7 NOISE AND VIBRATION

7.1 INTRODUCTION

7.1.1 This chapter addresses the likely significant environmental effects of the construction and operational phases of the proposed development on the noise and vibration climate of the surrounding area. In particular, it considers the likely significant environmental effects of the existing and future noise climate to the proposed use of the site, the effect of noise from the site to the existing and future noise climate and the effect of construction noise and vibration to existing and proposed noise sensitive receptors.

7.1.2 The chapter describes the methods used to establish the baseline conditions currently existing at the Application Site and surroundings, the potential direct and indirect impacts of the proposed development arising from noise and vibration, the mitigation measures required to prevent, reduce or offset the impacts and the likely effects of the project taking into account the measures proposed.

7.1.3 There are no significant sources of vibration within the vicinity of the Application Site, therefore, the only vibration assessment considered necessary relates to the potential effects of vibration due to construction activities undertaken on the site as part of the project.

7.1.4 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature. To assist the reader, an explanation of the terminology used in the report is contained in Appendix 7.1.

7.1.5 The chapter has been prepared by Peter Brett Associates LLP.

7.2 POLICY CONTEXT

National Planning Policy

National Planning Policy Framework (NPPF), 2012

7.2.1 The NPPF was published in March 2012. In respect of noise, the document states that:

> **"The planning system should contribute to and enhance the natural and local environment by … preventing both new and existing development from contributing to or being put at unacceptable risk from or being adversely affected by unacceptable levels of … noise pollution."**

7.2.2 The NPPF goes on to advise that:

> **"Planning policies and decisions should aim to:**
>
> - **Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;**
> - **Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;**

- **Recognise that development will often create some noise and existing business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and**

- **Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."**

7.2.3 The NPPF cross-refers to the Noise Policy Statement for England (NPSE) to define the "significant adverse impacts".

Noise Policy Statement for England (NPSE)

7.2.4 The Noise Policy Statement for England was published in March 2010. The document seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. It also 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."**

7.2.5 The NPSE clarifies that noise should not be considered in isolation of the wider benefits of a scheme or development, and that the intention is to minimise noise and noise effects as far as is reasonably practicable having regard to the underlying principles of sustainable development.

7.2.6 The first two aims of the NPSE follow established concepts from toxicology that are applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level - 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 - the level above which adverse effects on health and quality of life can be detected.

7.2.7 The NPSE extends these to the concept of a significant observed adverse effect level.

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

7.2.8 The NPSE notes **"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"**.

Planning Practice Guidance - Noise

7.2.9 The Government's Planning Practice Guidance on noise was published in March 2014 and provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the NOEL and, as exposure increases, the LOAEL and SOAEL.

7.2.10 As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking

account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

7.2.11 The LOAEL is described in PPG as the level above which **"noise starts to cause small changes in behaviour and/or attitude e.g. turning up volume of television; speaking more loudly; or 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 perceived change in the quality of life."**

7.2.12 PPG identifies the SOAEL as the level above which **"noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."**

Guidance and British Standards

British Standard 8233: 2014 'Guidance on Sound Insulation and noise reduction for buildings'

7.2.13 BS 8233, in relation to this planning application, sets out desirable guideline values in habitable rooms, such as living rooms and bedrooms.

7.2.14 BS 8233 sets guideline values for steady external noise without a specific character, previously termed 'anonymous noise'. According to the standard, noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content. It may be appropriate for the guideline value for noise of a specific character to be lower than that for steady external noise without a specific character. Examples of noise with a character may include tonal/intermittent plant noise emissions, music playback, and workshop noise. Examples of external steady noise sources without a specific character may include environmental noise sources such as road, rail and air traffic.

7.2.15 The desirable internal ambient noise levels for dwellings are presented in Table 7.1.

Table 7.1: BS 8233 Recommended Internal Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00

Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$
Note 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,f, depending on the character and number of events per night. Sporadic noise events could require separate values.			
Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative source of ventilation that does not compromise the façade insulation or the resulting noise levels.			
Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.			

7.2.16 BS 8233 also provides advice in relation to design criteria for external noise. It states that:

> **"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.**
>
> **In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.**
>
> **Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.**
>
> **Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.**
>
> **In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB LAeq,T or less might not**

be possible at the outer edge of these areas, but should be achievable in some areas of the space."

British Standard 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites

7.2.17 BS 5228: 2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' gives recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels.

Calculation of Road Traffic Noise (CRTN): 1988

7.2.18 CRTN is a Department of Transport (DoT) memorandum that describes the procedure to calculate the road traffic noise at a given receptor location.

DEFRA 'Method for Converting the UK Road Traffic Noise Index LA10,18h to the EU Noise Indices for Road Noise Mapping'

7.2.19 The 'Method for Converting the UK Road Traffic Index LA10,18h to the EU Noise Indices For Road Noise Mapping' was published by Defra, TRL and Casella Stanger in 2006 and is used to convert noise levels from LA10,18h to day, evening and night-time LAeq,T. This methodology has been adopted in the noise model to convert LA10,18h to LAeq,16h and LAeq,8h for the day and night-time periods respectively.

