the background sound level. This is summarised in Table 10.1 below.

Table 10.1: BS 4142 (2019) LOAEL and SOAEL Criteria

Period	LOAEL	SOAEL
Daytime (0700-2300hrs)	Equal to background sound level, $L_{A90,T}$ (with consideration of context)	Background sound level, $L_{A90,T}$ + 10 dB (with consideration of context)
Night-time (2300-0700hrs)	Equal to background sound level, $L_{A90,T}$ (with consideration of context)	Background sound level, $L_{A90,T}$ + 10 dB (with consideration of context)

Development related noise exposures which fall between LOAEL and SOAEL have the potential to constitute a significant effect, subject to additional considerations, namely:

- The magnitude of the effect;
- The change in magnitude of the effect;
- The type of effect, including its intermittency;
- The existing ambient environment;

- How effective the measures employed to mitigate the effect are, including best practicable means (BPM); and

- The duration of effect.

Assessment Methodology

BS 4142 (2019) is used to rate and assess sound of an industrial nature including but not limited to assessing sound from proposed, new, modified or additional sources of industrial sound. It contains guidance on the monitoring and assessment of industrial and commercial sound sources (including fixed installations comprising mechanical and electrical plant and equipment) affecting residential receptors.

The methodology relies on comparing the rating level, $L_{Ar,Tr}$, (i.e. the specific noise from the equipment or source plus any allowance for character correction) with the background sound level, $L_{A90,T}$ (i.e. the level that would be present without the development) over a representative time period. BS 4142 (2019) provides guidance on the measurement of background sound, the determination of specific sound and calculation of the rating level.

In order to determine the impact threshold levels for the assessment of operational industrial sound, the difference between the rating level and background sound level is considered, as advocated by the methodology within BS 4142 (2019).

Noise Baseline

The noise baseline has been characterised over a noise survey. The noise survey was undertaken 06/07/2021 – 07/07/2021 at locations representative of the closest residential receptors.

The noise survey included unattended long-term measurements, supplemented by short-term measurements. The monitoring locations are presented in Figure 10.1, and a summarised in Table 10.2.

