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Oxford Corridor Phase 2 Capacity Improvement Scheme

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10. NOISE AND VIBRATION

10.1 Introduction

10.1.1 This chapter of the Environmental Statement reports the potential effects resulting from the construction and operation of the Scheme on noise and vibration. The assessment has taken the following approach:

- describe the relevant legal and policy framework which informs the undertaking of the noise and vibration assessment;
- describe the methodology used for the identification and assessment of likely significant noise and vibration effects;
- identify the limitations encountered in conducting the Environmental Impact Assessment (EIA);
- describe the noise and vibration baseline having regard to the existing train movements;
- identifies and assesses the likely significant effects that could result from the Scheme during construction and operation phases;
- consider mitigation of likely significant effects; and
- provide a summary of the residual effects following mitigation.

10.1.2 A full description of the Scheme is given in Chapter 2. All technical terms used in this chapter are explained within Appendix 1.5 – Glossary and Acronyms.

10.1.3 This chapter is supported by the following documents.

<u>Volume 3</u>

- Figure 10.1 – Noise Constraints Map;
- Figure 10.2 – Operational Noise Contour Plot – Do Minimum;
- Figure 10.3 – Operational Noise Contour Plot – Do Something – No Mitigation; and
- Figure 10.4 – Operational Noise Contour Plot – Do Something - With Mitigation;

<u>Volume 4</u>

- Appendix 10.1 – Baseline Noise and Vibration Report, and;
- Appendix 10.2 – Noise and Vibration Assessment – Supporting

Information.

10.2 Legislation, Policy and Guidance

10.2.1 The following section outlines the relevant national legislation, regional and local planning policies and guidance relevant to this assessment.

10.2.2 Table 10.1 sets out the relevant legislation for noise and vibration; Tables 10.2 and 10.3 set out relevant planning policy for noise and vibration whilst Table 10.4 provides a summary of relevant guidance for this noise and vibration assessment.

10.2.3 The legislation, policies and guidance listed have been taken into account in the assessment of the likely significant effects on noise and vibration as a result of the Scheme and the development of appropriate mitigation measures.

10.2.4 None of the policy or guidance documents assign numeric values to significance levels. This is because the effect level should reflect the nature of the noise source, the sensitivity of the receptor and also local context. The effect level thresholds for this Scheme, with the rationale behind each are defined in Section 10.3.

Table 10.1: Legislation relevant to noise and vibration

Legislation	Description in relation to noise and vibration	Relevance to the Scheme
Environmental Noise Directive 2002/49/EC and The Environmental Noise (England) Regulations 2006 (as amended)	The Environmental Noise (England) Regulations 2006 (as amended) transpose the provisions of the assessment and Management of Environmental Noise Directive 2002/49/EC. The production of strategic noise maps and action plans are legal requirements set out in the Environmental Noise (England) Regulations 2006. From these noise maps, certain areas alongside the major roads and railways have been identified as 'Important Areas' ("IA"), where dwellings are subject to noise levels considered high enough to warrant further investigation.	The investigations are the responsibility of the noise making authority who should report possible mitigation measures at each IA to Defra. The noise making authority for the railways is Network Rail.
Land Compensation Act 1973	Part I of the Land Compensation Act provides a means by which compensation can be paid to owners of land or property due to a loss in value of these assets caused by the public works, such as new or improved railways and roads. Noise and vibration are two of the factors which would be considered in any claims for compensation, but the claim should consider all changes and effects, including betterment. Part II of the Act imposes a duty on authorities to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings. This is subject to meeting certain criteria given in the Noise Insulation Regulations.	The Scheme may potentially increase operational noise and vibration levels in the study area, which could potentially result in a compensation claim. It should be noted that this noise and vibration assessment has aimed to provide solutions through noise and vibration mitigation to meet with appropriate noise thresholds.
The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996	The Noise Insulation (Railways and Other guided Transport Systems) Regulations 1996 ("NIRR") were introduced to meet a need to consider the impact of railways, tram systems and other guided transport systems upon existing residential properties along their route, and to consider the need for noise insulation measures to those properties as a result of the development of the transport system. The NIRR provide a duty to install noise insulation for eligible dwellings affected by noise from the operation of a new or additional railway line or guided transport system, and powers to carry out similar works for properties affected by altered existing rail systems. The criteria for eligibility are defined in the NIRR. It should be noted that the NIRR only apply to noise from moving railway vehicles, so no account is taken of noise from stationary rail vehicles when considering applicability.	The NIRR are relevant as Network Rail proposes to install a new railway line and thereby fulfils the initial assessment criteria. It should be noted that this noise and vibration assessment has aimed to provide solutions through noise and vibration mitigation to meet with appropriate noise thresholds.

Table 10.2: Planning policy relevant to noise and vibration

Policy Document	Description in relation to noise and vibration	Relevance to the Scheme
Noise Policy Statement for England	The Government's noise policy is set out in the Noise Policy Statement for England ("NPSE"). It contains the high level vision of promoting good health and good quality of life (wellbeing) through the effective management of noise. It is supported by three aims and together they provide the necessary clarity and direction to enable decisions to be made in any particular situation, both nationally and locally, regarding what is an acceptable noise burden to place on society. These three aims are: • to avoid significant adverse impacts on health and quality of life; • to mitigate and minimise adverse impacts on health and quality of life; and • where possible, contribute to the improvement of health and quality of life. The three aims of the NPSE are reiterated in other relevant policy documents.	The NPSE formed part of the framework used to determine noise and vibration effects from the Scheme.
National Planning Policy Framework	The second associated policy document is the National Planning Policy Framework ("NPPF"), which was reissued in February 2019. The NPPF paragraph 170(e) states that the planning system should contribute to and enhance the natural and local environment by, among other things, preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of noise pollution. Paragraph 180 goes on to advise that planning policies and decisions should *"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".*	The NPPF formed part of the framework used to inform the determination of noise effects as a result of the Scheme.
Planning Practice Guidance – Noise	The Planning Practice Guidance ("PPG") – Noise (2019) provides guidance on the application of government noise policy. This document reaffirms the effect levels set out in the NPSE and also adds an additional term of Unacceptable Adverse Effect Level ("UAEL") at which noise should be prevented from reaching at sensitive receptors. Table 10.3 is from Planning Practice Guidance – Noise (paragraph 005), and summarises the noise exposure hierarchy, based on the likely average response.	The Planning Practice Guidance formed part of the framework used to determine noise effects from the Scheme.

Table 10.3: Planning Practice Guidance noise exposure hierarchy and effect levels

Response	Example Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No effect.	No observed effect	No specific measures required
No Observed Adverse Effect Level			
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Noise can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No observed adverse effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up the television volume; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Noise affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The 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.	Significant observed adverse effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation / awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable adverse effect	Prevent

Table 10.4: Guidance relevant to noise and vibration

Guidance document	Description in relation to noise and vibration
Design Manual for Roads and Bridges ("DMRB") LA111 Noise and Vibration – Revision 2.	This Standard provides guidance on the assessment of the impacts that road projects may have on levels of noise and vibration. The assessment criteria in LA111 are also relevant for railway schemes.
Department of Transport Calculation of Railway Noise ("CRN") 1995.	Provides the procedures for calculating noise from moving railway vehicles as defined in the NIRR.
BS 7385-2:1993 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration' (British Standards Institution, 1993)	This British Standard provides guidance on vibration levels likely to result in building damage.
British Standard 5228-1:2009 +A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 (Noise).	This British Standard endorses methods for noise and vibration control during construction operations, including procedures that aim to assist acoustic engineers, architects, contractors, site operatives, developers and planners.
BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.	BS 4142 is used to assess the impact of industrial and commercial sound. It covers a range of methods starting with subjective through objective, to the reference method. The use of the BS4142 methodology helps to clearly determine if noise complaints are likely as a result of a new noise source.

10.3 Methodology

Introduction

10.3.1 The approach outlined below has been followed in preparing this chapter. It reports the consultation undertaken, defines the study area, temporal scope, the sources of baseline data, and the methodology and significance criteria. The limitations and assumptions of the study are also described.

Consultation

10.3.2 The scope and method of assessment for this noise and vibration assessment was presented in the Environmental Impact Assessment Scoping Report (Network Rail, 2020). Oxford City Council issued a Scoping Opinion in response to the Scoping Report in December 2020. The Scoping Opinion included a requirement for noise and vibration to be included in the EIA and further direction on the content of the assessment.

10.3.3 An overview of consultation undertaken on the Scheme is summarised in Chapter 4 – Approach to Environmental Impact Assessment.

10.3.4 In relation to the noise and vibration assessment there has been engagement with the following stakeholders:

- Oxford City Council; and
- The Canal and River Trust.

10.3.5 Table 10.5 provides a summary of the consultation responses that were received regarding the scope and methodology to be applied in the EIA and where appropriate how the scope and methodology have been revised in response.

