# A1 in Northumberland: Morpeth to Ellingham

## Scheme Number: TR010041

## 6.3 Environmental Statement – Chapter 6 Noise and Vibration

## Part B

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

June 2020

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009**

# The A1 in Northumberland: Morpeth to Ellingham

Development Consent Order 20[xx]

## Environmental Statement

| | |
|---|---|
| **Regulation Reference:** | APFP Regulation 5(2)(a) |
| **Planning Inspectorate Scheme Reference** | TR010041 |
| **Application Document Reference** | TR010041/APP/6.3 |
| **Author:** | A1 in Northumberland: Morpeth to Ellingham Project Team, Highways England |

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| Rev 0 | June 2020 | Application Issue |

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## TABLES

# 6. NOISE AND VIBRATION

## 6.1. INTRODUCTION

6.1.1. This chapter presents the assessment of likely significant noise and vibration effects as a result of Part B: Alnwick to Ellingham (Part B) on sensitive receptors. It builds on the content of the **Scoping Report** (**Application Document Reference: TR010041/APP/6.11**) for Part B.

6.1.2. This chapter is intended to be read alongside the following technical appendices within **Volume 8** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.8**):

a. **Appendix 6.1: Glossary of Acoustical Terminology**
b. **Appendix 6.2: Legislation, Policy and Guidance**
c. **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**
d. **Appendix 6.4: Source Information and Assumptions for Construction Noise Assessment**
e. **Appendix 6.5: Source Information and Assumptions for Operational Road Traffic Noise Assessment**
f. **Appendix 6.6: Equipment Details**
g. **Appendix 6.7: Summary of Baseline Noise Survey Weather Conditions**
h. **Appendix 6.8: Noise Monitoring Results**
i. **Appendix 6.9: Construction Noise and Vibration Mitigation Clauses**

6.1.3. A glossary of acoustic terminology used within this chapter is included in **Appendix 6.1: Glossary of Acoustical Terminology**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

6.1.4. A full description of Part B, along with the Scheme as a whole is set out in **Chapter 2: The Scheme**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). An assessment of combined effects of Part B is set out in **Chapter 15: Assessment of Combined Effects** of this ES and combined and cumulative effects of the Scheme are set out in **Chapter 16: Assessment of Cumulative Effects**, **Volume 4** of this ES (**Application Document Reference: TR010041/APP/6.4**).

6.1.5. **Section 4.3** of **Chapter 4: Environmental Assessment Methodology**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) identifies any differences in the assessment methodology employed for Part A: Morpeth to Felton (Part A) and Part B. Further to this, there are other differences between the chapters for Part A and Part B. All key differences include:

a. There are differences between Part A and Part B that relate to the scoping process, for example elements that are scoped in and out of the assessment. Refer to the **Scoping Report** (**Application Document Reference: TR010041/APP/6.10**) and **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.12**) for Part A, and the

**Scoping Report** (**Application Document Reference: TR010041/APP/6.11**) and **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.13**) for Part B.

b. Part A and Part B adopt different approaches to assessment of construction noise. The differences in assessment are a function of the different Study Areas and the differing number of receptors falling within each Study Area. The differences in assessment approach are not material to the outcome of the assessments. Refer to **Chapter 4: Environmental Assessment Methodology**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) for further details.

c. The construction and operational Study Areas for Part A and Part B are dependent on the geographic location of each part, therefore different baseline, construction and operational conditions are reported. Different sensitive receptors are present within each Study Area.

d. Slightly differing construction activities have been assessed for Part A and Part B. The construction activities, 'cycle path construction' and 'noise barrier construction' are included for Part A but not Part B. This is because neither a cycle path nor noise barrier are proposed for Part B.

## 6.2. COMPETENT EXPERT EVIDENCE

6.2.1. **Table 6-1** demonstrates that the professionals contributing to the production of this chapter have sufficient expertise to ensure the completeness and quality of this assessment.

**Table 6-1 - Relevant Experience**

| Name | Role | Qualifications and Professional Membership | Relevant Experience |
|---|---|---|---|
| Nicola Bolton | Author | - Post Graduate Diploma, Acoustics & Noise Control; 2003<br>- Bachelor Honours Degree, Environmental Management & Technology, University of Bradford; 2001<br>- Member of the Institute of Acoustics | Associate<br>Over 19 years' experience working on a wide range of projects involving monitoring, modelling, prediction and assessment of noise and vibration. Substantial experience of managing projects including input to a wide variety of impact assessments including:<br>- Flore-Weedon bypass WebTAG options appraisal (2010)<br>- M40 noise barrier feasibility study (2016 – 2018)<br>- Lincoln Southern Bypass outline Business case WebTAG assessment (2019) |

| Name | Role | Qualifications and Professional Membership | Relevant Experience |
|---|---|---|---|
| | | | - A630 Road Widening non-statutory environmental assessment and full Business case WebTAG assessment (2019) |
| Robin Brown | Reviewer | - Bachelor of Science Honours Degree, Audio Technology, University of Salford; 2004 | Associate<br>Over 15 years' experience in environmental noise and vibration assessments with a focus on road schemes for the last 7.<br>Lead acoustician on a variety of projects, including working on many impact assessments including:<br>- Lake Lothing Third Crossing TAG environmental and distributional appraisals (2020)<br>- A59 Diversion noise and vibration noise and vibration Environmental Statement (2018-2019)<br>- A9 Dualling Dalraddy to Slochd noise and vibration Environmental Statement (2017-2019)<br>- Great Yarmouth Third River Crossing noise and vibration Environmental Statement (2017-2018)<br>- Spalding Western Relief Road noise and vibration Environmental Statement (2017-2018)<br>- Shrewsbury North West Relief Road TAG environmental and distributional appraisals (2017-2018) |

## 6.3. LEGISLATIVE AND POLICY FRAMEWORK

6.3.1. This assessment has been undertaken in accordance with the following current legislation, along with national, regional and local plans and policies. Further details are provided in **Appendix 6.2: Legislation, Policy and Guidance**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

### LEGISLATION

6.3.2. A summary of international and national legislation relevant to the potential effects on noise and vibration is presented below:

#### International

**Environmental Noise Directive 2002/49/EC and Environmental Noise (England) Regulations 2006 (as amended) (Ref. 6.1)**

6.3.3. This Directive relates to the assessment and management of environmental noise, and it is commonly referred to as the Environmental Noise Directive (END). It promotes the implementation of a three-step process:

a. Undertake strategic noise mapping to determine exposure to environmental noise.
b. Ensure information on environmental noise is made available to the public.
c. Establish Action Plans based on the strategic noise mapping results, to reduce environmental noise where necessary, and to preserve environmental noise quality where it is good.

**Directive 2014/52/EU of the European Parliament, 2014 (Ref. 6.2)**

6.3.4. This Directive published on 16 April 2014, amends Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.

6.3.5. It was considered necessary to amend the 2011 Directive to strengthen the quality of the environmental impact assessment procedure, align that procedure with current best practice and other relevant legislation and policies developed by the European Union and Member States.

6.3.6. An ES prepared under this legislation should include, inter alia, a description of the likely significant effects of the project and the measures proposed to avoid, reduce or, if possible, offset any identified significant adverse effects on the environment.

#### National

**The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref. 6.3)**

6.3.7. EU Directive 2014/52/EU has been transposed into UK law through the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations).

### Environmental Noise (England) Regulations 2006 (Ref. 6.4)

6.3.8. EU Directive 2002/49/EC has been transposed into UK law as the Environmental Noise (England) Regulations 2006 (as amended). As part of this process, noise mapping has been undertaken and Noise Important Areas (NIAs) have been identified at locations where the 1% of the population that are affected by the highest noise levels are located, in order to identify the areas which, require potential action.

### Noise Insulation Regulations (NIR) 1975 (as amended) (Ref. 6.5)

6.3.9. Regulation 3 imposes a duty on highway authorities to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings, subject to meeting certain criteria given in the Regulation, for new roads or carriageways.

6.3.10. Regulation 4 provides highway authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings for an altered road. Regulation 5 provides highway authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings during construction works for a substantial period of time, but in respect of which building no duty under Regulation 3 or power under Regulation 4 has arisen.

6.3.11. With respect to residential properties affected by noise from new or altered highways, to qualify for such an offer, four criteria must all be fulfilled at 1 m in front of the most exposed door or window of an eligible room in the façade of a property.

### The Control of Pollution Act (CoPA) 1974 (Ref. 6.6)

6.3.12. The principal legislation covering demolition and construction noise is Part III of CoPA. Sections 60 and 61 of the CoPA give the Local Authority special powers for imposing control requirements on noise arising from construction and demolition works, regardless of whether a statutory nuisance has been caused or is likely to be caused.