Figure 10.1: Monitoring Locations

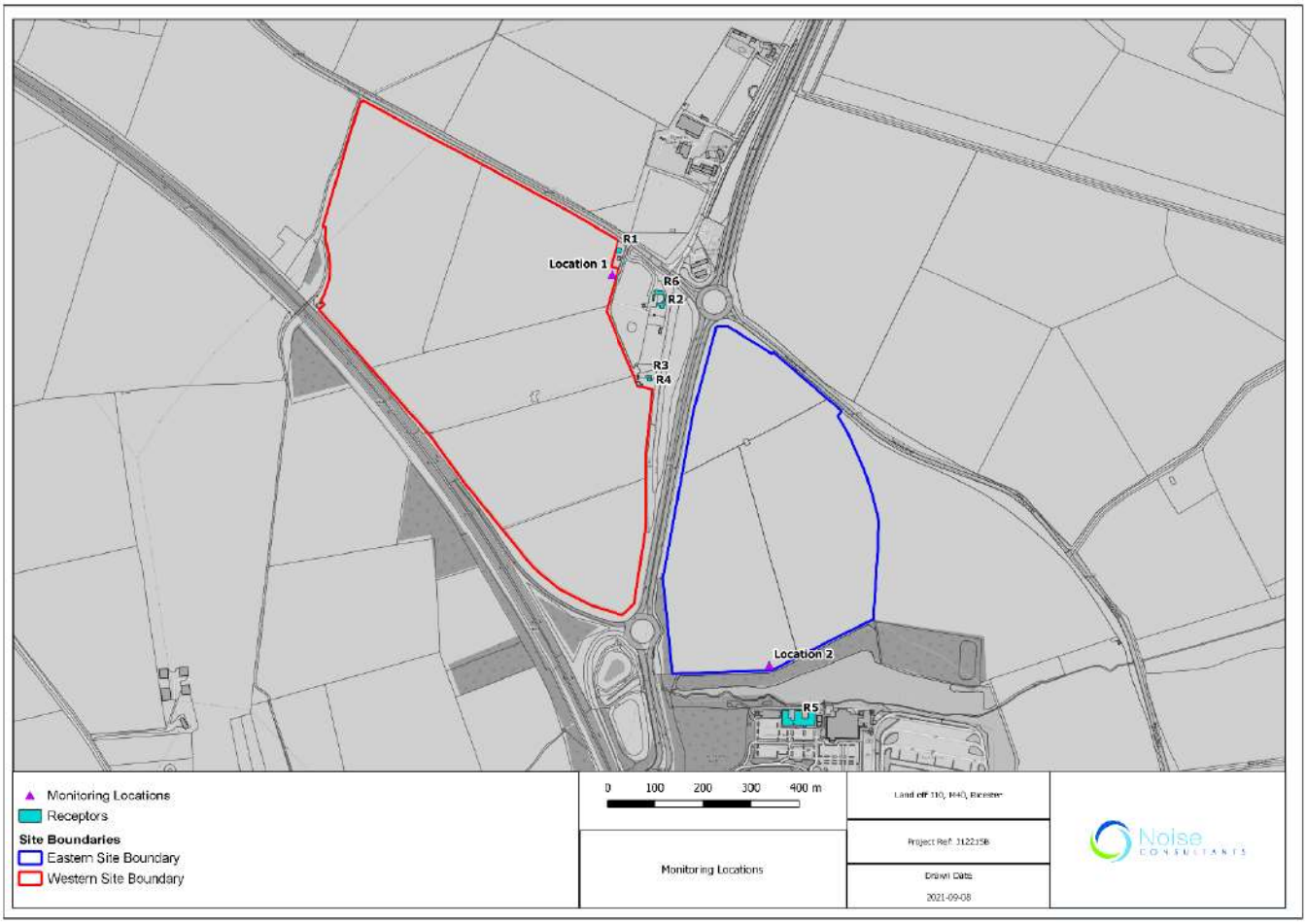

Table 10.2: Monitoring Locations

Monitoring Location	Location	Measurement Period (dd/mm/yyyy hh:mm)	Description
1	Western Site	06/07/2021 13:30hrs - 07/07/2021 13:00hrs	A measurement location at the northern section of the Western Development to quantify ambient noise levels representative of Baynard House, Baynard Barn, Medkre and The Cottages.
2	Eastern Site	06/07/2021 14:15hrs - 07/07/2021 13:30hrs	A measurement location at the southern section of the Eastern Development to quantify ambient noise levels representative of the Travelodge Hotel.

The calibration levels of the sound level meters (SLM) were checked before and after each measurement with no significant drift recorded. Windshields were fitted to the microphones to minimise the effects of any wind induced sound.

Details of the monitoring instrumentation (model/serial numbers and calibration details) are summarised in Table 10.3. All instrumentation was configured to report full suite of environmental parameters, including L_{Aeq}, L_{A10}, L_{A90}, and L_{Amax}, in one-third octave bands, and capture audio.

Table 10.3: Monitoring Instrumentation Details

Monitoring Location	Monitoring Instrument	Serial Number	Last Calibration Date	Calibration Due Date
1	Rion NL-52 Class 1 Sound Level Meter	687044	27/02/2020	27/02/2022
2	Rion NL-52 Class 1 Sound Level Meter	1176453	03/08/2020	03/08/2022
N/a	Rion NC-75 Acoustic Calibrator	35281145	03/03/2021	03/03/2022

All measurements were conducted adopting methodologies advocated in BS 4142 (2019) and BS 7445-1:2003 'Description and measurement of environmental noise. Guide to quantities and procedures' (BS 7445, 2003). Photographs of the monitoring locations can be found in Figure 10.2 and Figure 10.3 below.

Figure 10.2: Monitoring Location 1

Figure 10.3: Monitoring Location 2

Measured Baseline Noise Levels

A summary of the measured levels used to inform the noise baseline at the closest residential receptors is presented in Table 10.4 below. The noise levels are rounded to the nearest whole decibel.

Table 10.4: Summary of Measured Baseline Noise Levels

Monitoring Location	Location	Period	dB $L_{Aeq,T}$	dB $L_{A90,15min}$ (Mean)	dB $L_{A90,15min}$ (Mode)	dB L_{Amax} (Max)
Location 1	Western Development - Adjacent to Medkre and Baynard House	Daytime (07:00 - 23:00)	59	57	58	78
		Night (23:00 - 07:00)	55	50	47	76
Location 2		Daytime	57	54	55	77

	Eastern Development - Adjacent to the Travelodge Hotel	(07:00 - 23:00)				
		Night (23:00 - 07:00)	52	49	47	69

Time history charts of the measured levels captured are presented in Figure 10.4 and observations of the acoustic environment at the survey locations are summarised in Table 10.5 below.