Table 10.5: Summary of EIA Scoping Report consultation responses for noise and vibration scope and methodology

Consultee	Issues raised in response to the Scoping Report	Summary of the response to issues raised
Oxford City Council	In principle, the Council agrees with the scope of the noise and vibration considerations for the purposes of the Environmental Statement as outlined in the Scoping Report (Network Rail, 2020). Detailed as follows: Items of the noise and vibration assessment that have been included in the assessment are: • Construction vibration effects; • Construction airborne noise effects; • Construction traffic noise effects; • Operational railway noise effects; and • Operational railway vibration effects. Items of the noise and vibration assessment that have been scoped out of the assessment are: • Airborne industrial noise from fixed plant – operational phase; • Construction and operational vibration in Buildings; • Construction and operational noise on tranquil areas; and • Construction and operational ground borne noise.	Oxford City Council Environmental Health Department confirm agreement in principle. The potential effects have been assessed and are reported in Sections 10.6 and 10.8.
Oxford City Council	The methodology for the baseline noise and vibration survey was submitted to Oxford City Council Environmental Health Department January 2020.	The baseline noise and vibration survey was completed in February 2020 following approval of the methodology by the Oxford City Council Environmental Health Department.
The Canal and River Trust	The Canal and River Trust have requested that any noise impact assessment needs to include occupiers of nearby waterways.	Occupiers of nearby waterways, such as the River Thames and the Sheepwash Channel have been included in the assessment. The potential effects have been assessed and are reported in Sections 10.6 and 10.8.

Study Area

10.3.6 There is no specific guidance on defining the study area for the assessment of noise for a rail project.

10.3.7 An examination of two recent large rail schemes, High Speed 2 ("HS2") (Department for Transport, 2013) and Crossrail (RPS, 2005), has found the following in relation to the study area. It should be noted that both these assessments use the term 'Spatial scope' as opposed to 'Study area'.

10.3.8 HS2 (Department for Transport, 2013) (Paragraph 14.3.15): *"Spatial scope for direct effects - for a mitigated Proposed Scheme and taking account of reasonably foreseeable worst case assumptions, the following screening distances will be used which are consistent with HS1 and in excess of guidance from sources such as US Federal Railroad Administration Guidance for high speed rail:*

- *Construction (from BS 5228-1) – 300m from any construction activity or the area within which sound levels from the Proposed Scheme are forecast to give rise to potential impacts, whichever is the greater; and*
- *Operational Proposed Scheme – 500m and 1km from the centreline of the line of route in urban and rural areas respectively, or the area within which sound levels from the Proposed Scheme are forecast to give rise to potential impacts, whichever is the greater."*

10.3.9 Crossrail (RPS, 2005) (selected extracts): (Paragraph 5.7) *"The spatial scope of the noise and vibration assessment includes the following geographic coverage:*

- *Areas within approximately 100 m of construction worksites for the central route section and within approximately 250 m of the outer route sections, including grout shafts, excavated material and general materials handling facilities and utilities worksites, where significant activities may affect sensitive receptors. These distances were not strictly applied but used as a guide to limit the geographic distribution of receptors. The initial modelling included all receptors likely to be subject to a significant impact but receptor distribution was extended, if modelling indicated that further receptors could be subject to significant impacts;*
- *Rail routes which will experience direct or indirect changes in service patterns where sensitive receptors may be affected. The assessments have generally been carried out for receptors within 100 m of rail routes but this does vary slightly with ambient levels."*

10.3.10 Both these approaches recognise that the study area cannot be strictly defined, so allow flexibility to take account of possible impacts. The study area for the Scheme has therefore been defined as follows:

- Construction - An initial area of 100m from any construction activities was examined to determine potential impacts. Where significant impacts were identified at 100m then the study area was extended to a distance where these were not significant.
- Operation - An initial area of 300m from the centreline of the route was examined to determine potential impacts. Had significant impacts been identified at 300m then the area around these impacts would have been extended to ensure the study area included all receptors capable of receiving likely significant impacts beyond 300m. It was not necessary to extend the study area for the purposes of this noise assessment.

10.3.11 In accordance with the National Policy Statement for National Networks this approach was also applied to vibration, although the distance where impacts from vibration may be significant would be less than that for noise. Typically, these would be reduced tenfold compared with those distances for noise.

Temporal Scope

10.3.12 Baseline conditions are described using available data sources, including consideration of how this baseline may change from present day to the year of construction (i.e. the future baseline in the absence of the Scheme).

10.3.13 It should be noted that the baseline noise and vibration survey was undertaken in February 2020, before the first COVID-19 pandemic lockdown was enforced in March 2020. As such, the baseline noise and vibration data used to inform this assessment are considered to be representative of typical day to day levels at the measurement locations.

10.3.14 The temporal scope of this assessment was:

- baseline year: 2020;
- future baseline year (first year construction): 2022; and
- future baseline year (first year operation): 2025

Assessment Methodologies

10.3.15 The assessment followed the general methodology outlined in the Scoping Report (Network Rail, 2020) and described in Chapter 4 – Approach to Environmental Impact Assessment. It considers whether potential effects are

likely to be significant based on the sensitivity of the receptors and the magnitude of the impact.

10.3.16 The framework for the significance criteria for the noise and vibration assessment considered a number of factors for the construction and operation phases of the Scheme. Table 10.6 presents the sensitivity criteria used for different types of receptors.

Table 10.6: Criteria for determining the sensitivity of receptors for noise and vibration

Sensitivity	Criteria
High	Residential[1], Schools, Hospitals, National designated areas
Medium	Places of worship, Community facilities
Low	Commercial buildings (e.g. offices), Sports facilities

[1]The dwellings within an 'Important Area' defined by the 2014 Noise Action Plan for Roads (Department for Environment Food and Rural Affairs, 2010a) published under The Environmental Noise Regulations would be included in this category. The difference between them and residential areas not defined as an Important Area is covered by the approach adopted for treating an effect level.

Magnitude of Impact

10.3.17 The noise bands used for the magnitude of impact (i.e. change in noise) have been taken from the noise chapter of the Design Manual for Roads and Bridges ("DMRB") – LA111 Revision 2 Noise and Vibration (Highways Agency and Welsh Office, 2020). These are applicable to both increases and decreases in noise, and applicable to both construction and operation. LA111 provides a scale for both short-term and long-term changes in noise and these are shown in Tables 10.7 and 10.8.

Table 10.7: Assessment criteria for determining the magnitude of the impact for short term operational noise

Magnitude of Change	Criteria – Short Term
Negligible	0.1 – 0.9
Low	1.0 – 2.9
Medium	3.0 – 4.9
High	5.0 +

Table 10.8: Assessment criteria for determining the magnitude of the impact for long term operational noise

Magnitude of Change	Criteria – Long Term
Negligible	0.1 – 2.9
Low	3.0 – 4.9
Medium	5.0 – 9.9
High	10.0 +

10.3.18 Tables 10.7 and 10.8 are only applicable to changes in noise as possible impacts from vibration relate only to absolute levels and not change. These are described later in this Section.

Significance of Effect

10.3.19 The significance of effect for operational noise is determined from the combination of the sensitivity of the receptor and the magnitude of impact. Table 10.9 provides a matrix to show the relationship between receptor sensitivity and magnitude of change used in this noise and vibration assessment.

Table 10.9: Factors in the assessment of significance of effect

Magnitude of Change	Sensitivity of Receptor		
	Low	Medium	High
High	Moderate (Significant)	Moderate / Major (Significant)	Major (Significant)
Medium	Minor	Moderate (Significant)	Moderate / Major (Significant)
Low	Negligible	Minor	Moderate (Significant)
Negligible	Negligible	Negligible	Minor

10.3.20 For the purpose of this noise and vibration assessment, effects of moderate significance or greater have been considered to be significant.

10.3.21 For construction noise, where the predicted construction noise exceeds the relevant effect level, this is an indication of a potential significant effect. However, to determine whether there is a significant effect, other factors are taken into consideration. This is mainly the duration of the activity and time for which the receptor would be exposed.

Effect Levels

10.3.22 As required by the NPSE and PPG-Noise, noise thresholds for the onset of adverse effects have been defined in terms of the overall levels of exposure. These effect levels and the change in noise levels predicted to occur as a result of the Scheme have been considered when classifying the magnitude of the impact.

10.3.23 The 'Explanatory Note' within the NPSE provides further guidance on defining 'significant adverse effects' and 'adverse effects', using the following concepts:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected;
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur, and;
- Unacceptable Adverse Effect Level (UAEL) – the level at which significant adverse effects on health and quality of life are to be prevented.

10.3.24 The last of these, UAEL, was added within Planning Practice Guidance – Noise (Department for Communities and Local Government, 2019). The NOEL has not been used for this assessment as it is considered that the effect would be similar to that of the LOAEL for this Scheme.

10.3.25 The NPSE (Paragraph 2.22) recognises that *"it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, for different receptors and at different times of the day".*

Construction Noise Effect Levels – Residential Receptors

10.3.26 Noise impact thresholds for construction activities at residential premises have been classified using the guidance provided in DMRB LA111, which states the following:

"Lowest observable adverse effect level (LOAEL) and significant observable adverse effect level (SOAEL) shall be established and reported within the environmental assessment for all noise sensitive receptors within the construction activity study area, with reference to baseline noise levels."

10.3.27 In line with DMRB LA111 the LOAEL values set out in Table 10.10 have been taken from the Baseline noise survey report (Volume 4 – Appendix 10.1 – Noise Survey Report). The corresponding SOAEL threshold values have been derived from the LOAEL threshold values and using the guidance provided in Section E3.2 and Table E.1 BS 5228-1+A1 2014.

Table 10.10: Construction noise effect level

Time Period	LOAEL $L_{Aeq\ T}$dB	SOAEL $L_{Aeq\ T}$dB
Day (0700-1800 weekday and 0700-1300 Saturdays)	62	65
Night (2300 to 0700)	54	60
Evenings and weekends	60	65

Construction and Operation Vibration Effect Levels – All Receptors

10.3.28 The potential impacts from vibration are based upon absolute levels and not a change in level. These are broken down into those relating to building damage and annoyance to occupants. Since levels of magnitude between these are large, these are treated separately for this assessment.