### The Environmental Protection Act 1990 (EPA) (Ref. 6.7)

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

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

6.3.15. The provisions of the EPA have relevance to noise from construction activities including that generated by construction, vehicles, plant and machinery, but do not apply to noise generated by general road traffic.

## NATIONAL AND LOCAL POLICY

6.3.16. A summary of national and local policy relevant to the potential effects on noise and vibration, and compliance with relevant policy, is presented in **Table 6-2** and **Table 6-3** below.

**Table 6-2 – National Planning Policy Relevant to Noise and Vibration**

| National Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| National Policy Statement for National Networks (NPS NN), 2015 (**Ref. 6.8**) | "5.193 *Developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise."*<br>"5.194 *The project should demonstrate good design through optimisation of scheme layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The project should also consider the need for the mitigation of impacts elsewhere on the road networks that have been identified as arising from the development, according to Government policy.*<br>"5.195 *The Secretary of State should not grant development consent unless satisfied that the proposals will meet the following aims, within the context of Government policy on sustainable development:*<br>*Avoid significant adverse impacts on health and quality of life from noise as a result of the new development;*<br>*Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and*<br>*Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.*<br>"5.196 *In determining an application, the Secretary of State should consider whether requirements are needed which specify that the mitigation measures put forward by the applicant are put in place to ensure that the noise levels from the project do not exceed those described in the assessment or any other estimates on which the decision was based."* | As outlined below, in accordance with Paragraph 5.193 of the NPS NN, due regard has been given to the Noise Policy Statement for England (NPSE) (**Ref. 6.10**) and the National Planning Policy Framework (NPPF) (**Ref. 6.9**), as well as the associated guidance presented within Planning Practice Guidance: Noise (**Ref. 6.11**).<br>In accordance with Paragraph 5.194 and 5.195 of the NPS NN, Part B has been designed as far as reasonably possible to avoid giving rise to significant observed adverse effect levels (SOAEL) for noise and vibration. Where possible, the alignment has been designed to avoid passing sensitive receptors at a closer distance than the existing situation. The surface of the road for the entire Part B would be laid with Low Noise Surface (apart from bridge decks where Hot Rolled Asphalt would be laid). An **Outline Construction Environmental Management Plan (Outline CEMP)** (**Application Document Reference: TR010041/APP/7.3**) containing measures to control noise and vibration during construction has been produced to accompany this ES.<br>Consideration has been given to noise mitigation options where potential adverse impacts have been identified. Of these options, mitigation measures have been included where appropriate (refer to **Section 6.9**).<br>Enhancement measures in the form of acoustic screening have been considered along the length of Part B and are included where appropriate. |
| National Planning Policy Framework (NPPF), 2019 (**Ref. 6.9**) | "170…*e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of…noise pollution…*<br>"180. *Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*<br>*a) mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*<br>*b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"* | In compliance with Paragraph 170 of the NPPF, Part B has been designed to minimise the number of significant adverse noise and vibration impacts.<br>In compliance with Paragraph 180 of the NPPF, measures to minimise adverse noise and vibration effects at each receptor above the Lowest Observed Adverse Effect Level (LOAEL) have been investigated.<br>Consideration has been given to noise mitigation options where potential adverse impacts have been identified. Of these options, mitigation measures have been included where appropriate (refer to **Section 6.9**).<br>Enhancement measures in the form of acoustic screening have been considered along the length of Part B. |

| National Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| Noise Policy Statement for England (NPSE), 2010 (**Ref. 6.10**) | Paragraph 1.7 "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*<br>- *Avoid significant adverse impacts on health and quality of life;*<br>- *Mitigate and minimise adverse impacts on health and quality of life; and*<br>- *Where possible, contribute to the improvement of health and quality of life*"<br>To assist in the understanding of the terms 'significant adverse' and 'adverse', the NPSE (**Ref. 6.10**) describes the following concepts that are currently being applied to noise impacts (paragraph 2.20):<br>"*NOEL - No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to noise.*<br>*"LOAEL - Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected."*<br>*"SOAEL - Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur*."<br>Values for NOEL, LOAEL and SOAEL are not stated. It is advised that "*It is not possible to have a single objective noise based-measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times*." | In compliance with Paragraph 1.7 of the NPSE, Part B has been designed as far as reasonably possible to avoid giving rise to significant adverse noise and vibration effects.<br>Consideration has been given to noise mitigation options where potential adverse impacts have been identified. Of these options, mitigation measures have been included where appropriate (refer to **Section 6.9**).<br>Enhancement measures in the form of acoustic screening have been considered along the length of Part B. |

**Table 6-3 – Local Planning Policy Relevant to Noise and Vibration**

| Local Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| Northumberland Consolidated Planning Policy Framework. May 2019 (Version 27) (**Ref. 6.12**) | Details the planning policy documents that are currently used to determine and guide planning applications in Northumberland. There are no relevant planning policies contained in this document. | N/A |
| Northumberland Local Plan, Publication Draft Plan (Regulation 19), January 2019 (**Ref. 6.13**) and Schedule of Proposed Minor Modifications to the Publication Draft Plan (Regulation 19) (**Ref. 6.14**) | The Emerging Northumberland Local Plan – Publication Draft plan (Regulation 19) Consultation (January 1019) is intended to replace all current District and County Council Local Plans and Core Strategy documents into a single document. Neighbourhood Plans will not be replaced and will remain of relevance when determining planning applications.<br>The document has a number of policies which seek to alleviate the potential for noise or vibration effects.<br>The Schedule of Proposed Minor Modifications to the Publication Draft Plan (Regulation 19) (May 2019) proposes minor modifications to the Publication Draft Plan which do not materially affect the substance of the plan or its overall soundness | Part B has been designed as far as reasonably possible to minimise the noise and vibration impacts on potentially affected sensitive receptors. |

| Local Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| | but provides points of clarification, factual updates and modifications to typographical or grammatical errors. | |
| Castle Morpeth District Local Pan 1991-2006. Adopted February 27th, 2003. Published July 2003[1] (**Ref. 6.15**) (Part of the Northumberland Consolidated Planning Policy Framework) | The Castle Morpeth District Local Plan have aims and objectives relating to reducing environmental impacts from roads and transport. | Part B has been designed as far as reasonably possible to avoid giving rise to SOAEL for noise and vibration. Where possible, the alignment has been designed to avoid passing sensitive receptors at a closer distance than the existing situation. The surface of the road for the entire Part B would be laid with Low Noise Surface (apart from bridge decks where Hot Rolled Asphalt would be laid). An **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) containing measures to control noise and vibration during construction has been produced to accompany the Development Consent Order (DCO) application. The Outline CEMP would be developed into a CEMP by the main contractor.<br>Consideration has been given to noise mitigation options where potential adverse impacts have been identified. Of these options, mitigation measures have been included where appropriate (refer to **Section 6.9)**.<br>Enhancement measures in the form of acoustic screening have been considered along the length of Part B. |
| Alnwick District Local Development Framework. Core Strategy Development Plan Document. Adopted October 2007 (**Ref. 6.16**) (Part of the Northumberland Consolidated Planning Policy Framework) | Policy S3 sets out sustainability criteria which the council would need to be satisfied are met before granting planning permission for new development. The fifth criterion (out of six) states that "*there would be no significant adverse effects on the natural resources, environment, biodiversity, cultural, historic and community assets of the district.*"<br>Policy S16 sets out the strategic principles of good design which should be applied to all developments "*Proposals should take full account of the need to protect and enhance local environment having regard to their layout, scale, appearance, access and landscaping…*"<br>Chapter 7; Objective 6: "*assist in the delivery of a sustainable integrated transport system and enhance accessibility for all.*" | Part B has been designed as far as reasonably possible to avoid giving rise to SOAEL for noise and vibration. Where possible, the alignment has been designed to avoid passing sensitive receptors at a closer distance than the existing situation. The surface of the road for the entire Part B would be laid with Low Noise Surface (apart from bridge decks where Hot Rolled Asphalt would be laid). An **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) containing measures to control noise and vibration during construction has been produced to accompany the DCO Application. The **Outline CEMP** would be developed into a CEMP by the main contractor.<br>The assessment has considered all residential properties within the Study Area, as well as other noise sensitive receptors.<br>Part B has been designed such that no receptors are predicted to be subject to significant adverse effects once operational.<br>Consideration has been given to noise mitigation options where potential adverse impacts have been identified. Of these options, mitigation measures have been included where appropriate (refer to **Section 6.9)**.<br>Enhancement measures in the form of acoustic screening have been considered along the length of Part B. |