Design Manual for Roads and Bridges, Volume 11

7.2.20 Volume 11, Section 3, Part 7 (Highways Agency et al. 2011) of the Design Manual for Roads and Bridges (DMRB) provides guidance on the assessment of the impacts that projects relating to roads (including change of traffic flows) may have on the levels of noise.

7.2.21 People may report positive or negative benefits when the actual noise changes are as small as 1 dBA. This noise change is equivalent to an increase of 25% or a decrease in traffic flow of 20%.

British Standard 7445: Part 1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures.

7.2.22 BS 7445-1 describes methods and procedures for measuring noise from all sources which contribute to the total noise climate of a community environment, individually and in combination. The results are expressed as equivalent continuous A-weighted sound pressure levels, LAeq,T.

7.2.23 BS 7445-1 states that the sound level meters should conform to Class 1 (or Class 2 as a minimum) as described in BS EN 61672:2013 and should be calibrated according to the instructions of the manufacturer. It is recommended that field calibration should be undertaken at least before and after each series of measurements.

7.2.24 Key aspects of the outdoor measurement procedure are the following:

- Whenever possible the measurements should be undertaken at a distance of more than 3.5m from a reflective structure other than the ground;
- The ideal measurement height is between 1.2m and 1.5m; and
- Measurement time intervals should be chosen so that measurements are completed within specified meteorological conditions.

7.2.25 BS 7445-1 also provides advice on selecting appropriate parameters when recording various types of noise, e.g. steady noise, fluctuating noise, etc.

World Health Organisation, Guidelines for Community Noise, 1999 (WHO)

7.2.26 The World Health Organisation (WHO) Guidelines for Community Noise (1999) also sets out guidance on suitable internal and external noise levels in and around residential properties. The following internal noise levels are recommended by the WHO:

- 35 dB LAeq,T in living rooms over a 16 hour day; and
- 30 dB LAeq,T in bedrooms during the 8 hour night.

7.2.27 With respect to the night-time maximum noise levels, the WHO guidelines state:

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

7.2.28 In section 4.2.1. the guidelines state that:

> **"For speaker-to-listener distance of about 1 m:**
>
> **Speech in relaxed conversation is 100% intelligible in background noise levels of about 35 dBA, and can be understood fairly well in background levels of 45 dBA.**
>
> **Speech with more vocal effort can be understood when the background sound pressure level is about 65 dBA."**

7.2.29 A report compiled by the National Physical Laboratory for the Department for Environment Transport and the Regions concluded that the WHO guidelines might be considered as highly precautionary. In considering how the WHO guidelines should be interpreted, the report states that:

> **"In essence the WHO guidelines represent a consensus view of international expert opinion on the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached".**

7.2.30 The National Physical Laboratory report also states:

> **"The most constructive use for the WHO guidelines will be to set thresholds above which greater attention should be paid to the various possibilities for noise control action when planning new developments. It is important to make clear at this point that exceedances do not necessarily imply an overriding need for noise control, merely that the relative advantages and disadvantages of noise control action should be weighed in the balance. It is all a question of balance, and mere exceedance of the WHO guidelines just starts to tip the scales".**

7.2.31 Finally, the National Physical Laboratory (NPL) report notes that **"We know from the most recent national survey of noise exposure carried out in England and Wales (SARGENT 93) that around 56% of the population are exposed to daytime noise levels exceeding 55 dB(A) Leq,16hr"** and **"In addition there is no evidence**

that anything other than a small minority of the population exposed at such noise levels find them to be particularly onerous in the context of their daily lives".

World Health Organisation (WHO) 2009: Night Noise Guidelines for Europe

7.2.32 The introduction of the Directive on Environmental Noise, obliges Member States to assess and manage noise levels. With the support of the European Commission, the WHO Regional Office for Europe has developed night noise guidelines for Europe to help Member States develop legislation to control noise exposure.

7.2.33 The guidelines are based on scientific evidence on the effects of noise and the thresholds above which these effects appear to harm human health.

7.2.34 There is limited evidence that night noise is related to hypertension, heart attacks, depression, changes in hormone levels, fatigue and accidents.

7.2.35 The WHO report summarised the threshold levels of night noise above which a negative effect starts to occur or above which the impact becomes dependent on the level of exposure. For example, the threshold level for waking in the night and/or too early in the morning was 42 dB.

7.2.36 It also established that there are differences in the intensity and frequency of noise depending on the source, which lead to different impacts. Road traffic is characterised by low levels of noise per event, but as there are a high number of events, on average it has a greater effect on awakenings than air traffic, which has high levels of noise per event but fewer events.

7.2.37 Integrating these findings, the report proposed a guideline target limit of outdoor night noise of 40 dB (annual average defined as 'Lnight' in the Environmental Noise Directive). There is not sufficient evidence that the biological effects observed below this level are harmful to health but adverse effects are observed above 40 dB.

7.2.38 Member States can adopt this night noise guideline to reduce noise using measures such as house insulation, locating offices in noise-exposed areas and creating zones where a certain level of noise cannot be exceeded. It can also be used for health impact assessment of new projects such as roads, airports or residential areas.