Buildings

10.3.29 BS 7385-2 (British Standards Institution, 1993) provides guidance on vibration levels likely to result in cosmetic damage and is referenced in BS 5228-2:2009 + A1:2014. Guide values for transient vibration, above which cosmetic damage could occur, are given in Table 10.11.

Table 10.11: Transient vibration guide values for cosmetic damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mms^{-1} at 4Hz and above	
Unreinforced or light framed structures Residential or light commercial buildings	15 mms^{-1} at 4Hz increasing to 20 mms^{-1} at 15Hz	20 mms^{-1} at 15Hz increasing to 50 mms^{-1} at 40Hz and above

NOTE 1: Values referred to are at the base of the building.
NOTE 2: For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

10.3.30 BS 7385-2 (British Standards Institution, 1993) indicates that for continuous vibration the threshold is around half of the transient values given in Table 10.11. The level for cosmetic damage, which would be considered as a low impact, has therefore been set to 7.5 mm/s, which is half of the lower of the

values from Table 10.11 for residential or light commercial buildings. In addition, the standard states that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration level twice that of minor damage. This has been used to set the levels of magnitude for medium and high impacts.

10.3.31 BS 7385-2 (British Standards Institution, 1993) also states that that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity, which can be halved for a conservative level for continuous vibration. Although now superseded, BS 5228-4:1992 (British Standards Institution, 1992) suggested a threshold for cosmetic damage at peak particle velocities of 10 mm/s for intermittent vibration and 5 mm/s for continuous vibrations. This lower level has been used to assign the level for no change. The thresholds within BS 5228-4:1992 (British Standards Institution, 1992) have not been updated within the more recent version but it assumed that they are still valid.

10.3.32 Table 10.12 presents the magnitude of impact for building damage from vibration. These are based on a building that is structurally sound. If a building is not structurally sound then these values may be reduced. It should be noted that BS 7385-2 (British Standards Institution, 1993) states (Paragraph 7.5.2) *"A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive".* As the receptor is a building and not a human receptor, no values for the effect level can be assigned.

Table 10.12: Magnitude of impact for potential vibration damage to buildings

Magnitude of Impact	Damage Risk	PPV mm/s^{-1}
High	Major	30
Medium	Minor	15
Low	Cosmetic	7.5
Negligible	Negligible	5
No Change	None	< 5

[1] Peak Particle Velocity ("PPV") is defined as the maximum instantaneous positive or negative peak of the vibration signal. It is specified in millimetres per second (mm/s). It is important to note that the PPV refers to the movement within the ground of molecular particles and not surface movement.

People

10.3.33 The effect of building vibration on people inside buildings is often assessed using the Vibration Dose Value ("VDV") index, as described in BS 6472-1:2008 (British Standards Institution, 2008). However, a simpler approach is often used initially to establish if there is potential for perceptible effects, and this is possible with the PPV index. This approach is described by BS 5228-

2:2009 + A1:2014 (British Standards Institution, 2014b), which states in Paragraph B.2:

"BS 6472, as stated, provides guidance on human response to vibration in buildings. Whilst the assessment of the response to vibration in BS 6472 is based on the VDV and weighted acceleration, for construction it is considered more appropriate to provide guidance in terms of the PPV, since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage. Furthermore, since many of the empirical vibration predictors yield a result in terms of PPV, it is necessary to understand what the consequences might be of any predicted levels in terms of human perception and disturbance."

10.3.34 Further, BS 5228-2:2009 + A1:2014 (British Standards Institution, 2014b) states (Paragraph B.2) that *"Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote anxiety lest some structural mishap might occur"*. Section 3 of LA111 (Highways England 2020) sets out the recommended thresholds for vibration, which are, the LOAEL is set at 0.3 mm/s and the SOAEL at 1.0 mm/s. A table of guidance levels is provided in BS 5228-2:2009 + A1:2014 (British Standards Institution, 2014b) and is shown in Table 10.13, together with the assigned effect levels.

Table 10.13: Magnitude of impact for vibration annoyance

Vibration Level, PPV mm/s^{-1}	Effect	Magnitude of Impact	Effect Level
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High	UAEL
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	Medium	SOAEL
0.3	Vibration might be just perceptible in residential environments.	Low	LOAEL
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	LOAEL
< 0.14	Vibration not perceptible.	No change	NOEL

10.3.35 If the predicted levels for a single event for construction are above the SOAEL then mitigation measures and the duration of the construction activity will be considered first to determine if further investigation is required using the VDV index. For operation, if any single events are predicted above the SOAEL then a further assessment would be undertaken using the VDV index.

Operational Noise Effect Levels – Residential Receptors

10.3.36 The effect levels assigned for operational noise are shown in Table 10.14, with an explanation of how they have been derived provided after the table.

Table 10.14: Operation noise effect levels for residential receptors

Effect Level	Period	Noise Level[1]
UAEL	Day	74 dB $L_{Aeq,16h}$
	Night	-
SOAEL	Day	66 dB $L_{Aeq,16h}$
	Night	55 dB $L_{Aeq,8h}$
LOAEL	Day	50 dB $L_{Aeq,16h}$
	Night	40 dB $L_{Aeq,8h}$

[1]All levels are free-field. A free-field level is one that does not contain the contribution from reflections from nearby buildings.

10.3.37 For the day-time the UAEL has been set with reference to Planning Policy Guidance - Noise (Department for Communities and Local Government, 2014), where it identifies that this level should be prevented.

10.3.38 The level of 73 dB $L_{Aeq,18h}$ is equivalent to a level of 74 dB $L_{Aeq,16h}$ (conversion from Planning Policy Guidance Note 24: Planning and Noise (Department of Environment, 1994).

10.3.39 The UAEL at night has not been assigned as there is insufficient guidance available to define a level. This is acknowledged in the first round Noise Action Plan Major Railways (Department for Environment Food and Rural Affairs, 2010b), where it states in Paragraph 5.08:

"The LAeq,18h indicator describes only the noise that occurs between the hours of 0600 and 2400 and doesn't cover the night period. Even so, the identification of Important Areas has been based solely on the $L_{Aeq,18h}$ value. This reflects the fact that for the first round of mapping the L_{night} values had to be based on a range of assumptions that, while perfectly adequate for strategic noise mapping, do not provide a robust basis for developing detailed actions. Furthermore, implementing many of the potential actions available to manage noise issues and effects would not only address the noise as measured by the LAeq,18h indicator but also the noise that occurs at night".

10.3.40 For daytime, the SOAEL is in relation to the daytime trigger level of 68 dB $L_{Aeq,18h}$ for Noise Insulation as defined in The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996. The 16h level of 66 dB is derived by first correcting to a free-field level from a façade level (-2.5 dB as defined by the Calculation of Railway Noise, Department of Transport 1995) and then adding 1 dB for and 18h to 16h conversion. This derived level of 66.5 dB is then rounded down to 66 dB. Linking the SOAEL with the trigger level for noise insulation is consistent with a consequence of the SOAEL as stated in Planning Practice Guidance – Noise (Department for Communities and Local Government, 2014), where people start "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".

10.3.41 For night-time, the SOAEL is set at 55 dB $L_{Aeq,8h}$. This aligns with the interim night-time outdoor target level provided in the WHO Night Noise Guidelines for Europe (World Health Organisation, 2009). This is also consistent with a consequence of the SOAEL as stated in Planning Practice Guidance – Noise (Department for Communities and Local Government, 2014) of *"Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep".*

10.3.42 The LOAEL is set at 50 dB $L_{Aeq,16h}$ and is based on the information provided in the Guidelines for Community Noise ("GCN") (World Health Organisation, 1999). In that document it states that 50 to 55 dB L_{Aeq} represent "day-time levels below which the majority of the adult population will be protected from becoming moderately or seriously annoyed". The level of 50 dB $L_{Aeq,16h}$ for moderately annoyed has therefore been chosen.

10.3.43 For night-time the LOAEL is set at 40 dB $L_{Aeq,8h}$ which is explicitly defined as the LOAEL in the WHO Night Noise Guidelines for Europe ("NNG") (World Health Organisation, 2009).

<u>Mitigation Approach</u>

10.3.44 The approach to mitigation is determined by the predicted environmental impacts, which include both the effect level and the change in noise as a result of the Scheme. This defines levels of effect on health and quality of life. These are:

- no observed effect;
- adverse observed effect;
- significant observed adverse effect; and

- unacceptable adverse effect.

10.3.45 The thresholds that have been used to define these effects (shown in Table 10.13) relate to an absolute level of noise and not a change in noise. An impact that is against these aims would be considered as a policy impact. However, mitigation may not always be considered for each policy impact. In determining whether mitigation is to be provided, the change in noise and number of dwellings affected has been considered.

10.3.46 An environmental impact would be one that causes 'likely significant effects'. An impact of this type would be where the change in noise is at or above the level defined to be significant. For the purpose of this noise and vibration assessment, effects of moderate significance or greater (Table 10.8) have been considered to be significant.

10.3.47 Table 10.15 presents the approach to mitigation for residential receptors at each effect level for policy and environmental impacts. As with the effect levels (Table 10.14), the suggested levels on when to mitigate presented in Table 10.15 are not definitive values and the decision to mitigate or not should not be based solely on a change in noise level.