| Local Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| Alnwick District Wide Local Plan. Adopted April 1997 (**Ref. 6.17**) | Aim TT1: "*improve the accessibility of the residents and businesses of the District to the national transportation systems*."<br>Aim TT3: "*ameliorate the impact of the motor vehicle on the rural and built environment.*"<br>Aim TT6: "*encourage the Highways Agency [now known as Highways England] to upgrade the A1 Truck Road to dual carriageway standard through the District at the earliest opportunity*."<br>In the Community Development Chapter, Policy CD32 reinforces the requirement for development not to result in unacceptable environmental impacts or to cause harm to residential amenity: "*planning permission will not be granted for development which would cause demonstrable harm to the amenity of residential areas or to the environment generally as a result of releases to water, land or air, or of noise, dust, vibration, light or heat.*" | Part B has been designed to minimise the number of significant adverse noise and vibration effects including due regard to enhancement measures.<br>The assessment has considered all residential properties within the Study Area, as well as other noise sensitive receptors.<br>Part B has been designed such that no receptors are predicted to be subject to significant adverse effects once operational.<br>The appraisal of mitigation and enhancement has included consideration to both treatment at source (low noise road surface) and intermediate measures (acoustic screening).<br>Construction stage mitigation would be secured through a CEMP. An **Outline CEMP** (**Application Document Reference TR010041/APP/7.3**) has been produced as part of the DCO application which would be developed into a CEMP by the main contractor. |

### HIGHWAYS ENGLAND POLICY

6.3.17. A summary of Highways England policy relevant to the potential effects on noise and vibration is presented in **Table 6-4**.

**Table 6-4 – Highways England Policy**

| Highways England Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| Highways England Licence. Highways England, 2015 (**Ref. 6.18**) | Minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment and ensure this is considered at all levels of operations. In exercising its functions, the licence holder must have due regard to relevant principles and guidance on good design, to ensure that the development of the network takes account of geographical, environmental and socio-economic context. | Part B has been designed as far as reasonably possible to avoid giving rise to significant adverse noise and vibration impacts.<br>As detailed in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), low noise road surface is a committed design measure for the majority of Part B and therefore has been accounted for within the assessment. |
| Road Investment Strategy (RIS) for the 2015/16 – 2019/20 Road Period. Highways England, 2015 (**Ref. 6.19**) | Highways England aspire to be a better neighbour to communities, such that by 2040 over 90% fewer people will be impacted by noise from the strategic road network. The RIS (**Ref. 6.19**) identifies a capacity to improve noise levels through the management and redevelopment of Highways England assets, via low noise road surfacing, noise barriers etc. and commits to investigating and mitigating at least 1,150 NIAs by the end of Road Period 1 (RP1), to help improve the quality of life of around 250,000 people living and working near the network.<br>All new and improved road schemes will, therefore, be expected to utilise low noise road | Part B has been designed as far as reasonably possible to avoid giving rise to significant adverse noise and vibration impacts.<br>As detailed in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), low noise road surface is a committed design measure for the majority of Part B and, therefore, has been accounted for within the assessment. |

| Highways England Policy | Relevant Policy Objectives | Significance of Part B on Policy Objective |
|---|---|---|
| | surfaces as a default and investigate noise attenuating barriers and other potential mitigation options, where practicable. | |

6.3.18. Each of the policy documents identified is described in further detail in **Appendix 6.2: Legislation, Policy and Guidance**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**), however, a limited summary of key aspects of national policy is included below.

6.3.19. The NPS NN (**Ref. 6.8**) states that development consent should not be granted unless the proposals meet the following aims, which are also replicated in the NPSE (**Ref. 9.10**) and reflect the aims of the NPPF (**Ref. 6.9**).

a. Avoid significant adverse impacts on health and quality of life.
b. Mitigate and minimise other adverse impacts on health and quality of life.
c. Contribute to improvements to health and quality of life, where possible.

6.3.20. The Explanatory Note to the NPSE (**Ref. 6.10**) assists in the definition of significant adverse and adverse by describing the following concepts:

a. NOEL – no observed effect level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
b. LOAEL – lowest observed adverse effect level. This is the level above which adverse effects on health and quality of life can be detected.
c. SOAEL – significant observed adverse effect level. This is the level above which significant adverse effects on health and quality of life occur.

6.3.21. Government policy and guidance does not state values for the NOEL, LOAEL and SOAEL, advising that they are different for different noise sources, for different receptors and at different times, and should be defined on a strategic or project basis accounting for the specific features of that area, source or project. The derived values for the effect levels that have been adopted for the assessment of Part B are set out in **Section 6.4**.

6.3.22. A key objective of this assessment is not only to determine whether Part B delivers the objectives stated within the Applicant's Licence and the RIS, but also whether it complies with national noise policy.

# 6.4. ASSESSMENT METHODOLOGY

## SCOPE OF ASSESSMENT

6.4.1. As presented within the **Scoping Report** (**Application Document Reference TR010041/APP/6.11**), the **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.13**) and **Scoping Opinion Response Tracker** (**Appendix 4.1**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)), the following topics have been assessed in this chapter:

a. Temporary (i.e. construction noise and vibration) effects.
b. Permanent traffic noise effects (including night time noise effects).
c. Permanent traffic nuisance effects.
d. Permanent traffic induced vibration effects.
e. Cumulative effects (refer to **Chapter 15: Assessment of Combined Effects** of this ES and **Chapter 16: Assessment of Cumulative Effects**, **Volume 4** of this ES (**Application Document Reference: TR010041/APP/6.4**)).

## CONSULTATION

6.4.2. Northumberland County Council (NCC) was consulted prior to the undertaking of the environmental noise survey, with discussions surrounding proposed measurement locations and the proposed methodology for the noise and vibration assessment. A summary of this consultation is included within **Table 6-5** and relevant consultation correspondence provided in **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

**Table 6-5 – Summary of Consultation**

| Consultee | Type of Consultation and Date | Summary of Consultation | Action |
|---|---|---|---|
| NCC - Environmental Protection Officer | 07 June 2018<br><br>(Email) | Introducing Part B, proposed assessment methodology (including approach to defining operational Study Area), proposing baseline noise measurement locations and requesting information of specific planning policies, known local sensitive receptors (other than dwellings) and sources of known noise or vibration complaint.<br><br>It was proposed to undertake detailed level assessment in line with the Design Manual for Roads | N/A |

| Consultee | Type of Consultation and Date | Summary of Consultation | Action |
|---|---|---|---|
| | | and Bridges (DMRB) HD 213/11 (**Ref. 6.20**). The methodology to derive the Study Area for Part B in accordance with DMRB HD 213/11 was also proposed. | |
| NCC (EPO) | 13 July 2018<br><br>(Email) | Response from NCC EPO suggesting slight changes to proposed measurement locations. Confirmed that there are no known sources of noise and vibration complaint and stating that there are no known particularly sensitive receptors other than dwellings within the vicinity of Part B.<br><br>No issues were raised regarding the proposed assessment methodologies. | Measurement locations were updated to reflect consultation response. |
| NCC (EPO) | 24 August 2018<br><br>(Phone call and email) | Alternative noise measurement locations suggested by the Applicant due to previous consultation feedback and proposed additional construction compound. | N/A |
| NCC (EPO) | 17 October 2018<br><br>(Email) | NCC stated that the proposed changes / additions to the noise measurement locations were acceptable. | Updated noise measurement locations were implemented. |

### METHODS OF BASELINE DATA COLLECTION

6.4.3. Baseline data for this assessment has been obtained through the following methods / sources:

a. Desk top review of online mapping and street scene photography.
b. Baseline noise survey.

c. Review of AddressBase Plus data[1].
d. Review of GIS databases to identify presence of designated sites.
e. Review of Public Rights of Way.