7.3 ASSESSMENT APPROACH

Methodology

Baseline Data Collection

7.3.1 A baseline environmental noise survey was undertaken between 1 and 2 April 2014 to characterise the current noise climate of the Application Site as far as possible.

7.3.2 Table 7.2 provides details of the measurement location.

Table 7.2: Environmental Noise Survey Measurement Location

Location	Summary of Measurements

1: Along Camp Road to the north of the Proposed Site	One continuous 24 hour measurement period

7.3.3 Location 1 was selected in order to obtain the typical noise levels around the Application Site adjacent to the main noise source.

7.3.4 Table 7.3 provides details of the equipment used.

Table 7.3: Instrumentation Used During the Baseline Noise Survey

Item	Type	Manufacturer	Serial Number	Laboratory Calibration Date
Sound Calibrator	4231	Bruel & Kjaer	2389171	08.01.2014
Sound Level Meter	NL-52	Rion	00732075	04.11.2014
Microphone	UC-59	Rion	05632	04.11.2014

7.3.5 The microphone was mounted on a pole and positioned approximately 1.5 m above ground level during the survey.

7.3.6 On-site calibration checks were performed before and after all measurements with no significant deviation being observed (i.e. no more than 0.3 dB).

7.3.7 Weather conditions remained calm and dry throughout the survey period. The air temperature was around 15^{o}C during the daytime with negligible wind speed and no precipitation. These meteorological conditions are generally considered acceptable for environmental noise surveys.

7.3.8 The survey was undertaken in general accordance with the guidance in BS 7445.

Assessment

Noise Model

7.3.9 The baseline noise survey results established the noise climate. A noise model was prepared to complement the baseline studies and to predict the likely noise impact arising from the operation of the proposed development. Furthermore, this assessment used the noise model to determine any areas that require mitigation and to test and demonstrate the efficacy of any proposed mitigation measures.

7.3.10 Noise modelling has been undertaken using SoundPLAN v7.3.

7.3.11 The site topography and existing buildings have been included within the model and so corrections for these factors are included within the calculations in accordance with CRTN guidance.

7.3.12 SoundPLAN v7.3 uses the CRTN methodology to model noise from road traffic. The methodology is used to determine noise levels from roads using variables such as the volume and speed of traffic.

7.3.13 Defra's 'Method for Converting the UK Road Traffic Index $L_{A10,18hour}$ to the EU Noise Indices For Road Noise Mapping' has been adopted in the noise model to convert LA10,18hour to LAeq,16hour and LAeq,8hour for the day and night time periods.

7.3.14 The following scenarios have been modelled:

- Baseline 2014;
- Year of completion (assumed to be 2021) with proposed development.

7.3.15 The cumulative effects have also been assessed based on traffic data information for 2021 with committed developments. This data assumes the full occupation of committed developments in the vicinity of the site.

Construction Noise

7.3.16 The noise levels generated by construction activities on any nearby sensitive receptors depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on-site, or on-site activities (i.e. the physical demolition), generally expressed as sound power levels (LW);
- The periods of operation of the plant on the site, known as its 'on-time';
- The distance between the noise source and the receptor; and
- The attenuation provided by ground absorption and any intervening barriers.

7.3.17 Construction noise predictions have been undertaken, using the methodology outlined in BS 5228-1: 2009+A1:2014 Code of practice for noise and vibration control on construction and open sites: Part 1: Noise (BSI, 2014). BS 5228-1: 2009+A1:2014 predicts noise as an equivalent continuous A- weighted sound pressure level over a period such as one hour ($L_{Aeq,1hour}$).

7.3.18 BS 5228-1: 2009+A1:2014 contains a database of the noise emissions from individual items of equipment, activities and routines to predict noise from demolition and construction activities at identified receptors. The prediction method gives guidance on the effects of different types of ground, barrier attenuation and how to assess the impact of fixed and mobile plant.

7.3.19 The assessment of demolition and construction noise effects at residential properties has been undertaken according to the 'example method 1 – the ABC method' as defined in BS 5228-1: 2009+A1:2014, Annex E. Table 7.4 below provides guidance in terms of appropriate threshold values for residential receptors, based upon existing ambient noise levels.

Table 7.4: BS 5228 Recommended Construction Noise Limits

	Threshold Value in Decibels (LAeq,T)

Assessment Category and Threshold Value Period	**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 Application 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 3 dB due to the Application Site noise.

Note 3: Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.
D) 19.00-23.00 weekdays, 13.00-23.00 Saturdays and 07.00-23.00 Sundays

7.3.20 In accordance with the NPPF and NPSE Explanatory Note it is also important to identify receptors that exceed the LOAEL and SOAEL, and ensure adverse effects are mitigated and minimised.