Table 10.15: Approach to mitigation for operational noise – residential receptors

Government policy mitigation approach	Environmental assessment mitigation approach
Prevent	N/A – level would be prevented from occurring
Unacceptable Adverse Effect Level (UAEL) Day – 74 dB $L_{Aeq,16h}$	
Avoid - Reduce noise level through scheme design.	Mitigate any increase in noise from the scheme that is above 1 dB[1].
Significant Observed Adverse Effect Level (SOAEL) 66 dB $L_{Aeq,16h}$ and 55 dB $L_{Aeq,8h}$	
No specific action unless environmentally significant.	Mitigate where increases are environmentally significant in the short term (i.e. > 3 dB(A))
Lower Observed Adverse Effect Level (LOAEL) 50 dB $L_{Aeq,16h}$ and 40 dB $L_{Aeq,8h}$	
No specific action unless environmentally significant.	Mitigate where increases are environmentally significant in the long term (i.e. > 5 dB(A))

[1]To reflect the adverse health effects of being above the SOAEL, a smaller increase in noise is considered sufficient to determine the need for mitigation to be considered. This is reflected in PPG-Noise as *"In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur".*

Items Scoped Out of the Assessment

10.3.48 In line with the Scoping Opinion Volume 4 – Appendix 1.1) the parts of the noise and vibration assessment that are scoped out of the Environmental Statement are as follows:

Construction Phase

- Ground borne noise and vibration effects on buildings; and
- Construction noise effects on tranquil areas.

Operational Phase

- Airborne noise from fixed plant items
- Operational noise on tranquil areas
- Operational noise from road traffic
- Vibration on buildings as a result of the operation of the Scheme
- Ground borne noise as a result of the operation of the Scheme

10.3.49 These have been scoped out on the basis that they would not be likely to result in a significant effect on noise or vibration.

Limitations and Assumptions

10.3.50 Limitations and assumptions for noise and vibration comprise the following:

- Limitations have been encountered for the construction assessment as the contractor has yet to be appointed. Assumptions have been made regarding the majority of plant and equipment likely to be used and the techniques used to construct:
  - a new railway line;
  - a new platform;
  - the western entrance building;
  - the replacement of the Sheepwash Bridge, and;
  - the construction of the Botley Road Bridge.
- The Network Rail GRIP 4 constructability report (163390 – Oxford Corridor Phase 2) has been used to inform the construction noise and vibration assessment. Any assumptions made have been based on professional judgement and experience of previous similar schemes.
- The main limitations associated with the operation of the Scheme are the assumptions that were made with regard to the operation of the passenger service on the Down Oxford Passenger Loop. Assumptions have been made and agreed with Network Rail. These are assumptions are related to:

- the class of passenger train that would be used;
- the number of train movements per day using the Down Oxford Passenger Loop;
- the frequency and noise level associated with station platform announcements:
- the operating characteristics (e.g. speed) of the trains along the route, and;
- it has been assumed that freight train locomotives would not be operated at full power when passing through the station.

10.3.51 For further details on limitations and assumptions refer to Appendix 10.2

10.4 Baseline Conditions

Characterisation of the Environmental Baseline

10.4.1 The baseline noise levels in the study area are predominantly influenced by major transport infrastructure networks, which include trains stopping at and passing through Oxford Station, also road traffic using Botley Road and the surrounding road network.

Baseline Noise and Vibration Survey

10.4.2 The baseline noise survey was conducted over seven days between (and inclusive of) Wednesday 26th February to Wednesday 04th March 2020. The objective of the survey was to obtain baseline sound level data at locations representative of receptors near the Scheme. Baseline noise measurements were undertaken at the following locations:

- Location 1 - Roger Dudman Way
- Location 2 – Roger Dudman Way (Network Rail compound)
- Location 3 – Botley Road Bridge (Network Rail compound)

10.4.3 Full details of the baseline noise and vibration survey and measurement locations are provided in Appendix 10.1 in Volume 4 of the Environmental Statement.

10.4.4 Short term attended noise monitoring was undertaken at location 1 (Appendix 10.1) on the Roger Dudman Way footpath adjacent to Cripley Road.

10.4.5 The long-term unattended noise monitoring was undertaken at location 2 and location 3, where noise monitoring equipment was installed and left monitoring continuously for a period of seven days.

10.4.6 Railway noise levels at location 2 (the Network Rail compound on Roger Dudman Way) are considered to be representative of the rear façade of the properties on Abbey Road.

10.4.7 The closest noise sensitive receptors to location 3 (the Network Rail compound at Botley Road Bridge) are residential properties on Mill Street at a distance of 35m from the measurement location. To account for the difference in path length between measurement location and receptor location, the measured baseline noise data at location 3 have been corrected using standard acoustic propagation methods for a line noise source. Screening bodies and ground absorption have not been considered in the corrected baseline noise levels at the Mill Street receptors. Table 10.16 provides a summary of the representative ambient noise levels at the noise sensitive receptor locations.

Table 10.16: Baseline noise levels at sensitive receptor locations

Noise sensitive receptors[1]	L_{Aeq} dB	
	Day (07:00 – 23:00)	Night (23:00 – 07:00)
ST1 – Cripley Road	61.1	54.0[2]
LT1 – Abbey Road	63.1	61.0
LT2 – Mill Street	62.3	61.0

[1] The 'ST' location is a short term attended measurement. Locations that begin with 'LT' are where unattended measurements were undertaken over a period of at seven days. The noise level presented is the average of the samples taken in the respective time period.

[2] Night time measurements were not undertaken at ST1 Cripley Road, therefore night time noise levels have been extrapolated from the closest location LT1 Abbey Road and corrected for distance.

Future Baseline

10.4.8 The baseline noise levels in the study area are mainly influenced by the major transport infrastructure networks, which include trains stopping at and passing through Oxford Station and road traffic using Botley Road and the surrounding road network.

10.4.9 Without the Scheme in place the capacity for trains passing through Oxford Station is unlikely to change substantially between 2020 and 2025. As such, there is unlikely to be a noticeable increase in noise from train movements between 2020 and 2025.

10.4.10 A desk based review has been undertaken to establish the increase in road traffic levels that may be likely for the construction year 2022 and first operation year 2025. The review has included data available from the Department for Transport (DfT) – Road traffic statistics (Site 27121 Botley Road).

10.4.11 To create a 1 dB increase in traffic noise level would require a minimum increase in traffic flow of 25%. The DfT data show that during the five year period between 2014 to 2019 there was a 7% increase in road traffic flow on Botley Road, which would equate to less than a 1dB increase in traffic noise level. It is reasonable to assume that during the following five year period (baseline year 2020 to future baseline of 2025) a similar increase in traffic flow may be likely to occur, which would result in an increase in road traffic noise of less than 1dB. Therefore, it is considered that the baseline noise data measured in 2020 would be suitably representative to inform the assessment for the construction year 2022 and opening year 2025. As the predicted increase of road traffic between these years is negligible in noise terms it is therefore not considered to be a limitation of this assessment.

Identification of Sensitive Receptors

10.4.12 The following noise and vibration sensitive receptors have been identified:

Residential:

- Cripley Road;
- Abbey Road;
- Botley Road;
- Mill Street; and
- House boats on River Thames and Sheepwash Channel

Schools and Education:

- Said Business School

Places of Worship:

- The Parish Church of Saint Thomas the Martyr, and;
- Oxford Jewish Synagogue.

10.5 Design and Best Practice Measures

Design Measures

10.5.1 The Scheme has been designed, as far as possible, to avoid and limit impacts and mitigate the effects of noise and vibration through the process of design-development considering good design principles. Embedded mitigation is defined within the DMRB LA111 as '*Design measures which are integrated into a project for the purpose of minimising environmental effects.'* The

embedded mitigation is reported as part of the Scheme description in Chapter 2 – Description of Scheme.

10.5.2 The assessment of whether significant effects would be likely to occur has been based on the Scheme as described in Chapter 2 – Description of the Scheme and taken account of measures embedded within the design as described in Chapter 4 – Approach to Environmental Impact Assessment.

Construction Management Measures

10.5.3 The Scheme would be constructed in accordance with the Code of Construction Practice (CoCP), (Volume 4 – Appendix 2.1). The CoCP sets out the principles for environmental mitigation, which would then be used as the basis of the Construction Environmental Management Plan (CEMP).

10.5.4 The CEMP would outline measures to be put in place to ensure that levels of noise and vibration are minimised during the construction phase of the proposed Development. In particular, the CEMP would detail pollution prevention and control measures, as well as contingency plans to deal with an exceedance of agreed construction noise limits.

10.5.5 This noise and vibration assessment has identified management measures which would be required to control noise and vibration effects during the construction phase. Discussed further in Section 10.7.

10.6 Assessment of Noise and Vibration Effects

Construction Phase - Noise

10.6.1 The potential impact from construction activities at locations along the route are described below, together with a summary table for each location showing the expected noise levels at the closest sensitive receptors.

10.6.2 The expected works have been first broken down by location, and then into specific work areas each comprising a number of activities. The full list of assumed construction plant for each activity is included within Volume 4 – Appendix 10.2 – Noise and Vibration Assessment Supporting Information.