Figure 10.4: Location 1 Time History Chart

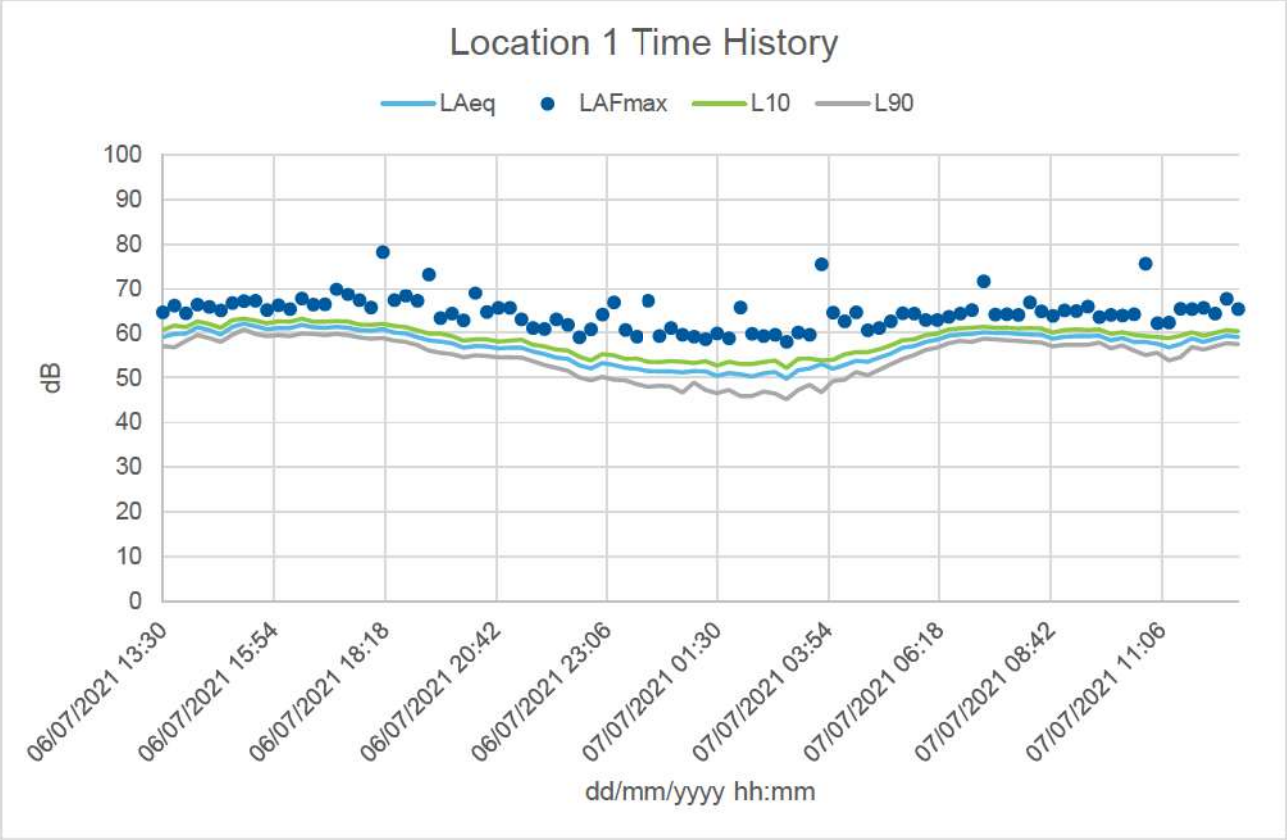

Figure 10.5: Location 2 Time History Chart

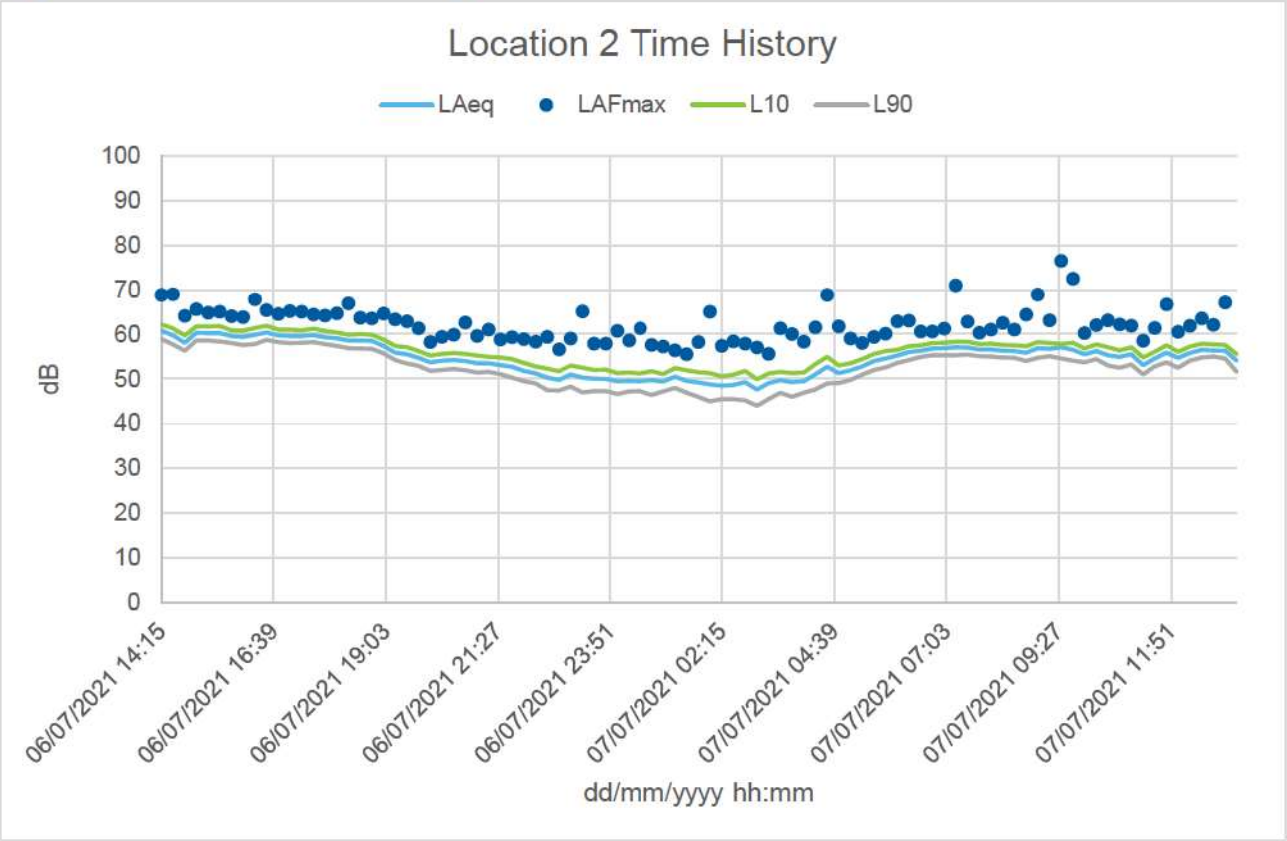

Table 10.5: Survey Observations

Monitoring Location	Observations
Location 1	Road traffic noise from the M40 to the southwest, B4100 to the north and the A43 to the east of the monitoring location was noted to be the dominant contributor to the ambient noise climate whilst an NCL consultant was on site. This included day and night periods.
Location 2	Road traffic noise from the M40 to the west and the A43 to the west of the monitoring location was noted to be the dominant contributor to the ambient noise climate whilst an NCL consultant was on site. This included day and night periods.

A representative background sound level (L_{A90}) is required to facilitate an assessment of impacts from an industrial sound source. In order to determine the representative background sound level at residential receptors for use in the assessment, consideration has been given to the mean and modal average $L_{A90,15min}$ captured at the monitoring locations, and the distribution of sound levels.