**METHODOLOGY**

**Technical Guidance**

6.4.4. The following technical guidance documents (**Table 6-6)** have been used during the preparation of this chapter. A summary of each document is presented in **Appendix 6.2: Legislation, Policy and Guidance**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

**Table 6-6 – Technical Guidance**

| Document |
|---|
| DMRB Volume 11, Section 3, Part 7, HD 213/11 Noise and Vibration. Highways Agency, Transport Scotland, Welsh Government, The Department for Regional Development Northern Ireland. November 2011 (DMRB HD 213/11) (**Ref. 6.20**) |
| Calculation of Road Traffic Noise (CRTN). Department of Transport and Welsh Office. 1988 (**Ref. 6.21**) |
| Interim Advice Note (IAN) 185/15. Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB, Volume 11, Section 3, Part 1 Air Quality and Volume 11, Section 3, Part 7 Noise. Highways England. 2015 (**Ref. 6.22**) |
| Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping. P G Abbott and P M Nelson (TRL Limited). Project Report PR/SE/451/02. 2002 (**Ref. 6.23**) |
| Guidelines for Community Noise. World Health Organisation. 1999 (**Ref. 6.24**) |
| Night Noise Guidelines for Europe. World Health Organisation. 2009 (**Ref. 6.25**) |
| World Health Organisation Environmental Noise Guidelines for the European Region. 2018 (**Ref. 6.26**) |
| British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise and Part 2: Vibration. BS 5228:2009+A1:2014. 2014 (**Ref. 6.27** and **Ref. 6.28**) |
| Planning Practice Guidance Noise (PPG), July 2019 (**Ref. 6.29**) |

6.4.5. The principal guidance document for the assessment of both temporary construction and permanent operational impacts as a result of Part B is the relevant section of the DMRB, Volume 11, Section 3. Part 7 HD 213/11 revision 1 (November 2011) (**Ref. 6.20**). The

[1] AddressBase Plus is a vector address dataset containing current properties using addresses sourced from Local Authorities, Ordnance Survey and Royal Mail. The data includes Unique Property Reference Numbers (UPRN) and contains local authority current addresses, classifications, and the OS MasterMap TOID (Topographic Identifier).

assessment of temporary construction stage impacts is supplemented by guidance contained in BS 5228 (**Ref. 6.27** and **Ref. 6.28**).

6.4.6. However, the emergence of other guidance since the DMRB was published in 2011, based around the effects of noise on health and wellbeing, has necessitated an evolution in the approach to the assessment of road traffic noise, particularly with respect to the assessment of likely significant effects.

6.4.7. As detailed within **Table 6-2,** the aims of the NPSE (**Ref. 6.10**) are to avoid significant adverse noise effects. A noise level above the SOAEL would be noticeable and disruptive and/or can cause adverse health effects. A noise level above the LOAEL but below the SOAEL, depending on other factors (e.g. habituation, design of dwellings etc) would increasingly cause behavioural changes as a result of the noise level experienced.

6.4.8. The term significant environmental effect is also used within the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) (**Ref. 6.3**) to describe an environmental effect caused by a scheme that is of sufficient magnitude that it should be considered by the decision makers. Further information regarding significance is presented from **paragraph 6.4.79** onwards.

6.4.9. Consequently, this assessment, which encompasses both the temporary construction stage and the permanent operational stage impacts of Part B, makes a clear distinction as to whether Part B:

a. Complies with the NPSE (**Ref. 6.10**), NPPF (**Ref. 6.9**) and NPS NN (**Ref. 6.8**).
b. Gives rise to significant environmental effects under the EIA Regulations (**Ref. 6.3**).

6.4.10. Notwithstanding the above, DMRB (**Ref. 6.20**) is still the principal guidance document for the assessment of road schemes, and, therefore, it is appropriate that the requirements contained within this document are described first.

6.4.11. In accordance with DMRB HD 213/11 (**Ref. 6.20**), the operational road traffic noise assessment for Part B has been based on calculated noise levels using the methodology detailed in CRTN (**Ref. 6.21**) and Annex 4 of the DMRB HD 213/11 (**Ref. 6.20**). It is also appropriate to establish the baseline noise conditions by measurement and to this end noise measurements have been made at a sample of locations in the vicinity of Part B as agreed with the Environmental Protection Officer at NCC. The locations were chosen such that representative measurements were undertaken along the route of the A1 applicable to Part B and at distances from the road representative of noise sensitive receptors. **Figure 6.2: Baseline Noise Measurement Locations**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) shows the measurement locations. Details of the baseline noise survey are presented within **paragraphs 6.7.9** to **6.7.23**.

### Updated DMRB Guidance

6.4.12. Since the assessments reported in this ES were completed, a number of DMRB guidance documents have been superseded and updated with revised guidance. The DMRB HD 213/11(**Ref. 6.20**) guidance was current at the commencement of the assessment and throughout all the work to determine the noise and vibration effects of Part B. The consultation process described above, also refers to HD 213/11.

6.4.13. However, updated guidance in the form of DMRB LA 111 Noise and Vibration Revision 0 (LA 111) was released in November 2019 and subsequently superseded by Revision 1 in February 2020 and Revision 2 in May 2020 (**Ref. 6.29**). This new guidance supersedes DMRB HD 213/11 (**Ref. 6.20**) and Interim Advice Note 185/15 (IAN 185/15) (**Ref. 6.22**).

6.4.14. To determine the implications of the updated guidance to the conclusions of the ES, a sensitivity test has been undertaken to identify key changes in the assessment methodology and determine whether there would be changes to the significant effects reported in this ES if the updated guidance had been used for the assessment.

6.4.15. The findings of the sensitivity test are detailed in **Appendix 6.10: Noise and Vibration DMRB Sensitivity Test**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) and summarised in **Section 6.10** of this chapter and in **Appendix 4.5: DMRB Sensitivity Test**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

**SENSITIVITY OF RECEPTORS**

6.4.16. In accordance with the DMRB HD 213/11 (**Ref. 6.20**), examples of sensitive receptors include dwellings, hospitals, places of worship (including burial grounds), schools, community facilities and designated areas. The DMRB HD 213/11 (**Ref. 6.20**) also requires consideration of outdoor noise sensitive areas such as designated areas and Public Rights of Way (PRoW).

6.4.17. Existing sensitive receptors within the Study Area[2] have been identified using AddressBase Plus data, with receptors being allocated into one of the following categories (in accordance with the DMRB HD 213/11 (**Ref. 6.20**)):

a. Residential
b. Other noise-sensitive (including health, educational, religious and community uses)

6.4.18. All other receptors were categorised as ‘not noise sensitive’ as the level or change in noise is unlikely to affect the behaviour of the people using these buildings or areas and have therefore not been included within the assessment.

6.4.19. Noise sensitive developments that are known to have been granted planning permission since the last update of the AddressBase dataset are addressed in **Chapter 16: Assessment of Cumulative Effects**, **Volume 4** of this ES (**Application Document Reference: TR010041/APP/6.4**).

6.4.20. Further consideration of human health impacts is provided in **Chapter 12: Population and Human Health** of this ES.

[2] Further explanation of the Study Area is provided in **Section 6.6**.

6.4.21. Ecological receptors have not been considered within this chapter but are considered within **Chapter 9: Biodiversity** of this ES.

**ASSESSMENT OF CONSTRUCTION NOISE AND VIBRATION**

**Construction Noise**

6.4.22. **Chapter 2: The Scheme**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) provides detailed information regarding the proposed construction programme including working hours and the potential for night time, weekend and bank and public holiday working.

6.4.23. At this stage, full details of construction activities, methods and timescales have not been finalised for Part B. The assessment of potential impacts therefore relies on outline construction information available at this stage. To adequately assess the potential impacts and associated mitigation measures, it is appropriate to undertake a quantitative assessment based on a number of reasonable worst-case assumptions. A set of informed assumptions of expected construction stages and associated operations and plant to be employed have been generated. Consideration has been given to the programme of activities, and professional experience gained from other similar large infrastructure projects has been used to further inform the assessment. It is therefore considered that the adopted assessment approach is proportionate to the current stage of Part B.

6.4.24. The following activities, encompassing all anticipated key noise generative construction activities, have been considered in the construction stage assessment:

a. Site Clearance
b. Earthworks (including topsoil strip)
c. Road Construction
d. Bridge Construction (including piling)
e. Compound Operation of the Charlton Mires, Lionheart Enterprise Park and Main Compound.

6.4.25. In addition, the demolition of existing buildings has been considered. However, the closest sensitive receptors are located at considerable distance (greater than 350 m) from demolition works, such that impacts are not expected. No further consideration has been given to noise from demolition of existing buildings. Similarly, noise from demolition of existing culverts has been considered, however, given that culverts are located close to Part B alignment, associated noise levels would be comparable to and of lesser duration than those generated by other construction activities undertaken at similar locations, such as site clearance, earthworks and road construction. It is therefore considered that predicted impacts and associated mitigation applicable to the worst-case operations listed above sufficiently address potential construction stage noise impacts including those associated with works to existing culverts.

6.4.26. The assessment of predicted construction noise impacts for the above activities has been undertaken, taking into account the guidance set out in the NPSE (**Ref. 6.10**).