10.6.3 The proposed working hours during the construction phase for the works would adhere to normal daytime working hours (typically 07:00 to 18:00 Monday to Friday and 08:00 to 13:00 Saturday), with no working on Sundays, Bank or Public Holidays except as reasonably necessary and notified to the relevant and affected residents by an agreed notification procedure. For the construction works along the operational railway line it would be necessary to arrange possessions to block train movements as safety requirements dictate. The programme for the possessions has not been finalised at this

stage but may include weekday night working and possessions of up to 100 hours during the week or over weekends, especially during the works to replace the Botley Road Bridge. As a result, there is likely to be night-time working and 24-hour working in shifts during some weekdays and at some weekends.

10.6.4 Certain structures, such as the YHA building on Botley Road and the station buildings associated with the existing Platform 4, would require demolition.

10.6.5 The stages of construction for the Scheme has been separated into four main elements; these are summarised as follows:

- The Sheepwash Bridge replacement.
- Demolition of the Platform 4 buildings and construction of the new Platforms 4 and 5 and new track (the down Oxford passenger loop).
- The new bridges at Botley Road.
- Demolition of the YHA building (Botley Road) and construction of the western entrance to the station.

10.6.6 The estimates given for the duration of each construction stage have been based on information supplied in the GRIP 4 constructability report and professional judgement and, as such, can only be indicative until a construction contractor is appointed.

<u>Sheepwash Bridge Replacement Works – Overview</u>

10.6.7 The existing Sheepwash Bridge located to the north of Oxford Station, consists of 5 decks, carrying 5 ballasted non-electrified railway tracks, a road and a footpath/cycleway over the Sheepwash Channel. To accommodate the Oxford Passenger Down Loop it is proposed that the existing road and a footpath/cycleway bridges are to be replaced and realigned to accommodate an additional rail bridge span. Roger Dudman Way would be re-aligned clear of the new Platform 5 and over the new Sheepwash Bridge span, with the southern end diverted from the present Botley Road junction to a new junction with Cripley Road.

10.6.8 The realignment of Roger Dudman Way would also require the temporary relocation of the existing Co-operative Childcare building, which is located adjacent to the Sheepwash Channel. When the road realignment works are complete a new retaining wall would be constructed at the realigned boundary of the Co-operative Childcare site.

10.6.9 Table 10.17 provides a summary of the predicted demolition and construction noise levels at the closest sensitive receptors. Full details for the Sheepwash Bridge construction assessment are provided in Appendix 10.2 in Volume 4 in the Environmental Statement.

Table 10.17: Sheepwash Bridge - Predicted noise levels from construction activity

Location of works / works areas	Highest expected noise level at the closest receptor, LAeq, dB	Activity associated with highest noise level[1]	Distance to closest receptor, m	Effect Level[2]
Compound construction	68	Operation of heavy plant and power tools	30	LOAEL
Compound construction - Facilities	60	Vehicle Movements	30	LOAEL
Road realignment - sub base	80	Cutting road surface	20	SOAEL
Road realignment - Surfacing	71	Asphalt surfacing	20	SOAEL
Existing Sheepwash Bridge removal	78	Operation of barge crane	10	SOAEL
Sheepwash Bridge installation	78	Operation of barge crane and power tools	10	SOAEL
Temporary building for Co-operative Childcare construction	81	Vehicle movements and power tools	10	SOAEL

[1]Some work areas have more than one activity. These are shown in detail in Appendix 10.2 in the Environmental Statement Volume 4.
[2]These are in terms of daytime predicted noise level.

10.6.10 Table 10.17 shows that the SOAEL is predicted to be exceeded for some of the Sheepwash Bridge works. This would be a temporary significant adverse effect. The noise levels are considered to be significant in relation to the EIA Regulations 2017. Section 10.7 considers the mitigation measures proposed to be used.

10.6.11 If any of the construction works are to be undertaken at night then the expected noise levels would be similar to those presented in Table 10.17. The predicted noise levels at the closest receptor are above the night-time UAEL of 65 $dB_{LAeq,1h}$ and would cause a temporary significant adverse environmental effect which would be significant in relation to the EIA

Regulations 2017. An assessment to determine eligibility for noise insulation would be undertaken prior to any night working.

Platform 5 and Down Oxford Passenger Loop Works - Overview

10.6.12 To accommodate the new Down Oxford Passenger Loop a new Platform 5 would be constructed to the back of the existing Platform 4 requiring the demolition of all existing Platform 4 buildings, other associated buildings and the YHA buildings on Botley Road. A retaining wall would also be constructed to support the proposed Platform 5 track alignment from a new Botley Road Bridge span along the re-aligned Roger Dudman Way.

10.6.13 Before the main Platform 5 construction works start, the site construction compound would be set up on land in the down carriage sidings.

10.6.14 It is understood that the piling works would be undertaken as part of the new Platform 5 construction works using a small rig. Once piling works are complete the main steel work for the new platform and associated buildings would be installed during possessions of the lines (i.e. during weekday night-time?).

10.6.15 Table 10.18 provides a summary of the predicted demolition and construction noise levels at the closest sensitive receptors. Full details for the new Platform 5 and Down Oxford Passenger Loop construction assessment are provided in Appendix 10.2 in Volume 4 of the Environmental Statement.

Table 10.18: Platform 5 and Down Oxford Passenger Loop - Predicted noise levels from construction activity

Location of works / works areas	Highest expected noise level at the closest receptor, LAeq, dB	Activity associated with highest noise level[1]	Distance to closest receptor, m	Effect Level[2]
Platform 4 Buildings Demolition	76	Excavation / groundworks	20	SOAEL
Platform 4 and 5 structure construction (including steelwork)	73	Concreting and power tools	20	SOAEL
Piling works	77	Piling rig	20	SOAEL
Trackbed Preparation	74	Plant vehicles	20	SOAEL
Track drainage	72	Plant vehicles	20	SOAEL
Track laying	74	Power tools	20	SOAEL
Ballasting, tamping and lining	78	Tamping and lining	20	SOAEL

[1]Some work areas have more than one activity. These are shown in detail in Appendix 10.2 in in Volume 4 of the Environmental Statement.
[2]These are in terms of daytime predicted noise level.

10.6.16 Table 10.18 shows that the SOAEL is predicted to be exceeded for the Platform 5 and Down Oxford Passenger Loop works. This would be a temporary significant adverse effect. The noise levels are considered to be significant in relation to the EIA Regulations 2017. Section 10.7 considers the mitigation measures proposed to be used.

10.6.17 If any of the construction works are to be undertaken at night then the expected noise levels would be similar to those presented in Table 10.18. The predicted noise levels at the closest receptor are all above the night-time UAEL of 65 $dB_{LAeq,1h}$ and would cause a temporary significant adverse environmental effect which would be significant in relation to the EIA Regulations 2017. An assessment to determine eligibility for noise insulation would be undertaken prior to any night working.

Botley Road Bridge Replacement Works - Overview

10.6.18 Botley Road Bridge is a bridge which carries four tracks of the Didcot-Chester line over Botley Road. The existing Botley Road Bridge would be replaced with a new structure formed by two reinforced concrete box culvert units to contain the pedestrian and cycle paths and an orthotropic steel deck spanning between the culvert units to support 200mm minimum of ballast and the sleepers and tracks. It is also proposed to lower Botley Road by circa 1m to increase the head room under the bridge to a serviceable 4.8m. The highway would be re-graded to suit.

10.6.19 Table 10.19 provides a summary of the predicted demolition and construction noise levels at the closest sensitive receptors. Full details for the Botley Road Bridge construction assessment are provided in Volume 4 – Appendix 10.2.

Table 10.19: Botley Road Bridge - Predicted noise levels from construction activity

Location of works / works areas	Highest expected noise level at the closest receptor, LAeq, dB	Activity associated with highest noise level[1]	Distance to closest receptor, m	Effect Level[2]
Compound Construction	66	Operation of heavy plant	40	LOAEL
Compound Construction - Facilities	58	Operation of heavy plant	40	LOAEL
Vegetation removal / groundworks	75	Wood chipper	40	SOAEL

Location of works / works areas	Highest expected noise level at the closest receptor, LAeq, dB	Activity associated with highest noise level[1]	Distance to closest receptor, m	Effect Level[2]
Road Realignment - Sub base	74	Operation of heavy plant	40	SOAEL
Road Realignment - Surfacing	76	Vibratory roller	40	SOAEL
Botley Road Bridge Foundations	70	Concrete mixer truck	40	SOAEL
Botley Road Bridge piling	73	Piling rig	40	SOAEL
Botley Road Bridge Construction	69	Heavy plant and power tools	40	SOAEL

[1]Some work areas have more than one activity. These are shown in detail in Appendix 10.2 in Volume 4 of the Environmental Statement.
[2]These are in terms of daytime predicted noise level.

10.6.20 Table 10.19 shows that the SOAEL is predicted to be exceeded for some of the Botley Road Bridge works. This would be a temporary significant adverse effect. The noise levels are considered to be significant in relation to the EIA Regulations 2017. Section 10.7 considers the mitigation measures proposed to be used.

10.6.21 If any of the construction works are to be undertaken at night (for example those affecting the operational railway) then the expected noise levels would be similar to those presented in Table 10.19. Some of the predicted noise levels at the closest receptor are above the night-time UAEL of 65 $dB_{LAeq,1h}$ and would cause a temporary adverse environmental effect which would be significant in relation to the EIA Regulations 2017. An assessment to determine eligibility for noise insulation would be undertaken prior to any night working.

Western Entrance Works - Overview

10.6.22 The existing YHA building on the corner of Cripley Road and Botley Road is to be demolished to make way for the western entrance. At this stage it is not known if the proposed demolition and construction works would be phased with the Platform 4 and 5 works, however, as a worst case construction noise assessment approach it is assumed that the western entrance works would be undertaken concurrently with the Platform 4 and 5 works.