The derived background sound levels for the daytime (0700 – 1900) and night-time (2300 – 0700) periods are summarised in Table 10.6, along with a justification of the selected level to inform the assessment.

Table 10.6: Derived Background Sound Level Justification

Location	Period	Derived dB $L_{A90,15\ min}$	Justification

1	Daytime (0700-1900)	58	Most commonly occurring
	Night-time (2300-0700)	47	Most commonly occurring
2	Daytime (0700-1900)	55	Most commonly occurring
	Night-time (2300-0700)	47	Most commonly occurring

Modelling Inputs and Assumptions

The likely greatest operational sound sources from the Development include:

- Building services sound from the Development warehouses;
- Road traffic using roads within the Development site; and
- Road traffic movements in car park areas.

Building Services Sound

Operational sound from building services has been calculated based on breakout noise from the proposed units. As details of the construction and makeup of the proposed units is unavailable at this stage, it is assumed that the cladding to be used will have similar sound reduction properties as Kingspan KS1000, which has been used on similar projects. Using an assumed internal noise level of 75 dB(A) and the assumed sound reduction index presented in Table 10.7 below, breakout sound levels have been calculated.

Table 10.7: Kingspan KS1000 Cladding SRI

Cladding	Rating, Rw	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
Wall	25	-20.0	-18.0	-20.0	-24.0	-20.0	-29.0	-39.0	-47.0
Roof	23	-20.0	-15.0	-17.0	-23.0	-18.0	-25.0	-40.0	-46.0

Road traffic using roads within the Development site

Internal traffic movements have been calculated based on traffic flows derived from the transport chapter. The trip rates are determined based on the floor area of the proposed development. The trip rates and proposed floor areas for Units 1 - 5 are presented in Table 10.8 and Table 10.9, respectively. It is recognised that the final design, including location of internal roads, may change from those assessed, however the design upon which the assessment is based is considered to represent a conservative assessment.

Table 10.8: Trip Rates

Traffic Metric	Time Period	Trip Rates per 100m^2		
		Light Vehicles	HGV	Total
AM Peak	08:00-09:00	0.12	0.037	0.157
18h AAWT	06:00-24:00	1.602	0.601	2.204
8h AAWT	23:00-07:00	0.407	0.189	0.595

Table 10.9: Unit 1 - 5 Floor Areas

Proposed Warehouse Unit	Land Site	Floor Area (square meters)
Unit 1	Western	87586
Unit 2	Western	36423
Unit 3	Western	45697
Unit 4	Eastern	66081
Unit 5	Eastern	33309

Calculation of noise from traffic movements on roads within the Eastern, Western and Development Sites has been undertaken using methodologies advocated in BS5228-1 (2009). Table 10.10 presents the source sound power level data for HGV's and car movements, as used in the noise model.

Table 10.10: HGV & Light Vehicles Source Data

Source	Noise Level Reference	Octave Band Centre Frequency Lw(Z), Hz								Lw(A)
		63	125	250	500	1000	2000	4000	8000	
HGV	BS5228 C11.5	120.0	110.0	105.0	104.0	105.0	100.0	96.0	91.0	108.0
Car	Measured	101.3	96.2	92.7	94.2	97.8	89.5	82.7	73.8	99.3

Road traffic movements in car park areas

In the absence of a standard adopted methodology for the prediction of noise from car parks in the UK, a noise modelling exercise has been undertaken in line with the methodology of revisions 3 and 4 the Parkplatzlärmstudie des Bayerischen Landesamts für Umweltschutz (Bavarian Parking Lot Study of the Bavarian department for Environmental Protection) (the 'Bavarian method'). The calculations were undertaken using LimA® computational sound modelling software (version 2020).

The Bavarian method converts the number of movements per bay, per hour (daytime and night-time) and the number of bays within the car park into an area noise source for inclusion within the model. A $L_{Aeq,1h}$ and $L_{Aeq,15min}$ are then calculated for the day and night period respectively for an assessment in accordance with BS4142 (2019).

The modelling is based on an assumed worst-case daytime hour and night-time 15-minute period, where all spaces in the car parks would be switched over during a shift change i.e.

- Daytime period (worst-case hour) - each space would be used by 2 vehicles per hour: and
- Night-time period (worst-case 15-minute period) – each space would be used by 2 vehicles.

Car park areas have been considered for both car parking and HGV parking taking into account the difference in source height between cars and HGVs. Car parking and HGV parking locations were provided on site plans from the architects.

For the purpose of the assessment, the operational sound level is assumed to a combination of the building services sound from the Development warehouses, road traffic using roads within the Development site and road traffic movements in car park areas. This is considered a conservative approach.

Car park areas have been considered for both car parking areas and HGV parking areas

Assessment of Effects

The basic procedure of a BS 4142 (2019) assessment is to compare the operational sound level from the source(s) at the assessment location(s) (the specific sound level, Ls) with the existing acoustic environment (background sound level, $L_{A90,T}$).

The assessment is performed by comparing the rating level of the sound source(s), $L_{Ar,Tr}$, against the background sound level, $L_{A90,T}$. The background sound level should be measured during a period in absence of the influence of sound from the industrial sources. Guidance is provided on how to monitor and determine the background sound level, specific sound level and rating level.

Where there are certain acoustic features of the specific sound level, Ls that would likely increase the significance of impact, then an appropriate character correction is added to the specific sound level, Ls. This is referred to as the rating level $L_{Ar,Tr}$.