7.3.21 In terms of the LOAEL and SOAEL for residential properties, these have been defined as in Table 7.5.

Table 7.5: Construction Noise Effect Levels for Residential Buildings (facade levels)

Time Period	**LOAEL LAeq,T (dB)**	**SOAEL LAeq,T (dB)**
Daytime (07:00 – 19:00 and Saturdays 07:00 – 13:00)	65	75
Evenings and Weekends (19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays)	55	65
Any Night (23:00 07:00)	45	55

7.3.22 Should the existing ambient noise level already exceed the SOAEL, then on the basis that construction noise should not increase the ambient noise level by more than 3 dB, the SOAEL is re-defined as equivalent to the ambient.

Construction Vibration

7.3.23 The effects of human response to whole body vibration in buildings are defined in BS 6472-1: 2008 (BSI, 2008). This gives effects in terms of Vibration Dose Value (VDV). However, for human response to construction related vibration, it is considered more appropriate to use the Peak Particle Velocity (ppv) measure, as suggested in BS 5228-2:2009+ A1:2014 Code of practice for noise and vibration control on construction and open sites (BSI, 2014). Part 2: Vibration.

7.3.24 The limit of human perception to vibration is between about 0.15 mms-1 and 0.3 mms-1 ppv. The sensitivity of the human body also varies according to different frequencies of vibration, with perception generally possible between 1 Hz to 80 Hz.

7.3.25 The vibration ppv due to specific construction works has been estimated at sensitive receptors using example measured source data and the appropriate propagation relationship taken from BS 5228-2: 2009 + A1:2014.

Whole Body Vibration

7.3.26 Table 7.6 adapts the guidance on the annoyance effects of vibration as provided in BS 5228-2:2009+ A1:2014 Annex B.

7.3.27 The onset of significant effects (the LOAEL) is classified as 1mms-1 PPV, the level at which construction vibration can be tolerated with prior warning.

Table 7.6: Guidance on Effects of Vibration Levels

Vibration Level PPV mm/s	Description of Effects	Effect	Adverse Effect Level
<0.3	Vibration is unlikely to be perceptible in even the most sensitive situations for most vibration frequencies associated with construction	Negligible	NOEL
1	Increasing likelihood of perceptible vibration in residential environments	Minor	LOAEL
10	Increasing likelihood of complaint in residential environments, but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Moderate	SOAEL
>10	Vibration is likely to be intolerable for any more than a very brief exposure to a level of $10mms^{-1}$	Major	

Suitability for Residential Use

LOAELs for transportation airborne noise affecting outdoor amenity areas

7.3.28 Outdoor sound levels of 50 dB LAeq,16h during the daytime and 40 dB LAeq,8h during the night-time are considered the LOAELs for airborne noise.

7.3.29 In the WHO Night Noise Guidelines for Europe a free field level of 40 dB LAeq,8h during the night-time is said to be "equivalent to the LOAEL for night noise".

7.3.30 For the daytime level, the information used to support BS8233 indicates that it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. Due to the location of the Proposed Site, a LOAEL of 50 dB LAeq,T is deemed acceptable.

7.3.31 The WHO Guidelines for Community Noise also identify 60 dB LAFMax outside as the guideline value for sleep disturbance with windows open. For this reason, sound levels of 60 dB LAFMax at the façade is also considered the LOAEL for individual noise events. The above assumes a 15 dB difference when a window is partially open.

SOAELs for transportation airborne noise affecting outdoor amenity areas

7.3.32 Sound levels of 65 dB LAeq,16h during the daytime and 55 dB LAeq,8h during the night-time are considered the SOAEL's for transportation noise for outdoor amenity areas at residential dwellings.

7.3.33 The daytime SOAEL is consistent with the daytime trigger level in the UK's Noise Insulation Regulations. The WHO Night Noise Guidelines for Europe sets the Interim Target at 55 dB LAeq,8h during the night-time outside dwellings. This noise threshold has been taken to be the night-time SOAEL. However, as outdoor amenity areas are not routinely occupied during the night-time, exceedance of the night-time level may be considered acceptable.

7.3.34 The application of these levels for outdoor amenity areas should take into consideration the advice within BS8233:2014. Due to the advice contained herein, these levels may not be considered appropriate in all circumstances.

LOAEL and SOAEL for transportation airborne noise affecting indoor residential levels

7.3.35 Incident façade levels should not be considered in isolation of the sound reduction provided by the external building fabric. The guidance within Planning Policy Guidance states that **"consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations."**

7.3.36 Based on the advice within BS:8233:2014 an indoor noise level of 35 dB LAeq,16h during the daytime and 30 dB LAeq,8h during the night-time may be considered as the LOAEL for transportation noise.

7.3.37 Similarly an indoor noise level of 50 dB LAeq,16h and 45 dB LAeq,8h during the night-time may be considered as the SOAEL for transportation noise.

7.3.38 Research findings on adverse effects on non restorative sleep which indicate that adverse effects on sleep can be avoided if the maximum noise level inside the bedroom do not exceed 65 dB when more than 20 discreet events occur. This may be considered the SOAEL level. It may also be argued that if less than 20 discreet events occur during the night-time, the internal LAMax SOAEL level could be 70 dB.