6.4.27. Calculation methodologies within Part 1 of BS 5228 have been used to predict noise levels from the above construction activities as well as the propagation of noise over distance. The purpose of this assessment is to determine where noise levels would exceed the relevant SOAELs. Where noise levels are above the SOAEL, there is the potential for significant effects and mitigation measures have been considered. **Table 6-8** present SOAELs used for this assessment. **Paragraphs 6.4.79** to **6.4.81** discuss in greater detail the approach to determining construction noise and vibration significant effects.

**Diverted Traffic Noise During Construction**

6.4.28. A qualitative assessment of potential noise impacts arising from changes in road traffic noise levels during possible traffic diversions has also been carried out. Effect levels have been determined qualitatively, with consideration given to the regularity of anticipated diversions, their duration and the proposed diversion routes that would be adopted.

**Construction Traffic Noise**

6.4.29. A quantitative assessment of noise from construction traffic has been undertaken. This has considered anticipated noise level changes along routes expected to be used by construction traffic. Level changes of less than 1 dB correspond to the NOEL. For predicted changes of greater than 1 dB, determination of final significance would consider the number and timing of construction vehicle movements, their duration and the overall magnitude of the change.

**Construction Vibration**

6.4.30. The assessment of construction related vibration associated with working areas involved the:

a. Identification of areas where piling may be required
b. Identification of areas where other worst-case activities (vibratory rollers) may be required
c. Calculation of possible ground-borne vibration levels associated with piling activities and use of vibratory rollers
d. Determination of a distance buffer within which significant adverse effects are predicted
e. Identification of vibration-sensitive receptors within the identified distance buffer
f. Identification of mitigation as appropriate

6.4.31. The calculation and assessment of potential construction vibration effects has been undertaken following the guidance presented within BS 5228-2 and other guidance documents referenced therein.

**ASSESSMENT OF OPERATIONAL ROAD TRAFFIC NOISE AND VIBRATION**

**DMRB HD 213/11**

6.4.32. All road traffic noise predictions have been completed in accordance with the calculation methodology presented in CRTN (**Ref. 6.21**) and Annex 4 of DMRB HD 213/11 (**Ref. 6.20**). The guidance contained within IAN 185/15 (**Ref. 22**) published by Highways England (formerly the Highways Agency) has also been applied to the traffic data used in this assessment.

6.4.33. CRTN (**Ref. 6.21**) presents a methodology for the calculation of road traffic noise based on road related factors (such as gradient and surface type) and traffic related factors (such as flow, speed and the proportion of heavy duty vehicles). The propagation of noise is also covered in CRTN and can influence the noise levels at receptor locations.

6.4.34. The DMRB HD 213/11 (**Ref. 6.20**) is a comprehensive manual which provides guidance on the assessment of road traffic noise and vibration from new road projects.

### Night time Noise Assessment

6.4.35. The DMRB HD 213/11 (**Ref. 6.20**) requires that the assessment considers not just the daytime period in terms of $L_{A10,18h}$, but also the night time period in terms of $L_{night,outside}$. The evaluation of $L_{night,outside}$ only applies to long-term changes and where the road traffic noise level is predicted to exceed 55 dB $L_{night,outside}$.

6.4.36. The $L_{night,outside}$ has been determined using method 3 identified in TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (**Ref. 6.23**). The TRL report presents methods for converting the $L_{A10,18h}$ noise index to $L_{day}$, $L_{evening}$ and $L_{night}$ indices. The TRL report presents equations for three potential methods of conversion, depending on the traffic data available (further details are provided in **Appendix 6.2**: **Legislation, Policy and Guidance**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)).

6.4.37. Taking the methodology presented within the TRL report (refer to **Appendix 6.2**: **Legislation, Policy and Guidance**, **Volume 8** of this ES), and given that detailed hourly traffic data is not available, method 3 has been adopted as being the most appropriate for adoption within noise level calculations. The TRL report identifies conversion equations for two different road types: motorway and non-motorway. In this case, as none of the roads in the Study Area (including Part B) are motorways, all calculations to determine the $L_{night,outside}$ have utilised the non-motorway correction.

### Level of Assessment

6.4.38. DMRB HD 213/11 (**Ref. 6.20**) states (in paragraph 3.5) that the determination of the appropriate level of assessment for operational road traffic noise effects should be undertaken with reference to the following thresholds:

a. A permanent change in daytime road traffic noise of ±1 dB $L_{A10,18h}$ in the short-term (i.e. on opening).
b. A permanent change in daytime road traffic noise of ±3 dB $L_{A10,18h}$ in the long-term (typically 15 years after project opening).
c. A permanent change in night time road traffic noise of ±3 dB $L_{night,outside}$ in the long-term, where the predicted level also exceeds 55 dB $L_{night,outside}$.

6.4.39. For this assessment, a 'Detailed' assessment has been undertaken in line with DMRB HD 213/11 (**Ref. 6.20**) requirements.

### Representative Noise Levels at Buildings

6.4.40. The noise levels calculated are façade levels for buildings during the 18-hour period 06:00 to midnight (1 m from the external façade) and free-field levels incident on the façade of buildings during the 8-hour night time period 23:00 to 07:00. All levels are calculated at a default height of 4.0 m relative to the surrounding ground level. A height of 4 m has been selected regardless of the number of floors applicable at each property. Based on a review of the area, it is evident that the majority of properties have two floors or less, as such, a height of 4 m is expected to represent a worst-case in most situations. Open spaces are assessed in terms of free-field noise levels at 1.5 m above the ground.

6.4.41. Where a building is predicted to experience different changes in noise level on different façades, the least beneficial change in noise has been reported. Hence:

a. When all façades show a decrease in noise level, the smallest decrease has been reported.
b. When all façades show an increase in noise level, the largest increase has been reported.
c. Should the same least beneficial change in noise level arise on two or more façades, then the change on the façade with the highest level in the opening year (2023) Do-Minimum[3] (without Part B) scenario has been reported.

6.4.42. DMRB HD 213/11 (**Ref. 6.20**) acknowledges that the results produced by this assessment would usually present a worst-case and highlight the adverse impacts of Part B. Furthermore, it is also possible that the assessment may potentially mask beneficial effects of Part B.

6.4.43. For assessment of Part B in line with national noise policy, the highest noise level predicted on any façade of a building has been reported for the Do-Something scenarios.

### Existing Noise Barriers and Bunds

6.4.44. No existing noise barriers or bunds were identified along the existing A1 and, as such, no existing noise mitigation was modelled in the Do-Minimum opening or design year assessments.

### Other Developments Represented in Traffic Data

6.4.45. The following other developments were represented in all the traffic data scenarios ((Do-Minimum (without Part B) and Do-Something (with Part B)) used in the noise assessment (further details are provided in **Chapter 4** of the **Case for the Scheme** (**Application Document Reference: TR010041/APP/7.1**)):

a. A1 Coal House to Metro Centre

[3] The Do-minimum traffic scenarios are the opening and future year traffic data sets without Part B.

b. A1 Scotswood to North Brunton
c. A1 Birtley to Coal House
d. A19/A1058 Coast Road
e. A19 / A184 Testo's and Downhill Lane
f. A19 Norton to Wynyard
g. Morpeth Northern Bypass
h. Reopening of B6342 bridge over River Coquet in Rothbury
i. Blyth Relief Road
j. Junction 12 A1 North Brunton roundabout improvements, extra lanes and Rotary Way widening

### Traffic Vibration

6.4.46. Traffic vibration is a low frequency disturbance producing physical movement in buildings and their occupants. Vibration can be transmitted through the air or through the ground. Airborne vibration from traffic can be produced by the engines or exhausts of road vehicles and these are dominant in the audible frequency range of 50-100 Hz. Ground-borne vibration is often in the 8-20 Hz range and is produced by the interaction between rolling wheels and the road surface.

6.4.47. Ground-borne vibration can be measured in terms of Peak Particle Velocity (PPV). For vibration from traffic, a PPV of 0.3 $mms^{-1}$ measured on a floor in the vertical direction is considered likely to be perceptible and structural damage to buildings can occur when levels are above 10 $mms^{-1}$. The level of annoyance caused would also depend on building type and usage.

6.4.48. DMRB HD 213/11 (**Ref. 6.20**) adopts 0.3 $mms^{-1}$ as the threshold criterion for traffic induced vibration, either where the PPV is predicted to rise above this level or where existing vibration above this level is predicted to increase.

6.4.49. DMRB HD 213/11 notes (in paragraph 3.32) that PPVs in the structure of buildings close to heavily trafficked roads rarely exceed 2 $mms^{-1}$ and typically are below 1 $mms^{-1}$. Normal use of a building such as closing doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to those from road traffic.