Character Correction Considerations

Tonality

A tonal correction between 0 and +6 dB can be applied for sounds that range from not tonal to prominently tonal. Several methodologies are presented in BS 4142 (2019) in order to determine the appropriate correction to be applied. Table 10.11 presents the subjective assessment method corrections for tonal sounds.

Table 10.11: Subjective Method – Rating Level Corrections for Tonal Sounds

Subjective assessment of sound source at the receptor	Correction
The tone is just perceptible at the receptor	+2 dB
The tone is clearly perceptible at the receptor	+4 dB
The tone is highly perceptible at the receptor	+6 dB

Impulsivity

An impulsivity correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Table 10.12 presents the subjective method corrections for impulsive sounds.

Table 10.12: Subjective Method – Rating Level Corrections for Impulsive Sounds

Subjective assessment of sound source at the receptor	Correction
Impulsivity is just perceptible at the receptor	+3 dB
Impulsivity is clearly perceptible at the receptor	+6 dB
Impulsivity is highly perceptible at the receptor	+9 dB

Intermittency and Other Sound Characteristics

Where the specific sound is of an intermittent character (i.e. it has identifiable on/off conditions), a penalty of +3 dB can be applied.

Based on the design information available, no character corrections are deemed necessary for the Development.

An assessment of impacts adopting the BS 4142 (2019) methodology for the daytime and night-time periods for the Eastern and Western Developments and the Development as a whole is set out below.

Eastern Development

Residential Receptors

A summary of the BS 4142 (2019) assessment at residential receptors is presented in the tables below. As shown the predicted specific sound levels are more than 18 dB and 7 dB below the existing background sound level during the daytime and night-time periods, respectively. This is a 'low impact' and a significance outcome of 'Not Significant' is determined.

Table 10.13: Assessment of Impacts – Daytime (0700-2300hrs)

Description	R1	R2	R3	R4	R6
Predicted Specific Sound Level, $L_{Aeq,T}$, dB	32.8	38.4	39.5	39.8	38.0
Character correction (Tonal)	+ 0	+ 0	+ 0	+ 0	+ 0
Rating Level $L_{Ar,Tr}$, dB	32.8	38.4	39.5	39.8	38.0
Background Sound Level dB LA90 , dB	58.0	58.0	58.0	58.0	58.0
Difference (Rating Level – Background Sound Level), dB	-25.2	-19.6	-18.5	-18.2	-20.0

BS 4142 (2019) Outcome	Low impact	Low impact	Low impact	Low impact	Low Impact

Table 10.14: Assessment of Impacts – Night-time (2300-0700hrs)

Description	R1	R2	R3	R4	R6
Predicted Specific Sound Level, $L_{Aeq,T}$, dB	32.7	38.2	39.3	39.6	37.8
Character correction (Tonal)	+ 0	+ 0	+ 0	+ 0	+ 0
Rating Level $L_{Ar,Tr}$, dB	32.7	38.2	39.3	39.6	37.8
Background Sound Level dB LA90 , dB	47.0	47.0	47.0	47.0	47.0
Difference (Rating Level – Background Sound Level), dB	-14.3	-8.8	-7.7	-7.4	-9.2
BS 4142 (2019) Outcome	Low impact	Low impact	Low impact	Low impact	Low Impact

Non-Residential Receptors

A summary of the operational sound assessment at identified non-residential receptors is presented in the table below. As shown, the predicted sound levels are more than 10 dB below the noise criterion, and a significance outcome of 'Not Significant' is determined.

Table 10.15: Assessment of Impacts – Non-Residential Receptors

Receptor	Period	Predicted Specific Sound Level, $L_{Aeq,T}$, dB	Noise Criterion, dB	Margin, dB	Outcome
R5	Daytime	34.9	50.0	-15.1	Not Significant
R5	Night-time	34.9	45.0	-10.1	Not Significant

Western Development

A summary of the BS 4142 (2019) assessment at residential receptors is presented in the tables below. As shown the predicted specific sound levels are more than 17 dB and 6 dB below the existing background sound level during the daytime and night-time periods, respectively. This is a 'low impact' and a significance outcome of 'Not Significant' is determined.

Table 10.16: Assessment of Impacts – Daytime (0700-2300hrs)

Description	R1	R2	R3	R4	R6
Predicted Specific Sound Level, $L_{Aeq,T}$, dB	40.8	37.7	39.8	39.8	39.3

Character correction (Tonal)	+ 0	+ 0	+ 0	+ 0	+ 0
Rating Level $L_{Ar,Tr}$, dB	40.8	37.7	39.8	39.8	39.3
Background Sound Level dB LA90 , dB	58.0	58.0	58.0	58.0	58.0
Difference (Rating Level – Background Sound Level), dB	-17.2	-20.3	-18.2	-18.2	-18.7
BS 4142 (2019) Outcome	Low impact	Low impact	Low impact	Low impact	Low Impact

Table 10.17: Assessment of Impacts – Night-time (2300-0700hrs)

Description	R1	R2	R3	R4	R6
Predicted Specific Sound Level, $L_{Aeq,T}$, dB	40.3	37.5	39.7	39.6	39.0
Character correction (Tonal)	+ 0	+ 0	+ 0	+ 0	+ 0
Rating Level $L_{Ar,Tr}$, dB	40.3	37.5	39.7	39.6	39.0
Background Sound Level dB LA90 , dB	47.0	47.0	47.0	47.0	47.0
Difference (Rating Level – Background Sound Level), dB	-6.7	-9.5	-7.3	-7.4	-8
BS 4142 (2019) Outcome	Low impact	Low impact	Low impact	Low impact	Low Impact

Non-Residential Receptors

A summary of the operational sound assessment at identified non-residential receptors is presented in the table below. As shown, the predicted sound levels are more than 16 dB below the noise criterion, and a significance outcome of 'Not Significant' is determined.