7.3.39 Table 7.7 below presents the summary of the proposed targets.

Table 7.7: Proposed LOAEL and SOAEL noise Levels

	Proposed LOAEL and SOAEL levels for transportation noise affecting new residential premises	
Level	Daytime (07:00 hours to 23:00 hours)	Night-time (23:00 hours to 07:00 hours)
Internal Noise Levels		
LOAEL	35 LAeq,16h (dB)	30 LAeq,8h (dB)
SOAEL	55 LAeq,16h (dB)	45 LAeq,8h (dB)
LOAEL	Not applicable	45 dB LAmax if more than 20 events
	Not applicable	50 dB LAmax if less than 20 events
SOAEL	Not applicable	65 dB LAmax if more than 20 events
	Not applicable	70 dB LAmax if less than 20 events

External Amenity Areas (free field levels)		
LOAEL	50 LAeq,16h (dB)	40 LAeq,8h (dB)
SOAEL	65 LAeq,16h (dB)	55 LAeq,8h (dB)

Noise from Increased Road Traffic

7.3.40 The impact of the proposed development on the noise climate in the surrounding areas is based on the change in noise levels at noise sensitive receptors due to the increase in the volumes of road traffic generated by the proposed development.

7.3.41 The Design Manual for Roads and Bridges (DMRB) provides two magnitude scales of impact for the change in noise levels in the 'short-term' (opening year) and in the 'long-term' (future year). Assessment for the EIA uses long-term future year assessment criteria to assess the full and permanent effects of the proposed development. These are presented in Table 7.8 in terms of adverse effect levels.

Table 7.8: Adverse Levels for Existing Dwellings from Development Traffic

Adverse Effect Level (Increase in noise levels)	Change in LA10,18h Noise Levels in Long-term due to Road Traffic
SOAEL	5
LOAEL	3
NOEL	0.9

7.3.42 Development traffic impact has been assessed by comparing the 2021 with development scenario against the 2021 baseline scenario. The 'with development' scenario includes development traffic associated with committed developments.

Assessment of Significance

7.3.43 In accordance with the NPPF, NPSE and PPG guidance for noise, lowest observable (LOAEL) and significant observable adverse effect levels (SOAEL) are proposed for each noise and vibration source under assessment in the ES chapter.

7.3.44 In respect of the EIA Regulations, the beneficial and adverse effect levels of noise and vibration effects have been related to the significance levels. Based on the descriptions of the adverse effect levels in the PPG for noise (DCLG, 2014), recommended actions for each significance level have been provided. The noise and vibration significance criteria are presented in Table 7.9.

Table 7.9: Noise and Vibration Significance Criteria

Significance Level	Noise and Vibration Adverse Effect Level	Impact and Action
Severe		Noise causes extensive and regular changes in behaviour and could lead to psychological stress or physiological effects. This level is unacceptable and should be prevented.
Major	SOAEL	Noise causes a material change in behaviour and/or attitude. This level should be avoided.
Moderate		Noise can be heard and causes small changes in behaviour or attitude. Noise should be mitigated and reduced to a minimum.
Minor	LOAEL	Noise can be heard but does not cause a change in behaviour or attitude. No specific mitigation measures are required.
Negligible	NOEL	Noise has no effect. No specific measures required
None		Noise has no effect. No specific measures required

7.3.45 Mitigation to meet the internal noise levels for proposed dwellings has been based on the predicted noise levels derived in the modelling scenario 'Year of completion – with proposed development'. The mitigation has been proposed in order for the internal noise level criteria from BS 8233:2014 to be achieved.

7.3.46 The internal noise levels have been assessed at the proposed dwellings.

7.3.47 The assessment also determines whether noise levels in outdoor amenity areas would comply with the suggested criteria.

7.3.48 The mitigation methods outlined herein are indicative and are not intended for procurement of building elements as the calculations will be reviewed at the detailed design stage having regard to external noise levels and the size of the rooms.

Limitations to the Assessment

7.3.49 It has been assumed that the traffic flows during the noise survey were representative of normal movements.

7.3.50 The Application Site engineer noticed nothing unusual in terms of the noise climate at the times of the attended surveys. This assessment refers, within the limitations stated, to the environment of the Application Site in the context of the surrounding area.

7.4 BASELINE CONDITIONS

Site Description and Context

7.4.1 The assessment covers the noise impact at noise sensitive receptors directly around the Application Site and also includes the noise impact at existing dwellings along the links provided in Appendix 7.2 that might be affected by an increase in road traffic.

Baseline Survey Information

7.4.2 A summary of the noise survey results is presented in Table 7.10. More detailed survey results are provided in Appendix 7.3.

Table 7.10 Survey Summary

Location	Period	Duration, T (hh:mm)	LAeq,T dB	LAFmax dB	Typical LA10,5mins dB	Typical LA90,5mins dB
Location 1	Day	16:00	57	77	59	50
	Night	08:00	51	72	46	36

7.4.3 The noise survey was used to calibrate the noise model. The assessment shows that noise levels on land proposed for residential use adjacent to Camp Road, could be up to around 57 dB $L_{Aeq,16h}$.

7.4.4 During the night-time period the noise levels would be up to around 51 dB $L_{Aeq,8h}$ on land proposed for residential use.