### Noise and Airborne Vibration Nuisance Assessment

6.4.50. The methodology and results for the noise and airborne vibration nuisance assessment are presented in **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). A summary of the two assessment methodologies is presented below within **paragraphs 6.4.51** to **6.4.55**.

### Traffic Noise Nuisance Assessment

6.4.51. The DMRB HD 213/11 (**Ref. 6.20**) notes that the nuisance caused by road traffic noise mainly affects people in their homes. Nuisance, as defined in DMRB HD 213/11 (**Ref. 6.20**) is measured in terms of the percentage of the population as a whole that is bothered "very much" or "quite a lot" by virtue of a specific traffic related noise level. The correlation between specific levels and the percentage of the population bothered for the purposes of the assessment has been developed from studies that focused on reported nuisance where traffic related noise has changed over a relatively long period of time.

6.4.52. In line with the DMRB HD 213/11, the noise nuisance assessment considers:

a. The degree of bother based on a 'steady state' or 'before noise change' level (DMRB HD 213/11 Figure A6.1).
b. The abrupt change in bother that arises from a change in noise level (DMRB HD 213/11 Figure A6.2).

6.4.53. The noise nuisance assessment considers both the Do-Minimum and Part B Do-Something long-term comparisons, with the noise nuisance level changes being directly calculated from the predicted noise level changes.

### Traffic Airborne Vibration Nuisance Assessment

6.4.54. As required by DMRB HD 213/11 (**Ref. 6.20**), the predicted residential receptor noise levels have also been used as the basis for an appraisal of the change in airborne vibration nuisance that would arise as a result of Part B. This assessment has been undertaken for all residential receptors within 40 m of the roads within the Part B Calculation Area (described below in **Section 6.6**).

6.4.55. The assessment has been undertaken applying the DMRB HD 213/11 (**Ref. 6.20**) guidance which states that the percentage of people bothered by airborne vibration is 10% lower than for noise, with, on average, traffic induced vibration nuisance tending to zero at a noise level of 58 dB $L_{A10,18h}$. Nuisance levels used within this assessment are directly calculated from the predicted noise levels.

### Human Health

6.4.56. Consideration of human health impacts is set out in **Chapter 12: Population and Human Health** of this ES.

### Significance of Effects

### Magnitude of Noise Change

6.4.57. For the assessment of operational road traffic noise and airborne vibration impacts, DMRB HD 213/11 (**Ref. 6.20**) considers the noise level changes that would arise both in the short-term and the long-term.

6.4.58. The short-term scheme impacts are derived by comparing the 'Do-Minimum' scenario (without a scheme) in the 'opening year' (DM2023), with the 'Do-Something' scenario (with a scheme) in the same year (DS2023).

6.4.59. The long-term impacts of Part B are derived by comparing the 'Do-Minimum' scenario in the 'opening year' (DM2023) with the 'Do-Something' scenario in the future 'design year' (DS2038). The 'design year' is typically taken as the $15^{th}$ year after opening.

6.4.60. DMRB HD 213/11 also requires a third comparison, the ‘Do-Minimum’ scenario in the ‘opening year’ (DM2023) with the ‘Do-Minimum’ scenario in the ‘design year’ (DM2038), this comparison is used to determine long-term impact without Part B.

6.4.61. **Table 6-7** below summarises the classification of magnitude of noise impacts associated with short- and long-term changes in noise levels, as set out in DMRB HD 213/11 (Tables 3.1 and 3.2 of DMRB HD 213/11 combined). Both adverse and beneficial changes are considered in the assessment.

**Table 6-7 – Classification of Magnitude of Noise Impacts (DMRB HD 213/11)**

| Magnitude of Impact | Noise Change, dB ($L_{A10,18h}$) | |
|---|---|---|
| | Short-term | Long-term |
| No change | 0 | 0 |
| Negligible | 0.1 – 0.9 | 0.1 – 2.9 |
| Minor | 1.0 – 2.9 | 3.0 – 4.9 |
| Moderate | 3.0 – 4.9 | 5.0 – 9.9 |
| Major | >5.0 | >10.0 |

6.4.62. DMRB HD 213/11 notes (in paragraph 3.36) that a methodology has not yet been developed to assign significance according to both the value of a resource and the magnitude of impact. Instead, the DMRB concentrates on the magnitude of traffic noise impact, as described above.

6.4.63. For the assessment of significance, direction is drawn from other guidance and policy documents, starting with the NPSE (**Ref. 6.10**), which describes the concepts of SOAEL and LOAEL.

**Compliance with National Policy**

**Defining SOAELs and LOAELs**

6.4.64. Key to the consideration of compliance with the NPSE (**Ref. 6.10**) is defining the SOAELs and LOAELs for construction noise and vibration and operational road traffic noise and airborne vibration.

6.4.65. LOAELs and SOAELs should be set for all receptors[4]. However, for many, relevant acoustic criteria are broadly similar to those criteria relating to residential uses. Therefore, the LOAELs and SOAELs identified in **Table 6-9**, **Table 6-10** and **Table 6-11** which relate primarily to residential receptors, have been applied to all noise and vibration sensitive receptors.

[4] DMRB HD 213/11 provides (in paragraph A1.13) examples of sensitive receptors, which include dwellings, hospitals, schools, community facilities, designated areas and public rights of way.

6.4.66. LOAELs and SOAELs have only been considered for the period when the receptor is sensitive. So, for example, schools are not sensitive at night when they are closed, so the night time LOAEL and SOAEL would not be applicable for this type of receptor.

6.4.67. **Table 6-8** (adapted from Table E.1 in Annex E of BS 5228:2009+A1:2014 - Part 1 Noise (**Ref. 6.27**)), presents the adopted approach to defining LOAEL and SOAEL for the on-site construction noise assessment. As discussed during consultation, the assessment has drawn upon appropriate guidance presented within BS5228-1. This approach applies professional judgement and draws upon the guidance presented within Table E.1 in Annex E of BS 5228-1 (refer to Appendix B Table B5). In adopting this approach, consideration is also given to baseline noise levels applicable at representative noise sensitive receptors.

**Table 6-8 – SOAEL Thresholds for Construction Noise at Receptors**

| Period | Time (hh:mm) | LOAEL | SOAEL |
|---|---|---|---|
| Daytime weekday<br>Saturday mornings | 07:00 – 19:00<br>07:00 – 12:00 | Construction noise level < existing ambient noise level (refer to **Table 6-26**) | Exceeds relevant ABC threshold category defined in accordance with BS5228: 2009 + A1:2014 Section E3.2 (refer to **Table 6-26**) |
| Night time | 23:00 – 07:00 | | |
| Evenings<br>Weekend periods not covered above | 19:00 – 23:00<br>N/A | | |

Notes:

If the ambient noise level exceeds the SOAEL, then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

The SOAELs are set based on the ABC method as detailed within Section E3.2 (ABC assessment method) of BS 5228-1. The ABC method involves an assessment category of A, B or C being applied according to the prevailing noise level for the period of assessment.

The LOAELs are set at the existing ambient noise level during the relevant period, as construction noise levels below the existing level are unlikely to cause adverse effects on health or quality of life.

6.4.68. A qualitative assessment of potential noise impacts arising from changes in road traffic noise levels during possible traffic diversions has also been carried out applying professional judgement. Effect levels have been determined qualitatively, with consideration given to the regularity of anticipated diversions, their duration and the proposed diversion routes that would be adopted.

6.4.69. A quantitative assessment of noise from construction traffic has been undertaken using available construction traffic movement data. This has included calculation of anticipated noise level changes along routes anticipated to be worst affected by construction traffic. Level changes of less than 1 dB are considered to be insignificant.

6.4.70. **Table 6-10** (adapted from Table B.1 in Annex B of BS 5228:2009+A1:2014- Part 2 Vibration (**Ref. 6.28**)), presents the PPV vibration level thresholds adopted for LOAEL and SOAEL for the construction vibration assessment.

**Table 6-9 – LOAEL and SOAEL Thresholds for Construction Vibration at Receptors**

| Period | Time (hh:mm) | LOAEL | SOAEL |
|---|---|---|---|
| All periods | N/A | 0.3 $mms^{-1}$ PPV | 1.0 $mms^{-1}$ PPV |

Notes:

The SOAEL and LOAEL are set in accordance with guidance within BS 5228-2 (**Ref. 6.28**) which includes guidance on effects of vibration levels.

The effect of a vibration level of 0.3 PPV $mms^{-1}$ is stated as: “Vibration might just be perceptible in residential environments”.

The effect of a vibration level of 1.0 PPV $mms^{-1}$ is stated as: “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”.