Table 10.18: Assessment of Impacts – Non-Residential Receptors

Receptor	Period	Predicted Specific Sound Level, $L_{Aeq,T}$, dB	Noise Criterion, dB	Margin, dB	Outcome
R5	Daytime	29.1	50.0	-20.9	Not Significant
R5	Night-time	29.0	45.0	-16.0	Not Significant

Development

A summary of the BS 4142 (2019) assessment at residential receptors is presented in the tables below. As shown the predicted specific sound levels are more than 16 dB and 6 dB below the existing background sound level during the daytime and night-time periods, respectively. This is a 'low impact' and a significance outcome of 'Not Significant' is determined.

Table 10.19: Assessment of Impacts – Daytime (0700-2300hrs)

Description	R1	R2	R3	R4	R6
Predicted Specific Sound Level, $L_{Aeq,T}$, dB	41.1	41.0	41.2	41.5	39.3
Character correction (Tonal)	+ 0	+ 0	+ 0	+ 0	+ 0
Rating Level $L_{Ar,Tr}$, dB	41.1	41.0	41.2	41.5	39.3
Background Sound Level dB LA90 , dB	58.0	58.0	58.0	58.0	58.0
Difference (Rating Level – Background Sound Level), dB	-16.9	-17.0	-16.8	-16.5	-18.7
BS 4142 (2019) Outcome	Low impact	Low impact	Low impact	Low impact	Low Impact

Table 10.20: Assessment of Impacts – Night-time (2300-0700hrs)

Description	R1	R2	R3	R4	R6
Predicted Specific Sound Level, $L_{Aeq,T}$, dB	40.7	40.8	41	41.4	39.0
Character correction (Tonal)	+ 0	+ 0	+ 0	+ 0	+ 0
Rating Level $L_{Ar,Tr}$, dB	40.7	40.8	41	41.4	39.0
Background Sound Level dB LA90 , dB	47.0	47.0	47.0	47.0	47.0
Difference (Rating Level – Background Sound Level), dB	-6.3	-6.2	-6	-5.6	-8
BS 4142 (2019) Outcome	Low impact	Low impact	Low impact	Low impact	Low Impact

Non-Residential Receptors

A summary of the operational sound assessment at identified non-residential receptors is presented in the table below. As shown, the predicted sound levels are more than 9 dB below the noise criterion, and a significance outcome of 'Not Significant' is determined.

Table 10.21: Assessment of Impacts – Non-Residential Receptors

Receptor	Period	Predicted Specific Sound Level, $L_{Aeq,T}$, dB	Noise Criterion, dB	Margin, dB	Outcome
R5	Daytime	35.3	50.0	-14.7	Not Significant
R5	Night-time	35.2	45.0	-9.8	Not Significant

Proposed Management and Control Measures

The BS 4142 (2019) outcome is Low impact for all assessed scenarios. No specific noise mitigation associated with the operational sound assessment is proposed.

Appendix 10.5

OPERATIONAL ROAD TRAFFIC NOISE

Appendix 10.5: Operational Road Traffic Noise

For operational road traffic on new, altered or existing roads the study area was defined based on the combined extent of:

- The area within 50m of road links with the potential to experience a short-term Basic Noise Level (BNL) change of more than 1 dB(A) as a result of the Development;
- Identified receptors with the potential to experience a short-term Basic Noise Level (BNL) change of more than 1 dB(A) as a result of the Development; and
- Where the noise level at identified receptors is forecast to exceed the relevant Lowest Adverse Effect Level (LOAEL).

Assessment Criteria

The assessment criteria is primarily based on the LOAELs and SOAELs as set out within Design Manual for Roads and Bridges: Sustainability & Environment Appraisal LA 111 Noise and vibration (LA 111, 2020).

UK policy does not define daytime or night-time UAEL values for road traffic noise. The assessment has assumed UAEL values based on advice set out within BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings (BS8233, 2014) and ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise (ProPG, 2017).

It has been assumed that the target internal noise levels, as set out in BS 8233 (2014) would be deemed unacceptable once exceed by 10 dB or more. It has also been assumed that 26 dB is a reasonable and conservative assumption for the outdoor to indoor level difference. This represents the level difference expected for a property with a masonry construction and single glazed (closed) windows.

The derivation of the UAEL values from the BS 8233 (2014) daytime and night-time target internal noise levels is presented in Table 10.1.

Table 10.1: Road Traffic Noise – UAEL Threshold Derivation

Noise Source	Period	BS8233(2014) Target Internal Noise Level	Unacceptable Internal Noise Level	Unacceptable Internal Noise Level (UAEL)
Operational Road Traffic	Daytime	35 dB $L_{Aeq,16hr}$	45 dB $L_{Aeq,16hr}$	71 dB $L_{Aeq,16hr}$
	Night	30 dB $L_{Aeq,8hr}$	40 dB $L_{Aeq,8hr}$	66 dB $L_{Aeq,8hr}$

A summary of the assessment criteria used to assess road traffic noise is given in Table 10.2. Whilst LA 111 specifies night-time criteria as L_{night} and the derived UAEL is in terms of $L_{Aeq, 8hr}$, for the road traffic assessment these are considered to be equivalent as they have both been determined in relation to annual average road traffic flows.