7.5 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

Construction

Noise

7.5.1 Details of the types of construction methods and plant likely to be used during the construction phases have yet to be formulated and at this stage in the scheme's design it is not possible to state precisely where plant will operate and for how long during the working day. Therefore, noise levels have been calculated for a realistic worst case situation over a 1 hour period assuming that plant will operate at its closest point to each receptor in the absence of mitigation.

7.5.2 In practice, noise levels would tend to be lower due to greater separation distances and screening effects, and they would also tend to reduce over a 10-12 hour working day due to periods of plant inactivity.

7.5.3 The main construction phases are likely to include site levelling/clearance, ground excavation, concreting, building construction and new internal road construction. The building construction phase, and the servicing and fitting out of new buildings, is normally not a significant source of noise or vibration for local receptors.

7.5.4 Details of typical construction plant noise levels at the standard reference distance of 10 m provided by BS 5228 in the absence of noise controls such as screening and operational constraints are given below in Table 7.11. Highest noise levels tend to be associated with plant that will be employed during earthmoving and concreting.

Table 7.11: Typical Construction Plant Noise Level

Plant	**Typical dB LAeq Sound Pressure Level at 10 m**
Earth moving	85
Supply vehicles	80
Auger piling	85
Truck concrete mixer	80
Poker vibrators	84
Crane	74
Vibratory roller	76
Asphaltspreader	80
Wheeled loader	76
Compressors	74
Welding Generators	42

7.5.5 In the absence of specific details on the phasing and siting of construction activities, this information has been used to derive indicative noise levels at selected distance bands using the data and procedures of BS 5228, the results are presented in Table 7.12.

Table 7.12: Predicted Indicative Construction Noise Levels

Activity	**Predicted Indicative Construction Noise Levels, LAeq,1hour in dB**						
	10 m from site	**20 m from site**	**50 m from site**	**100 m from site**	**200 m from site**	**250 m from site**	**500 m from site**
Earthmoving	85	79	71	65	59	57	51
Concreting	86	80	72	66	60	58	52
Road pavement	80	74	66	60	54	52	46

7.5.6 In order to define the noise level criteria in accordance with the ABC method of BS 5228, the measured daytime ambient noise levels have been analysed. The closest dwellings to the Application Site are new dwellings constructed and under construction direct east of the Application Site. Ambient noise levels at these receptors would be less than 65 dB LAeq,T. Therefore, category A (see Table 7.4) would be representative for

these dwellings which relates to a LOAEL level of 65 dB LAeq,12hour and a SOAEL level of 75 dB LAeq,12hour.

7.5.7 Therefore, a significant impact from some construction works are likely to arise at existing properties less than 100m from the construction activities and appropriate noise mitigation measures will need to be implemented. The impact would be temporary. Existing dwellings within 20m of the construction activity could exceed the SOAEL levels and therefore without mitigation could be a major temporary impact.

7.5.8 However, the application of the Construction Environmental Management Plan (CEMP) will minimise adverse effects as much as practicable.

7.5.9 At this stage of the application, without contractors being appointed, there is limited information available on the proposed construction works and hence construction traffic. However, it is unlikely that construction traffic movements would be more than those generated by the operational traffic impacts. Therefore, based on the operational impacts which are assessed later in this chapter, the noise effects of construction traffic have been deemed negligible.

Vibration

7.5.10 With respect to potential vibration impacts on sensitive uses adjacent to the Application Site, the construction of new development is not normally seen to be a significant source of vibration unless piling operations are required. Where piling is required, effects can be minimised using methods such as continuous flight augering which does not involve driving piles into the ground using impulsive forces.

7.5.11 Monitoring could be undertaken for piling operations and vibration levels should have regards to Table 7.6 of this chapter.

Operation

Proposed Dwellings

7.5.12 The following noise contour maps for the daytime and night-time '2021 with development' scenarios were produced using the noise model:

- Daytime: Noise grid map with a grid resolution of 5 m by 5m, at a distance of 1.5 meters above ground level (representative of the ground floor and outdoor amenity areas) showing the LAeq,16hour sound pressure levels. This is presented within Figure 7.1.
- Night-time: noise grid map with a grid resolution of 5 m by 5 m, at a distance of 4 meters above ground levels, this is presented within Figure 7.2.

7.5.13 The daytime contours show that the highest noise levels on the site would be along Camp Road. Noise levels at the application site, on land proposed for residential use adjacent, as per the parameter plan, could be up to approximately 55- 60 dB LAeq,16hour.

7.5.14 The desirable target of 50 dB LAeq,16hour for outdoor living spaces such as gardens would be exceeded for gardens directly adjacent to Camp Road and mitigation measures would be required. For the majority of the site away from Camp Road external noise levels would be met without any mitigation measures.

7.5.15 During the night-time period the highest incident noise levels would occur along Camp Road and may be up to approximately 50-55 dB LAeq,8hour.

7.5.16 Noise criteria for internal areas of dwellings have been set at 35 dB LAeq,16hour for the daytime and 30 dB LAeq,8hour for the night-time. Recommended measures in order to allow the proposed dwellings to meet these levels are provided in the mitigation section below.