In light of the above guidance within BS 5228-2, the SOAEL and LOAEL have been set at 1.0 PPV $mms^{-1}$ and 0.3 PPV $mms^{-1}$ respectively.

6.4.71. Whilst LOAELs have been set for the construction noise and vibration assessments, specific mitigation requirements for the construction of Part B are dependent on the SOAEL and whether receptors are located within the Construction Noise Study Area (further detail is provided in **Section 6.9**). Whilst the NPSE strictly requires the consideration of the LOAEL for construction noise and vibration, the approach taken for this assessment is to mitigate all construction activities within the Construction Noise Study Area rather than just those causing levels above the LOAEL.

6.4.72. **Table 6-10** presents the noise level thresholds adopted for LOAEL and SOAEL for the operational road traffic noise assessment.

**Table 6-10 – LOAEL and SOAEL Thresholds for Operational Road Traffic Noise at Receptors**

| Time Period | LOAEL | SOAEL | Notes |
|---|---|---|---|
| Day (06:00-24:00) | 55 dB $L_{A10, 18h}$ (façade)<br>50 dB $L_{Aeq, 16h}$ (free-field) | 68 dB $L_{A10,18h}$ (façade)<br>63 dB $L_{Aeq,16h}$ (free-field) | [1], [2] |
| Night (23:00-07:00) | 40 dB $L_{night\ outside}$ (free-field) | 55 dB $L_{night,outside}$ (free-field) | [3], [4] |

Notes:

[1] The daytime LOAEL is based on the onset of moderate community annoyance, (ref WHO guidelines for Community Noise (**Ref. 6.24**)).

[2] The daytime SOAEL is based on the NIR (**Ref. 6.5**) threshold and the onset of cardiovascular health effects (ref. WHO Guidelines for Community Noise (**Ref. 6.24**)).

[3] The night time LOAEL is defined in the WHO Night Noise Guidelines for Europe (**Ref. 6.25**).

[4] The night time SOAEL is equivalent to the levels above which cardiovascular health effects become the major public health concern (ref. WHO Night Noise Guidelines for Europe (**Ref. 6.25**)).

6.4.73. The response to operational airborne induced vibration is directly linked to the response to operational road traffic noise. Therefore, the assessment of operational road traffic noise levels against the LOAEL and SOAEL has been used as a surrogate for the assessment of operational airborne vibration levels. Consideration has also been given to nuisance from airborne vibration as noted in **paragraph 6.4.50**.

### Determining Compliance with National Policy

6.4.74. Compliance with the NPSE (**Ref. 6.10**) is determined by considering whether the level of noise at each sensitive receptor lies above the LOAEL or SOAEL.

6.4.75. To determine whether a scheme complies with the NPSE (**Ref. 6.10**), the aims of the NPSE, as set-out in **Table 6-2** have to be tested. The NPS NN (**Ref. 6.8**) (paragraph 5.195) states that the Secretary of State for Transport should not grant development consent unless satisfied that  the Scheme would meet, within the context of Government policy on sustainable development, the three aims set out in both the NPSE and NPS NN.

6.4.76. **Table 6-11** reproduces the three policy aims of the NPSE (**Ref. 6.10**) and the process that has been adopted to test compliance.

**Table 6-11 – NPSE Aims and Process to Test Compliance**

| Policy Aim [1] | Noise Level | Process Adopted to Test Policy Compliance |
|---|---|---|
| [1] to avoid significant adverse noise and vibration effects. | Above or equal to SOAEL | Mitigation measures that could be used to reduce noise and vibration exposure to below SOAEL at each receptor or group of receptors have been investigated.<br>Where noise and vibration levels could not practicably be reduced to below the SOAEL, the reason(s) have been explained. |
| [2] to mitigate and minimise adverse noise and vibration effects. | Between LOAEL and SOAEL | The requirement or otherwise for mitigation measures used to minimise adverse noise and vibration effects at each receptor or group of receptors above LOAEL have been identified<br>Any measures that were considered to reduce noise and vibration levels but were not included within Part B, have been identified along with an explanation of why. |
| [3] to improve the noise and vibration environment where possible. | Applies to all levels | Mitigation and enhancement measures used to improve the noise and vibration environment have been investigated. Reference to measures investigated under Aims 1 and 2 have been included. |
| Note:<br>[1] The objective is to meet all aims within the context of Government policy on sustainable development. | | |

6.4.77. Compliance testing of Part B against national policy requires a thorough and comprehensive evaluation of the need for mitigation and enhancement along the entire length of Part B to reduce the overall environmental effects. For operational effects, these measures include the design and alignment of Part B as well as noise barriers and low noise road surfaces.

6.4.78. It is important to note that:

a. Part B should be assessed as a whole against the aims of the NPSE (**Ref. 6.10**).
b. A noise level above SOAEL does not automatically result in a significant effect as defined by the EIA Regulations (**Ref. 6.3**).

## SIGNIFICANT EFFECTS UNDER THE EIA REGULATIONS

### Construction Noise and Vibration

6.4.79. The thresholds defined adopting the approach presented in **Table 6-8**, **Table 6-9**, **Table 6-10** and **Table 6-11** indicate where there could be an adverse effect in terms of the NPSE (**Ref. 6.10**) as a result of the level of construction noise and vibration respectively. However, the context and duration of the impact also needs to be considered when determining the significance of effect in terms of the EIA Regulations (**Ref. 6.3**). Where the existing ambient noise level is already above the SOAEL, threshold levels may be permitted to be higher (refer to foot notes to **Table 6-8**).

6.4.80. Within Section E4 of BS 5228-1, in relation to example thresholds to determine eligibility for noise insulation, a duration for exceedance of threshold levels is also stated as follows:

"*…for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.*"

6.4.81. A significant effect in the context of the EIA Regulations (**Ref. 6.3**) has therefore been defined where a sensitive receptor exceeds the noise or vibration SOAEL for longer than a period of 10 or more days of working in any 15 consecutive days, or for a total number of days exceeding 40 in any six consecutive months.

### Operational Road Traffic Noise

6.4.82. The process for determining whether significant effects are likely to arise begins with determining the magnitude of noise change in the short-term. This comparison uses the predicted noise levels in the Do-Minimum and the Do-Something scenarios in the opening year (DM2023 and DS2023). This magnitude of change is compared against the scale in **Table 6-7** (middle column) to provide an initial assessment of likely significant effects, which has then been modified, if necessary, through consideration of a combination of other factors or indicators that provide context to the initial assessment.

6.4.83. **Table 6-12** presents the approach to the initial assessment of likely significant effects.

**Table 6-12 – Initial Assessment of Likely Significant Effects**

| Magnitude of Impact in the Short-Term | Short-Term Noise Change, dB $L_{A10,18h}$ | Likely Significant Effect [1] |
|---|---|---|
| No change or negligible | 0.0 – 0.9 | Not significant |
| Minor | 1.0 – 2.9 | Likely not to be significant |
| Moderate | 3.0 – 4.9 | Likely to be significant |
| Major | 5.0+ | Probably significant |

| Magnitude of Impact in the Short-Term | Short-Term Noise Change, dB $L_{A10,18h}$ | Likely Significant Effect [1] |
|---|---|---|
| Note: [1] Subject to consideration of a number of other factors / indicators | | |

6.4.84. The other factors that can be considered in the contextual assessment are as follows:

a. Whether the short-term change is towards the bottom or top of the noise band range
b. The long-term change, with Part B (DM2023 and DS2038) and without (DM2023 and DM2038)
c. Whether the absolute noise level is above or below the SOAEL
d. Receptor specific circumstances such as:
   i. whether the highest changes affect a blank façade or a façade without a habitable room window
   ii. the length of façade affected, relative to the whole building
   iii. whether benefits affect some façades to off-set adverse effects elsewhere (and vice versa)
e. Whether Part B is likely to alter the acoustic character of the area
f. The likely perception of residents to include factors other than noise such as changes to the landscape or setting

6.4.85. The number of properties affected has not been considered as a factor in final evaluation of significant effects, significance of effects has instead been considered for each individual receptor or group of receptors. Although, if significant environmental effects are predicted for a small number of properties, this could be taken into account by the Secretary of State for Transport when balancing overall, the relative merits of Part B.

6.4.86. The emphasis when considering these contextual factors is whether the changes in noise would likely lead to changes in behaviour and response. Noise level predictions have been made for every receptor in the Calculation Area; however, in order to provide a concise summary of the predicted beneficial and adverse effects of Part B, receptors are grouped together based on the predicted noise change, and contextual factors.