Table 10.2: Road Traffic Noise Thresholds of Potential Effect Criteria (outdoor, free-field noise levels unless otherwise stated)

Noise Source	Period	LOAEL	SOAEL	UAEL
Operational Road Traffic	Daytime	55 dB $L_{A10,18hr\ (f)}$	68 dB $L_{A10,18hr\ (f)}$	71 dB $L_{Aeq,16hr}$
	Night	40 dB $L_{night,\ outside}$	55 dB $L_{night,\ outside}$	66 dB $L_{Aeq,8hr}$

Where development related noise exposures are shown to be lower than the LOAEL values in Table 10.2, a significant effect in terms of the EIA Regulations was not deemed to occur at residential receptors.

Development related noise exposures which fall between LOAEL and SOAEL have the potential to constitute a significant effect, subject to additional considerations, namely:

- The level of noise exposure;
- The change in the noise exposure as a result of the Development; and
- The population experiencing such change and exposure to noise as a result of the Development.

Noise Exposure Classifications

Table 10.3 provides noise level categories between the LOAEL and UAEL thresholds. Greater weight in terms of significance evaluation has been given to higher noise levels, even when occurring between the same thresholds, i.e. LOAEL and SOAEL.

Table 10.3: Noise Level Categories

Noise Level	Operational Road Traffic	
Very Low	<55dB $L_{A10,18hr\ (f)}$	<40dB $L_{night,\ outside}$
LOAEL		
Low	55-59dB $L_{A10,18hr\ (f)}$	40-45dB $L_{night,\ outside}$
Medium	60-63dB $L_{A10,18hr\ (f)}$	46-49dB $L_{night,\ outside}$
High	64-67dB $L_{A10,18hr\ (f)}$	50-54dB $L_{night,\ outside}$
SOAEL		
Very High	>=68dB $L_{A10,18hr\ (f)}$	>=55dB $L_{night,\ outside}$
UAEL		
Unacceptable	>=71dB $L_{Aeq,16hr}$	>=66dB $L_{Aeq,\ 8hr}$

(f) - facade

Magnitude of Change in Noise Exposure

A beneficial change was deemed to occur where there was a reduction in noise level, and an adverse change was where there was an increase.

The road traffic change in noise level criteria are for both short term and long term impacts, derived from methodologies advocated in LA 111 (2020), as summarised in Table 10.4.

Table 10.4: Change in Noise Level Categories

Noise Change Category	Road Traffic Noise
Negligible	<1 dB
Low	1 – 2.9 dB
Medium	3 – 4.9 dB
High	5 – 10 dB
Very High	>10 dB

Table 10.5 summarises the framework for evaluation of potential significant adverse effect on health and quality of life in relation to receptor newly exposed to development related noise exposures. However, in general, where a noise exposure is between the LOAEL and SOAEL, and a medium change in exposure is calculated to occur, this is most likely to result in a significant effect.

Table 10.5: Significant Adverse Effects on Health and Quality of Life

Noise Exposure Category	Magnitude of Change (increases and decreases) Category				
	Negligible Change	Low Change	Medium Change	High Change	Very High Change
Very Low Exposure	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
Lowest Observed Adverse Effect Level (LOAEL) Exposure above LOAEL potentially significant depending upon population and the magnitude of change					
Low Exposure	Not Significant	Potentially Significant*	Potentially Significant*	Potentially Significant*	Potentially Significant*
Medium Exposure	Not Significant	Potentially Significant*	Potentially Significant*	Potentially Significant*	Potentially Significant*
High Exposure	Not Significant	Potentially Significant*	Potentially Significant*	Potentially Significant*	Potentially Significant*
Significant Observed Adverse Effect Level (SOAEL) Exposure above SOAEL due to Development considered significant on an individual receptor basis					
Very High Exposure	Not Significant	Significant	Significant	Significant	Significant
Unacceptable Observed Adverse Effect Level (UAEL)					
Unacceptable Exposure	Not Significant	Significant (individual receptors)	Significant (individual receptors)	Significant (individual receptors)	Significant (individual receptors)

*depending on population

Table 10.5 demonstrates that where noise exposure is above the LOAEL but below the SOAEL, the magnitude of change along with the scale of population experiencing this change may give rise to significant effects, which should be determined through consideration of 'additional factors'.

Assessment Methodology

The operational road traffic noise assessment has considered the following assessment years:

- 2019 - Baseline;
- 2025 - Future Baseline (without Development); and
- 2025 - Completed Development

The magnitude of change in noise exposure is considered for the following scenarios:

- 2019 – Baseline vs 2025 Future Baseline (without Development); and
- 2025 Future Baseline (without Development) vs 2025 Completed Development

The assessment scenario considering the 2019 Baseline year is to show the likely changes in effects associated with the 2025 assessment year in the absence of the Eastern, Western and Development Sites. These effects can be attributed to non-Development related growth.

The '2025 Future Baseline (without Development) vs 2025 Completed Development' assessment is the primary assessment scenario, and as an initial scoping stage, the magnitude of change is noise exposure is considered in terms of road links with the potential to experience a short-term Basic Noise Level (BNL) change of more than 1 dB(A). Where the change in BNL on all road links is <1 dB, and therefore a 'negligible' change, a significant effect in terms of the EIA Regulations is not deemed to occur.

Where there is a road link change in BNL of more than 1 dB(A) as a result of the Development, the magnitude of change and associated noise exposures have been determined to identify where road traffic noise levels are forecast to exceed the relevant Lowest Adverse Effect Level (LOAEL).