10.6.23 Table 10.20 provides a summary of the predicted demolition and construction noise levels at the closest sensitive receptors. Full details for the western

entrance construction assessment are provided in Appendix 10.2 in Volume 4 of the Environmental Statement.

Table 10.20: Western entrance - Predicted noise levels from construction activity

Location of works / works areas	Highest expected noise level at the closest receptor, LAeq, dB	Activity associated with highest noise level[1]	Distance to closest receptor, m	Effect Level[2]
YHA Building demolition	76	Concrete crushing and dumping	20	SOAEL
Western entrance construction	74	Operation of heavy plant and power tools	20	SOAEL

[1]Some work areas have more than one activity. These are shown in detail in Appendix 10.2 in Volume 4 of the Environmental Statement.
[2]These are in terms of daytime predicted noise level.

10.6.24 Table 10.20 shows that the SOAEL is predicted to be exceeded for some of the proposed western entrance works. This would be a temporary significant adverse effect. The noise levels are considered to be significant in relation to the EIA Regulations 2017. Section 10.7 considers the mitigation measures proposed to be used.

Construction Phase – Vibration

10.6.25 Potential impacts from vibration are considered in those locations where there is the potential for activities which could generate high levels of vibration. Given that no contractor has been appointed and the construction methodology is not finalised, such activities have been examined at three locations and the likely worst-case piling method has been assumed. These locations are where there is likely to be piling or compaction works, as these activities are considered likely to generate noticeable levels of vibration during the construction phase of the Scheme.

10.6.26 The first location is within the station site, where percussive (or hammer) piling may be required for the new Platform 4 and 5 foundations. The second is at the Botley Road Bridge, where vibratory sheet piling is likely to be required to create secure foundations for the structure to take the vertical load of the bridge and track-bed. The third location where vibration generating activities could take place is percussive piling as part of the construction of the western entrance to the station.

10.6.27 Calculations of possible levels of vibration have been undertaken using the equations provided within BS 5228-2:2009 + A1:2014 (British Standards Institution 2014b) These equations require input parameters based on variables such as the power of the piling rig, the depth of the pile toe and ground density conditions. The input parameters for these equations have

been estimated using professional judgement, taking into account any restrictions the location may impose on the equipment that could be used. Table 10.21 presents the calculated levels of vibration, which are summarised and compared against the effect significance criteria (Table 10.13). Further details of the calculations and input parameters are provided in Section 3, Appendix 10.2 in Volume 4 of the Environmental Statement.

Table 10.21: Predicted peak particle velocity from construction activities

Piling Location	Distance to closest receptor, m	PPV[1] mm/s	Effect[2]
Platform 4 and 5	25	0.3	LOAEL
Botley Road Bridge	40	0.7	LOAEL
Western entrance	20	0.4	LOAEL

[1]PPV is defined as the maximum instantaneous positive or negative peak of the vibration signal. It is specified in millimetres per second (mm/s). It is important to note that the PPV refers to the movement within the ground of molecular particles and not surface movement.

[2]Only applicable to the assessment against impacts on human receptors. See Table 10.13

10.6.28 In the vicinity of the new Platforms 4 and 5 the closest sensitive receptors are 25m away on Cripley Road. Using the scale presented in Table 10.12 this predicted level of 0.3 mm/s PPV is below the level where building damage may occur and would be classed as a negligible impact. Examining the impact on humans using Table 10.13 the predicted level of vibration would be at the level where “vibration might be just perceptible in residential environments” and would be classed as a low impact and a minor adverse significance of effect, which is not significant in relation to the EIA Regulations 2017. The thresholds for human response to vibration are the same for day and night, so night time vibration activity would make no difference to this assessment.

10.6.29 In the vicinity of Botley Road Bridge the closest sensitive receptors are 40m away on Mill Street. Using the scale presented in Table 10.12 this predicted level of 0.7 mm/s PPV is below the level where building damage may occur and would be classed as a negligible impact. Examining the impact on humans using Table 10.13 the predicted level of vibration would be at the level where “vibration might be just perceptible in residential environments” and would be classed as a low impact and a minor adverse significance of effect, which is not significant in relation to the EIA Regulations 2017.

10.6.30 Near the western entrance the closest sensitive receptors are 20m away on Cripley Road. Using the scale presented in Table 10.12 this predicted level of 0.4 mm/s PPV is below the level where building damage may occur and would be classed as a negligible impact. Examining the impact on humans using Table 10.13 the predicted level of vibration would be just above the level *where* “vibration might be just perceptible in residential environments” and

would be classed as a low impact and a minor adverse significance of effect, which is not significant in relation to the EIA Regulations 2017.

Construction Traffic – Noise

10.6.31 Heavy goods vehicles (HGV) movements to and from the site would occur after 09:30 and would cease before 16:30 hours, thus not impacting on peak hour congestion on the local highway network. Therefore, the HGV movements would be staggered throughout the 7.0 hour working day. It is understood that the route for HGV movements would be along Botley Road to the A34 bypass and A420. There are expected to be 20 HGV movements per day.

10.6.32 A desk-based review has been undertaken to establish the likely increase in traffic noise levels that may be likely as a result of HGV movements during the construction phase of the Scheme. The review has included data available from the Department for Transport (DfT) – Road traffic statistics (Site 27121 Botley Road).

https://roadtraffic.dft.gov.uk/manualcountpoints/27121

10.6.33 The most recent DfT traffic flow data for Botley Road are the 2019 traffic flow counts, which identify 285 HGV movements per day. The HGV movements identified during the construction phase of the Scheme would represent a 7% increase to existing HGV movements on Botley Road, which would equate to an increase in traffic noise level of less than 1dB. This is considered to be a negligible increase, which is not significant in relation to the EIA Regulations 2017.

Operational Phase – Noise from Train Movements

10.6.34 The operational impacts from the Scheme have been determined by comparing the existing noise level at receptor locations with that expected with the Scheme. The assessment of operational noise impacts includes the noise from the passenger services, including when stationary at the station, and the noise from additional train information announcements on the new Platform 5.

10.6.35 To predict the impact of the Scheme, the noise level generated by the operation of the passenger trains using the new down Oxford passenger loop is required. A computerised noise model using proprietary noise modelling software has been used to predict these noise levels, based on the following:

- The input data for the noise model are based on the expected usage of the line and the other related noise sources.

- Input data and assumptions used for the noise model and assessment are described and presented in Section 4, Appendix 10.2 in Volume 4.
- The assessment for noise considers the impact on opening by comparing with a Do-Minimum scenario in that same year.
- The opening year has been taken to be 2025.
- Each assessment location is intended to be representative of a number of properties.
- Effects which are evaluated as moderate or higher are considered to be significant in relation to the EIA Regulations 2017 and require further consideration for mitigation.

10.6.36 The results of the down Oxford passenger loop assessment are presented in the following paragraphs. The list of predicted noise levels for all scenarios is provided in Section 5, Appendix 10.2 in Volume 4 of the Environmental Statement.

Residential Receptors

10.6.37 Receptors on Abbey Road to the west of the station are predicted to experience a 1.4 dB increase in noise during the daytime and a 0.6 dB increase in noise during the night time as a result of the operation of the Scheme. The receptor sensitivity is considered to be high (in line with Table 10.6). In the short term the predicted increase in noise during the daytime is a low magnitude of impact with a moderate adverse significance of effect. During the night time the predicted increase in noise is a negligible magnitude of impact, the significance of effect is also negligible. In the long term the predicted increase in noise during the daytime is a negligible magnitude of impact with a minor adverse significance of effect. During the night time the predicted increase in noise is a negligible magnitude of impact, the significance of effect is also negligible.

10.6.38 Receptors on Cripley Road to the west of the station are predicted to experience an 8.6 dB increase in noise during the daytime and an 8.5 dB increase in noise during the night time as a result of the Scheme. This is partly due to the removal of intervening buildings, but also as the railway infrastructure would be brought closer to the receptors.

10.6.39 The receptor sensitivity is high (in line with Table 10.6). In the short term the predicted increase in noise during both the daytime and the night time is a high magnitude of impact, with a major adverse significance of effect. In the long term the predicted increase in noise during both the daytime and the night time is a medium magnitude of impact, with a moderate/major adverse

significance of effect. It is noted that the effect is below the fixed SOAEL threshold.

10.6.40 Receptors on Mill Street to the south west of the station are predicted to experience a 1.3 dB increase in noise during the daytime and a 1 dB increase in noise during the night time as a result of the operation of the Scheme. The receptor sensitivity is considered to be high (in line with Table 10.6). In the short term the predicted increase in noise during both the daytime and night time is a minor magnitude of impact, with a moderate adverse significance of effect. In the long term the predicted increase in noise during both the daytime and night time is a negligible magnitude of impact, with a minor adverse significance of effect It is noted that the effect is below the fixed SOAEL threshold.

10.6.41 Receptors on the River Thames and Sheepwash Channel to the north of the station are predicted to experience a 1.7 dB increase in noise during the daytime and a 0.8 dB increase in noise during the night time as a result of the operation of the Scheme. The receptor sensitivity is considered to be high (in line with Table 10.6). In the short term during the daytime the predicted increase in noise is a minor magnitude of impact, with a moderate adverse significance of effect. During the night time the predicted increase in noise is a negligible magnitude of impact, the significance of effect is also negligible. In the long term during the daytime and night time the predicted increase in noise is a negligible magnitude of impact, with a minor adverse significance of effect. It is noted that the effect is below the fixed SOAEL threshold.