Change in Ambient Levels – Existing Receptors

7.5.17 The principal source of noise associated with the proposed development would be traffic noise.

7.5.18 The impact of the operational traffic noise on roads surrounding the development has been predicted using the guidance in CRTN. All the road links presented in Appendix 7.2 have been assessed.

7.5.19 All the road links would experience an increase in traffic flows of less than 25%. This equates to an increase of less than 1 dB. Therefore, the change in ambient noise levels due to development traffic is likely to be negligible and below the LOAEL.

7.6 MITIGATION AND ENHANCEMENT

Mitigation by Design

Operational Noise

Outdoor Living Space

7.6.1 Figure 7.2 shows that the predicted future noise contours across the application site, with the development in place, during the daytime. It shows that the land overlooking the main roads would exceed the LOAEL for outdoor living spaces such as gardens and mitigation measures will have to be put in place for gardens that have line-of-sight with the roads.

7.6.2 In order to establish suitable external road traffic noise levels at private outdoor amenity areas the gardens have been placed at the rear of the dwellings along Camp Road such that the dwellings provide shielding from incident road traffic noise..

7.6.3 With this mitigation in place, the LOAEL for outdoor living space is likely to be met and no further mitigation would be deemed necessary.

Operational Noise

Internal Noise Levels

7.6.4 Typical thermal double glazing would have a Rw (weighted sound reduction index) of around 30dB. Therefore, with typical thermal double glazing included as part of the project, the internal noise level requirements are expected to be met.

7.6.5 For properties close to Camp Road, background ventilation would need to be provided using an alternative ventilation method. The provision of standard double glazing with hit and miss trickle ventilators would be sufficient to achieve the proposed internal noise criteria.

7.6.6 Mitigation measures have been identified for the proposed noise sensitive receptors. With this recommended mitigation in place, and secured through a planning condition, the noise level targets set for the proposed uses on site would not be exceeded. Therefore, the residual effect of the project in terms of residential suitability would be that standards would be met. This would result in no significant effects.

Construction

7.6.7 A quantitative assessment and further assessment of construction noise mitigation may be undertaken when a principal contractor has been appointed for each phase of the development and detailed method statements and the detailed construction programme are available.

7.6.8 The following advice is based upon guidance provided in BS 5228 and will be applied as appropriate through the CEMP, which would be secured through a suitable planning condition, in order to minimise noise from the construction activities affecting noise sensitive receptors:

- Appropriate operational hours, likely to exclude work during the night-time and during Sundays and public holidays;
- Considerate working hours for excessively noisy activities;
- Ensuring the use of quiet working methods, the most suitable plant and reasonable hours of working for noisy operations, where reasonably practicable;
- Locating noisy plant and equipment as far away from dwellings as reasonably possible and where practical, carry out loading and unloading in these areas;
- Screening plant to reduce noise which cannot be reduced by increasing the distance between the source and the receiver (i.e. by installing noisy plant and equipment behind large site buildings);
- Orienting plant that is known to emit noise strongly in one direction so that the noise is directed away from dwellings, where possible;
- Closing acoustic covers to engines when they are in use or idling; and
- Lowering materials slowly, whenever practicable, and not dropping them.

7.6.9 A CEMP will be agreed with the local planning authority prior to commencement of construction. The CEMP could form the basis of the agreed working methods with the local planning authority under Section 61 of the Control of Pollution Act 1974 should this be required.

7.6.10 It should also be proposed within the CEMP that the contractor shall, as far as reasonably practicable, monitor, control and limit noise and vibration levels. Noise and vibration monitoring schemes shall be determined in consultation with Cherwell District Council (CDC).

7.6.11 Where there is a requirement to work outside standard hours (08:00 to 18:00 Monday to Friday and 08:00 to 13:00 Saturday), this will be agreed in advance with CDC.

Existing Dwellings

7.6.12 The results of the assessment show that the increase in noise levels due to road traffic would be below the LOAEL and no mitigation measures are considered necessary.

Summary of Mitigation

7.6.13 Table 7.14 below presents a description of the proposed mitigation and how it would be implemented.

Table 7.14: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Condition
1	Gardens placed at the rear of the dwellings along Camp Road, such that	X		

	the dwellings provide shielding from incident road traffic noise			
2	CEMP			X
3	Mitigation for internal noise levels			X

7.7 CUMULATIVE AND IN-COMBINATION EFFECTS

7.7.1 The traffic data used within the noise model include the traffic flows due to committed developments in the vicinity of the site. Therefore, the cumulative effects are included in the modelling results. Furthermore, the mitigation proposed for the proposed dwellings accounts for future traffic flows including committed developments.

7.7.2 The increase in road traffic has been assessed in the close vicinity of the site. The impact has been demonstrated to be negligible.

7.8 SUMMARY

Introduction

7.8.1 This chapter addresses the likely significant environmental effects of the construction and operational phases of the proposed development on the noise and vibration climate of the surrounding area. In particular, it considers the likely significant environmental effects of the existing and future noise climate to the proposed use of the site, the effect of noise from the site to the existing and future noise climate and the effect of construction noise and vibration to existing and proposed noise sensitive receptors.