Where development related noise exposures are shown to be lower than the LOAEL values, a significant effect in terms of the EIA Regulations is not deemed to occur.

The methodology adopted for the calculation of operational road traffic noise associated with the Development is based upon the methodology presented within the Calculation of Road Traffic Noise (CRTN, 1988).

Modelling Inputs and Assumptions

The calculations are based upon road traffic flow data provided by David Tucker Associates (DTA). Road traffic data was provided in the form of 18-hour Annual Average Weekday Traffic (AAWT) including and 1-hour AAWT with % HGV and the speed limit for the road links. Road traffic flows for roads considered in the assessment are detailed in Table 10.6, Table 10.7, Table 10.8, Table 10.9, Table 10.10, and Table 10.11 for the daytime and night-time periods. The road links noted are those defined in Chapter 8: Transport and Access.

Table 10.6: AAWT, 18hr Daytime Road Traffic Flows – Eastern Development

Road	Link	AAWT,18hr Two-way Traffic Flow						Speed Limit (km/h)
		2019 Baseline		2025 Future Baseline		2025 With Development		
		AAWT,18hr	% HGVs	AAWT,18hr	% HGVs	AAWT,18hr	% HGVs	
B4100	1	7073	3	7662	3	7794	3	96.6
B4100	2	7073	3	7662	3	7794	3	80.5
B4100	3	12658	4	14697	4	16008	7	80.5
B4100	4	12658	4	14697	4	15590	4	80.5
B4100	5	12300	4	16311	4	17204	4	80.5
A4095	6	18143	4	20916	4	21235	4	80.5
A4095	7	14116	2	17609	2	17897	2	80.5
A43	8	34644	15	41608	14	42396	14	80.5
B430	9	8351	5	16158	5	16262	5	96.6
M40S	10	123826	14	138706	14	139229	14	112.7
M40N	11	95298	12	108578	12	108739	12	112.7
A43	12	37936	12	45716	11	46108	12	112.7
A43	13	34510	12	41927	12	42223	12	112.7
A421	14	12139	8	13151	8	13247	9	96.6
M40 Northbound On	15	5617	15	7533	12	7608	13	64.4
M40 Southbound Off	16	6497	16	7696	14	7780	14	64.4
M40 Northbound off	17	18082	17	21900	15	21986	15	64.4
M40 Southbound On	18	17368	18	20671	17	20757	17	64.4
M40 Overbridge	19	32050	13	44930	11	45195	11	80.5
MSA to Padbury	20	49418	15	65096	13	65448	13	80.5

Table 10.7: AAWT, 1hr Night-time Road Traffic Flows – Eastern Development

Road	Link	AAWT,1hr Two-way Traffic Flow						Speed Limit (km/h)
		2019 Baseline		2025 Future Baseline		2025 With Development		
		AAWT,1hr	% HGVs	AAWT,1hr	% HGVs	AAWT,1hr	% HGVs	
B4100	1	66	4	71	4	78	4	96.6
B4100	2	66	4	71	4	78	4	80.5
B4100	3	138	7	159	7	194	18	80.5
B4100	4	138	7	159	7	200	6	80.5
B4100	5	119	7	156	7	198	7	80.5

A4095	6	175	2	200	2	214	3	80.5
A4095	7	133	2	166	3	179	3	80.5
A43	8	510	16	604	16	624	18	80.5
B430	9	78	7	153	8	158	7	96.6
M40S	10	1864	17	2075	17	2087	18	112.7
M40N	11	1526	18	1728	17	1730	18	112.7
A43	12	528	16	631	15	641	16	112.7
A43	13	512	16	613	15	621	16	112.7
A421	14	114	13	125	13	127	15	96.6
M40 Northbound On	15	67	15	88	14	89	17	64.4
M40 Southbound Off	16	99	16	113	16	115	17	64.4
M40 Northbound off	17	198	18	234	17	241	18	64.4
M40 Southbound On	18	339	19	379	19	385	20	64.4
M40 Overbridge	19	343	15	472	13	485	14	80.5
MSA to Padbury	20	683	17	869	15	887	16	80.5

Table 10.8: AAWT, 18hr Daytime Road Traffic Flows – Western Development

Road	Link	AAWT,18hr Two-way Traffic Flow						Speed Limit (km/h)
		2019 Baseline		2025 Future Baseline		2025 With Development		
		AAWT,18hr	% HGVs	AAWT,18hr	% HGVs	AAWT,18hr	% HGVs	
B4100	1	7073	3	7662	3	7898	3	96.6
B4100	2	7073	3	7662	3	11393	11	80.5
B4100	3	12658	4	14697	4	16304	4	80.5
B4100	4	12658	4	14697	4	16304	4	80.5
B4100	5	12300	4	16311	4	17919	4	80.5
A4095	6	18143	4	20916	4	21489	4	80.5
A4095	7	14116	2	17609	2	18126	2	80.5
A43	8	34644	15	41608	14	43026	15	80.5
B430	9	8351	5	16158	5	16346	5	96.6
M40S	10	123826	14	138706	14	139647	15	112.7
M40N	11	95298	12	108578	12	108867	12	112.7
A43	12	37936	12	45716	11	46422	12	112.7
A43	13	34510	12	41927	12	42460	12	112.7
A421	14	12139	8	13151	8	13324	9	96.6
M40 Northbound On	15	5617	15	7533	12	7669	13	64.4
M40 Southbound Off	16	6497	16	7696	14	7848	15	64.4
M40 Northbound off	17	18082	17	21900	15	22054	15	64.4
M40 Southbound On	18	17368	18	20671	17	20826	17	64.4