Educational Receptors

10.6.42 The Said Business School situated to the east of the station site is predicted to experience an 0.9 dB increase in noise during the daytime as a result of the operation of the Scheme. The receptor sensitivity is considered to be high (in line with Table 10.6). The predicted increase in noise is a negligible magnitude of impact, the significance of effect is also negligible.

10.6.43 Co-operative Childcare situated on Roger Dudman Way is predicted to experience a 1.2 dB increase in noise during the daytime as a result of the operation of the Scheme. The receptor sensitivity is considered to be high (in line with Table 10.6). In the short term the predicted increase in noise is a minor magnitude of impact, with a moderate adverse significance of effect. In the long term the predicted increase in noise is a negligible magnitude of impact, with a minor adverse significance of effect. It is noted that the effect is below the fixed SOAEL threshold. It is also noted that due to the location of the Co-operative Childcare site, the building and playground are at a lower topographical level than Roger Dudman Way. As such, the external

playground area and windows in the Co-operative Childcare building are effectively screened from the existing railway lines. Therefore, the predicted noise increase at the Co-operative Childcare as a result of the Scheme is unlikely to be noticeable by staff or children.

Places of Worship

10.6.44 The Parish Church of Saint Thomas the Martyr situated to the south east of the station site is predicted to experience a 0.4 dB increase in noise during the daytime as a result of the operation of the Scheme. The receptor sensitivity is considered to be medium (in line with Table 10.6). The predicted increase in noise is a negligible magnitude of impact, the significance of effect is also negligible.

10.6.45 Oxford Jewish Synagogue situated to the north east of the station site is predicted to experience a 0.4 dB increase in noise during the daytime as a result of the operation of the Scheme. The receptor sensitivity is considered to be medium (in line with Table 10.6). The predicted increase in noise is a negligible magnitude of impact, the significance of effect is also negligible.

Stationary Noise Sources at Platform 5 during Operation

10.6.46 There would be new stationary noise sources as a result of the operation of Platform 5. Stationary noise sources would include engine noise from stationary passenger trains and platform announcements via the Platform 5 public address voice alarm (PAVA) system.

10.6.47 To assess the potential impact from stationary noise sources the methodology from BS4142:2014+A1:2019 (British Standards Institution 2019) has been used. This method compares the rating sound level from the source/s at the receptor location (including any acoustic character corrections applied) to the background sound level L_{A90} dB to establish a level difference. The higher the rating level is above the background sound level, the higher the potential for an adverse noise impact.

10.6.48 The assessment of stationary noise sources has used data measured as part of a separate study in September 2015. These data are as follows:

- Measurements of a stationary Class 165/166 DMU at the Oxford Station sidings, and;
- Measurements of a PAVA platform announcement at Bristol Parkway Station.

10.6.49 Table 10.22 provides a summary of the calculated sound power levels obtained for the stationary Class 165/166 DMU and PAVA platform announcement measurements.

Table 10.22: Class 165/166 DMU and PAVA sound power levels

Source	Sound power level, L_w dB(A)
Class 165/166 DMU - stationary	102.8
Platform announcement PAVA	83.9

10.6.50 The assessment of stationary noise sources at Platform 5 has been undertaken at the closest receptors on Cripley Road to the west of the station site, at a distance of 30m from the new track. Receptor locations to the east of the station site would be effectively screened by the existing Platforms 1 to 4 and associated station buildings. As such, noise impact at receptors to the east of the station from stationary sources on Platform 5 are not considered further.

10.6.51 As a reasonable worst case approach the assessment has assumed the following sources at Platform 5 would be operational simultaneously:

- The PAVA system (to include a minimum of eight clusters of loudspeakers positioned evenly along the length of the platform), and;
- A stationary Class 165/166 DMU with engines running.

10.6.52 The calculated specific sound level at the Cripley Road receptors from all stationary sources operating at Platform 5 is 61 dB(A).

10.6.53 The background sound level L_{A90} dB at the Cripley Road receptors has been taken from the baseline noise and vibration report provided in Appendix 10.1 in Volume 4. An acoustic feature correction of 3dB has been applied to the assessment to account for an intermittent sound source. Table 10.23 provides a summary of the results of the BS4142 assessment for stationary noise sources operating on the new Platform 5.

Table 10.23: BS4142 assessment summary – Platform 5 stationary noise sources

Results, dB	Cripley Road receptors	
	Daytime	Night time
Background sound level $L_{A90,1-hr}$	55	51
Specific Level (L_s)	61	61
Acoustic feature correction for intermittent sources	3	3
Rating level ($L_{ar,Tr}$) $L_{Aeq,T}$	64	64
Excess of rating level over background sound level	+ 9	+ 13

10.6.54 The results of the BS4142 assessment show an exceedance of 9dB above the background noise level for daytime and 13 dB above background for night time. These predicted noise impacts are considered as a major adverse effect, which is significant in relation to the EIA Regulations 2017. Section 10.7 considers the mitigation measures proposed to be used.

Operational Phase – Vibration

10.6.55 The assessment of operational vibration impacts has been undertaken by showing that the proposed passenger trains using the new track would not result in any more vibration than a freight train using the existing tracks. Measurements of vibration were undertaken at Oxford Station in September 2015. The 2015 vibration measurements were carried out on the approach to Oxford Station where there were passing freight trains and Class 166 passenger trains. During the vibration measurements there were freight trains passing through the station at a slow speed (assumed to be around 10 mph) and also Class 165/166 DMUs slowing to stop at the station. These slowing DMUs were assumed to be at the approximate same speed as the freight trains. A summary of the measured levels of vibration is provided in Table 10.24.

Table 10.24: Maximum vibration levels from existing trains at Oxford Station

Source	Maximum vibration level, PPV[1]	Distance[2]	Number of observations
Freight	0.52	6.5 m	3
Class 165 / 166	0.44	4 m	10

[1] This was the maximum level measured from the observations of each train type.
[2] The distance from the vibration monitor to the closest rail.

10.6.56 From the levels presented in Table 10.24 it can be seen that the freight traffic produced a higher level of vibration despite being further from the vibration

monitor. This would indicate that a freight train generates a higher level of vibration than a passenger train, which is unsurprising given the weight difference between the two train types.

10.6.57 When examining the measured levels of vibration from both freight and passenger trains the measured levels are comfortably below the 7.5 mm/s where the risk of building damage is considered to be negligible (see sig criteria Table 10.12). Compared against the level for an indication of human annoyance (Table 10.13) the measured levels from Table 10.24 are just above being 'just perceptible in residential environments'. These levels are not considered as significant.

10.6.58 It should also be noted that the vibration measurements presented in Table 10.24 were measured at 6.5m and 4m respectively. Ground borne vibration would reduce with increasing path length between the source and receiver. Therefore, it is reasonable to expect that vibration from train movements at the closest properties, which are 13m away on Abbey Road are likely to be lower than the levels presented in Table 10.24.

Noise Insulation Railway Regulations (NIRR)

10.6.59 The predicted overall noise levels at locations where the noise level change is predicted to change by more than 1 dB(A) are not above the trigger level of 68 dB $L_{Aaq,18h}$. Therefore, Part 2 of the NIRR is not triggered.

10.7 Additional Mitigation Measures

Construction Mitigation

10.7.1 Potential significant adverse temporary noise effects have been identified during construction. The appointed contractor would develop appropriate mitigation where necessary and practicable as required by the CoCP and the CEMP. In addition, the appointed contractor would seek to obtain prior consent from the relevant local authority (Oxford City Council) under Section 61 of the Control of Pollution Act 1974 for the proposed construction works. The consent application would set out the final Best Practical Means ("BPM") measures to minimise construction noise and vibration, including control of working hours, and also provide a further assessment of construction noise and vibration including confirmation of noise insulation / temporary re-housing provision, if required. The Section 61 application would also describe the procedures for the monitoring of noise and vibration during construction.

10.7.2 The application of BPM would be expected to reduce construction noise and eliminate all of the predicted temporary significant effects. As plant and equipment is likely to be fixed due to the constraints of working within a

railway-related environment, other forms of mitigation are likely to be required to result in acceptable noise levels at the receptor locations.

10.7.3 Noise mitigation measures that are known to be effective in reducing the impact should be considered and include:

- Provide effective liaison with local residents wherever working outside of core hours is to be undertaken;
- Programme and phase the works over a number of stages to restrict impacts within any one area to the minimum time;
- Erect local hoarding, screens or barriers as necessary to shield particularly noisy activities, or around the site boundary if residential properties are located close to construction works.
- Properly maintain and operate all plant and equipment in accordance with manufacturers' recommendations and in such a manner as to avoid causing excessive noise;
- Shut down equipment when not in use, i.e. maintain a 'no idling policy';
- Position equipment behind physical barriers, i.e. existing features, hoarding or purpose-built acoustic barriers;
- Site static machines as far away as practicable from inhabited buildings or other noise sensitive locations;
- Carry out toolbox talks to make sure that all those undertaking the works are aware of their environmental responsibilities and of the sensitivities of the vicinity. These would also ensure that BPM of control are delivered on the site;
- Direct noise emissions from plant, including exhausts or engines, away from sensitive positions;
- Handle all materials in a manner which limits noise, including reducing drop heights into hoppers and lorries;
- Avoid double handling and therefore the overall number of tipping actions;
- Avoid body and tailgate 'slap' from empty lorries;
- Lubricate moving parts of working platforms and other equipment to control noise when being operated;
- Remind all site employees of their obligation to limit noise on site by the use of signs and site inductions; and,

- Engage in community liaison to explore ways of reducing noise impacts and increasing local tolerance to noise.