7.8.2 The chapter describes the methods used to establish the baseline conditions currently existing at the Application Site and surroundings, the potential direct and indirect impacts of the proposed development arising from noise and vibration, the mitigation measures required to prevent, reduce or offset the impacts and the likely effects of the project taking into account the measures proposed.

Baseline Conditions

7.8.3 A baseline environmental noise survey was undertaken between 1 and 2 April 2014 to characterise the current noise climate of the Application Site as far as possible.

7.8.4 The noise survey was used to calibrate the noise model. The assessment shows that noise levels on land proposed for residential use adjacent to Camp Road, could be up to around 55 dB LAeq,16h.

7.8.5 During the night-time period the noise levels would be up to around 50 dB LAeq,8h on land proposed for residential use.

Likely Significant Effects

7.8.6 In the absence of specific details on the phasing and siting of construction activities, indicative noise levels at selected distance bands using the data and procedures of BS 5228 have been derived.

7.8.7 Significant impacts could occur within 30m of the construction site.

7.8.8 Although a detailed design has been included within the Planning Application Documents, it has not been determined how the construction of the proposed dwellings will be phased. However, it is unlikely that construction traffic movements would be more

than those generated by the operational traffic impacts. Therefore based on the operational impacts which are assessed later in this chapter, the noise effects of construction traffic have been deemed negligible.

Vibration

7.8.9 With respect to potential vibration impacts on sensitive uses adjacent to the Application Site, the construction of new development is not normally seen to be a significant source of vibration unless piling operations are required. Where piling is required, effects can be minimised using methods such as continuous flight augering which does not involve driving piles into the ground using impulsive forces.

Operation

Proposed Dwellings

7.8.10 The daytime contours show that the highest noise levels on the site would be along Camp Road. Noise levels at the application site, on land proposed for residential use adjacent, as per the parameter plan, could be up to approximately 55 dB LAeq,16hour.

7.8.11 The desirable LOAEL for outdoor living spaces would be exceeded for gardens if they were directly adjacent to the road sources and mitigation measures would be required.

7.8.12 During the night-time period the highest incident noise levels would occur along Camp Road and may be up to approximately 50 dB LAeq,8hour.

Change in Ambient Levels – Existing Receptors

7.8.13 The principal source of noise associated with the proposed development would be traffic noise. The change in ambient noise levels during the daytime at existing receptors, would be below 3 dB and would therefore be deemed negligible.

Mitigation and Enhancement

Mitigation by Design

7.8.14 The layout of the buildings and their orientation has been considered in the masterplan so that gaps between dwellings are reduced such that no garden area has a line-of-sight/overlooks Camp Road.

7.8.15 With these mitigation measures in place, the desirable external noise levels would be met and the impact would be classed as negligible.

Additional Mitigation

7.8.16 A CEMP will be agreed with the local planning authority prior to commencement of construction. The CEMP could form the basis of the agreed working methods with the local planning authority under Section 61 of the Control of Pollution Act 1974 should this be required.

7.8.17 To meet the desirable internal noise levels at dwellings specific glazing performance requirements will be specified through planning conditon accounting for the final layout of housing, window sizes and internal layout. Alternative means of ventilation like trickle

ventilators (or mechanical ventilation) will be required for background ventilation purposes.

7.8.18 Due to the distance to nearby existing noise sensitive receptors, it is expected that the significance of the noise and vibration effects of the construction phase of the proposed development could be 'moderate'.

7.8.19 Therefore, further assessment of construction noise and vibration mitigation should be undertaken as appropriate when a principal contractor has been appointed and detailed method statements and the construction programme are available.

Conclusion

7.8.20 As shown in the assessment, the Proposed Development at the Application Site could be made acceptable.

7.8.21 Table 7.15 provides a summary of effects, mitigation and residual effects.

Table 7.15: Summary of Effects, Mitigation and Residual Effects.

Receptor / Receiving Environment	Description of Effect	Nature of Effect *	Sensitivity Value **	Magnitude of Effect **	Geographical Importance ***	Significance of Effects ****	Mitigation / Enhancement Measures	Residual Effects ****
Construction								
Noise sensitive receptors	Noise	Temporary	High	Low	Local	Moderate	Noise mitigation measures set out within CEMP	Minor
Operation								
Noise sensitive receptors	Increase in road traffic	Permanent	High	Low	Local	Negligible	None	Negligible
	Outdoor Noise	Permanent	High	Moderate	Local	Moderate Adverse	Layout and orientation of the buildings	Negligible
	Indoor Noise	Permanent	High	Moderate	Local	Moderate Adverse	Alternative means of ventilation for background ventilation purposes	Negligible

Notes:

* Enter either: Permanent or Temporary / Direct or Indirect

** Only enter a value where a sensitivity v magnitude effects has been used – otherwise 'Not Applicable'

*** Enter either: International, European, United Kingdom, Regional, County, Borough/District or Local

**** Enter either: Major / Moderate / Minor / Negligible AND state whether Beneficial or Adverse (unless negligible)