Operation Mitigation

10.7.4 During operation, significant adverse effects from noise have been identified at the dwellings to the west of the station along Cripley Road and Abbey Road. The identified adverse effects are due to train movements on the down Oxford passenger loop and stationary noise sources at the new Platform 5.

10.7.5 A noise barrier has been considered within the design to mitigate the predicted effects at Cripley Road and Abbey Road. The barrier has been modelled as 250m long, extending from the north facing façade of the western entrance building to the Sheepwash Bridge. The barrier in the noise model is 2.2m high and absorptive to avoid reflections to sensitive receptors on the opposite side of the station. The barrier would need provide a minimum performance of D_{LR} ≥21 with a minimum surface density of 23kg/m^2.

10.7.6 The properties on Abbey Road are two storey terraced houses, the proposed noise barrier would block line of site to the upper storey bedroom windows and would reduce operational noise levels (including stationary noise sources) at these receptors by 3dB. This would result in an overall reduction in operational noise levels that are currently experienced at the Abbey Road receptors. With the overall noise level below the SOAEL, which is not a significant effect in relation to the EIA Regulations 2017.

10.7.7 For a noise barrier to be fully effective it needs to block line of sight between the noise source and receiver. The properties on Cripley Road include some three storey houses, which overlook the Oxford Station. To fully block line of site between the Cripley Road receptors and the Scheme would require a noise barrier with a minimum height of 4m. However, it is considered that a 4m high noise barrier is unlikely to be a suitable mitigation solution, due to the structural requirements for wind loading. A 4m high barrier would also be likely to obstruct daylight to some receptors. As such, the barrier proposed for consideration has been limited to a height of 2.2m. This is predicted to reduce operational noise levels at the Cripley Road receptors by 2 dB. With mitigation in place there would still be an increase in operational noise levels at the Cripley Road receptors of 6 dB. In line with Table 10.9 this would result in a major adverse effect.

10.7.8 It should be noted that the nature of the noise would not change (noise source would still be from trains using Oxford Station and PAVA announcements) and the location of the noise source would not change as it would still impact upon the same façade of the properties as it does at present. The overall

predicted noise level is below the fixed SOAEL threshold set out in Table 10.14.

10.8 Summary of Residual Noise Effects

10.8.1 The identified mitigation measures for construction would reduce all predicted significant adverse effects to not significant.

10.8.2 For operation with the identified mitigation measures in place significant adverse effects due to increases in noise are still predicted to occur at receptors on Cripley Road. However, the predicted noise levels are below the fixed SOAEL thresholds for daytime and night time, so negative health effects are considered unlikely to occur.

10.8.3 It is considered that the Scheme complies with the aims of the NPSE. The justification for this is provided in Table 10.25 in relation to each aim of the NPSE.

Table 10.25: NPSE – Scheme compliance justification

Aim	Justification
To avoid significant adverse impacts on health and quality of life.	During construction the identified significant adverse effects for noise and vibration would be avoided by following the measures set out in the CoCP and CEMP. The identified significant adverse effects for operational noise at Cripley Road and Abbey Road have been mitigated as far as practicable. There are no predicted significant operational effects from vibration.
To mitigate and minimise adverse impacts on health and quality of life.	Through the use of BPM the adverse effects are minimised through measures incorporated into the scheme design and operation. Continuous Welded Rail (CWR) has been identified for use on the Down Oxford Passenger Loop, which would help reduce operational noise. CWR provides the lowest correction in the Calculation of Railway Noise (Department of Transport, 1995).
Where possible, contribute to the improvement of health and quality of life.	With the introduction of the Scheme there is little opportunity to improve the quality of life in the surrounding area with regards to noise.

10.8.4 Table 10.26 summarises the residual likely effects of the Scheme for noise and vibration.

Table 10.26: Residual effects for noise and vibration

Potential Effect	Receptor(s)	Likely effect without additional mitigation	Additional Mitigation Measure(s)	Residual Effects
Construction				
Construction noise	Cripley Road	Temporary adverse effect - Significant	Prepare and implement a Noise and Vibration Control Plan for the CEMP. Use of BPM in the selection and operation of equipment. Use of Section 61 notice to agree maximum noise levels with the Local Authority.	Minor – Not Significant
	Abbey Road	Temporary adverse effect - Significant		Minor – Not Significant
	Mill Street	Temporary adverse effect - Significant		Minor – Not Significant
	River Thames / Sheepwash Channel	Temporary adverse effect - Significant		Minor – Not Significant
Construction Vibration	Cripley Road	Minor effect - Negligible	None required	-
	Abbey Road	Minor effect - Negligible	None required	-
	Mill Street	Minor effect - Negligible	None required	-
Operation				
Operational Noise	Cripley Road	Major adverse effect in terms of noise change but overall noise level is below the fixed SOAEL threshold.	250m long absorptive noise barrier to west facing boundary of station site.	Major adverse effect in terms of noise change but overall noise level is below the fixed SOAEL threshold. With the identified mitigation in place there are residual effects, but these have been mitigated as much as practicable in line with the context of sustainable development and the NPSE.
	Mill Street	Moderate Adverse - Significant	None proposed	Below SOAEL threshold – Not Significant

Potential Effect	Receptor(s)	Likely effect without additional mitigation	Additional Mitigation Measure(s)	Residual Effects
	Abbey Road	Moderate adverse effect - Significant	250m long absorptive noise barrier to west facing boundary of station site	Below SOAEL threshold – Not Significant
	Said Business School	Negligible effect – Not significant	None required	None
	Co-operative Childcare	Moderate Adverse - Significant	None proposed	Below SOAEL threshold – Not Significant
	Oxford Jewish Synagogue	Negligible effect – Not significant	None required	None
	St Thomas the Martyr Church	Negligible effect – Not significant	None required	None

10.9 Conclusions

10.9.1 This chapter reports the effects on noise and vibration as a result of the Scheme.

10.9.2 Through the implementation of design and construction management measures, as described in Section 10.5, this has resulted in the reduction or avoidance of impacts on noise and vibration. These measures included;

- The consideration of a noise barrier along the west boundary of the station to reduce operation noise levels from train movements and stationary noise sources.
- The appointed contractor would seek to obtain prior consent from the relevant Local Authority under Section 61 of the Control of Pollution Act 1974 for the proposed construction works. The consent application would set out the final Best Practical Means measures to minimise construction noise and vibration.

10.9.3 Following the assessment of noise and vibration effects by the Scheme, the additional mitigation measures described in Section 10.7 have been incorporated into the Scheme to manage or reduce potential effects. With the identified mitigation in place there are residual effects at the receptors on Cripley Road, these have been mitigated as much as possible in line with NPSE. The predicted noise levels on Cripley Road are below the fixed SOAEL threshold, so negative health effects are considered unlikely to occur.

References

British Standards Institution. (1992). *BS 5228-4:1992, Noise control on construction and open sites - Code of practice for noise and vibration control applicable to piling operations*.

British Standards Institution. (1993). *BS 7385-2:1993, Evaluation and measurement for vibration in buildings -Guide to damage levels from ground borne vibration*.

British Standards Institution. (2008). *BS 6472-1:2008, Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*.

British Standards Institution. (2014a). *BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Noise*.

British Standards Institution. (2014b). *BS 5228-2:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Vibration*.

British Standards Institution. (2014c). *BS 8233:2014, Guidance on sound insulation and noise reduction for buildings*.

British Standards Institution. (2019). *BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound*

Department for Communities and Local Government. (2014). *Planning Practice Guidance – Noise*.

Department of Environment. (1994). *Planning Policy Guidance: Planning and Noise 24. Statement for England*.

Department for Environment Food and Rural Affairs. (2014a). *Noise Action Plan: Railways (Including Major Railways)*.

Department for Environment Food and Rural Affairs. (2014b). *Possible options for the identification of SOAEL and LOAEL in support of the NPSE.*

Department of Transport and Welsh Office. (1988). *Calculation of Road Traffic Noise*.

Department of Transport. (1995). *Calculation of Railway Noise*.

Department for Transport. (2013). *High Speed Two: London- West Midlands Environmental Statement. Volume 5 | Technical Appendices. Methodology, assumptions and assessment (route-wide) (SV-001-000)*.

Environment Agency. (2004). *Horizontal Guidance for Noise Part 2 – Noise Assessment and Control*.

European Environment Agency. (2010). *Good practice guide on noise exposure and potential health effects, EEA Technical Report No. 11/2010*.

Highways England. (2020). *Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, LA111 Revision 2, Noise and Vibration*.

Network Rail. (2020). *Oxford Corridor Phase 2 Environmental Impact Assessment Scoping Report*.

Metrowest Phase 1. (2019b): *6.25, Environmental Statement, Volume 4, Appendix 13 Series, Noise and Vibration.*

RPS. (2005). *Crossrail: Technical Report Assessment of Noise and Vibration Impacts. Volume 1 of 8, Introduction, Scope and Methodology*.

World Health Organisation. (1999). *Guidelines for Community Noise*.

World Health Organisation. (2009). *Night Noise Guidelines for Europe*.

World Health Organisation. (2018). *Environmental Noise Guidelines for the European Region*.

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