6.4.87. For noise-sensitive areas (i.e. those not associated with a building), the proportion of the site that is affected by different noise bands has been determined. The overall judgement of significance has been assessed by balancing the predicted noise levels with the importance of the site and the duration of exposure.

**Operational Road Traffic Airborne Vibration**

6.4.88. The DMRB HD 213/11 (**Ref. 6.20**) provides a methodology for calculating airborne vibration nuisance as a result of Part B. Consideration is given within **paragraphs 6.8.59** to **6.8.62** to the potential significance of the results of this analysis.

6.4.89. Consideration has also been given within **paragraph 6.8.58** to the potential effect of operational ground-borne vibration.

**NOISE INSULATION REGULATIONS**

6.4.90. It is the Applicant's policy to exercise its powers under the NIR (**Ref. 6.5**). To qualify for compensation under the NIR (**Ref. 6.5**), the following four criteria must all be fulfilled at 1 m in front of the most exposed door or window of an eligible room (including living rooms and bedrooms) in the façade of a property:

a. Be within 300 m of Part B
b. Show a relevant noise level (the noise level in the future year with Part B) of at least 68 dB $L_{A10,18h}$ (façade)
c. Show a noise increase between the relevant noise level and the prevailing noise level of at least 1 dB(A)
d. The contribution to the increase in the relevant noise level from Part B must be at least 1 dB(A)

6.4.91. The prevailing noise level is that caused by traffic using any highway immediately before works to construct or alter the highway are commenced. However, due to the relatively short duration of the construction works for Part B, the prevailing noise level is taken to be equivalent to the noise level in the Do-Minimum opening year scenario. **Table 6-13** shows the parameters used to determine eligibility under the NIR, whilst **Table 16-14** shows the NIR eligibility conditions.

**Table 6-13 – Noise Levels Predicted for the NIR**

| NIR Definition [1] | Parameter used in this Section |
|---|---|
| Prevailing noise level (PNL) | $L_{A10,18h}$ Do-Minimum opening year 2023 [2] |
| Relevant noise level (RNL) | $L_{A10,18h}$ Do-Something future year 2038 |
| Maximum noise level from altered highways within 15 years (L'A) | $L_{A10,18h}$ Do-Something future year 2038 from Part B |
| Maximum noise level from all other highways within 15 years (L'B) | $L_{A10,18h}$ o-Something future year 2038 from all the roads outside Part B |

Notes:
[1] The associated acronyms are included for the NIR definitions.
[2] Strictly the prevailing level relates to the time immediately before the works to construct or improve the highway were begun, not the year of opening. Consequently, any assessment of eligibility in terms of the NIR must be seen as preliminary.
Source: Noise Insulation Regulations 1975 (as amended)

**Table 6-14 – Criteria to Define whether a Property Qualifies for Insulation under the NIR**

| Provision | Criteria [1] |
|---|---|
| NIR 7(1) | Distance ≤ 300 m from the nearest point of the carriageway |
| NIR 2(1) / 4(1) | RNL ≥ 68 dB $L_{A10,18h}$ façade (with 67.5 dB rounded up) |
| NIR 3(2)a / 4(2)b | RNL – PNL ≥ +1 dB(A) |
| NIR 3(2)b / 4(2)b | RNL – L'B ≥ +1 dB(A) |
| Note:<br>[1] For the acronyms refer to CRTN, Annex 1.<br>Source: Noise Insulation Regulations 1975 (as amended). | |

## 6.5. ASSESSMENT ASSUMPTIONS AND LIMITATIONS

6.5.1. A number of assumptions and limitations have been identified during the assessment. The uncertainty associated with each limitation has been reduced as far as possible.

### CONSTRUCTION NOISE

6.5.2. The methods and scheduling of construction works would be subject to change during the construction period to deal with situations arising on-site. A risk-based assessment has therefore been undertaken at this stage, based on typical road construction activities and plant noise levels presented in BS 5228-1 (**Ref. 6.27**).

6.5.3. **Appendix 6.4: Source Information and Assumptions for Construction Noise Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) provides details of the construction noise assumptions and the source of the information used in the construction noise calculations. These assumptions have been generated based on information provided by the Buildability Advisor regarding outline construction methodology and the construction programme as well as experience gained from other similar projects. **Table 6-15** details the limitations related to each element of the construction assessment.

**Table 6-15 – Limitations in Relation to the Construction Noise Assessment**

| Parameter | Description |
|---|---|
| Road traffic diversions | No traffic data have been used in assessing the temporary road traffic noise effects of diversions during the works. These have been assessed qualitatively in **Section 6.8**. |
| Construction plant location | Calculations undertaken in accordance with BS5228-1 (**Ref. 6.27**) have assumed that the full complement of plant for each activity is to operate together at a single point. Where assessment locations are positioned at a distance of less |

| Parameter | Description |
|---|---|
| | than 10 m from possible working areas, a distance of 10 m has been adopted within the calculations. Where assessment locations are located at greater distance from working areas, it has been assumed that all plant is located at the closest possible distance to the assessment location.<br>This approach is considered to represent a realistic worst-case. |
| Construction stages | Construction stages have been based on methodology within BS 5228-1 (**Ref. 6.27**), previous road scheme experience and information provided within Part B construction methodology and programme. The worst-case approach is considered to adequately account for simultaneous construction stages as equipment cannot all be positioned at the closest point to the receptor. |
| Construction plant and methods | Standard construction methods using plant and equipment detailed in BS 5228-1 (**Ref. 6.27**). |
| Construction timings and duration | Detailed timings (hour-by-hour) and durations of construction works including specific activities and exact locations are required to provide an accurate assessment of potential impacts. This information would not be available until the main contractor is appointed. |
| Noise sensitive receptors | Sensitive receptors identified through OS AddressBase data |

6.5.4. Precise details of construction plant, methods and scheduling would not be known until the main contractor has been appointed, all relevant surveys have been completed, and all other engineering and environmental constraints have been fully accounted for. Even then, the proposed works would be subject to change during the construction period to deal with situations arising on site. The assumptions adopted within the construction noise assessment therefore aim to represent a realistic worst-case scenario based on knowledge gained from other, similar schemes.

6.5.5. At this stage, it is considered appropriate to adopt a cautious approach to the assessment whereby no screening between construction works and nearby sensitive receptors has been considered; the actual topography and intervening buildings, in some cases, would, to some extent, be likely to reduce the potential impacts from noise. Where properties are completely screened from the works it would be expected that noise levels could be up to 10 dB lower.

6.5.6. Although cautious assumptions have been made, the quantitative construction noise assessment conventionally considers a full range of typical road construction activities, taking into account the preliminary works programme and design and plant noise levels presented in BS 5228-1 (**Ref. 6.27**). The specific plant item, number of and percentage on-times assumed for the construction noise predictions are presented in **Appendix 6.4**: **Source Information and Assumptions for Construction Noise Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

6.5.7. Noise levels have been predicted over acoustically absorbent ground, given the predominantly rural nature of Part B.

6.5.8. Notwithstanding the assumptions that have been made, the approach to the assessment is considered proportionate and suitable for the objective of identifying where potentially significant effects are likely to arise. Once appointed, the main contractor would produce a Noise and Vibration Management Plan (NVMP) and ensure that appropriate mitigation measures are employed to avoid significant effects where possible.

**CONSTRUCTION VIBRATION**

6.5.9. It has been assumed that percussive piling may be required during the construction stage with specific relevance to bridge construction. This presents a worst-case appraisal of the potential vibration impacts. Alternative methods of piling that generate less vibration, e.g. continuous flight auger piling, would be considered on a case-by-case basis where there are particular sensitivities in the surrounding area. **Table 6-16** below provides a summary of limitations relating to the construction vibration assessment.

**Table 6-16 – Limitations in Relation to the Construction Vibration Assessment**

| Parameter | Description |
|---|---|
| Piling | Piling methods have yet to be determined. The assessment presented assumes percussive piling which is likely to be worst-case. The **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) sets out a methodology for managing potential impacts due to piling. |

6.5.10. The local geology is varied along the length of Part B. Given it is not known exactly where all pilling operations would be undertaken and therefore what the exact ground conditions applicable to piling are, it is appropriate to make some worst-case assumptions in terms of propagation which have been informed by available knowledge of general ground conditions along the length of Part B. The ‘Kp’ factor (a correction applied to account for the geological conditions of the local area) is a coefficient in the formulae to calculate the predicted vibration levels.

6.5.11. Based on information presented within **Chapter 11: Geology and Soils** of this ES, it is expected that, as a worst-case the general ground conditions along Part B include stiff soils.

As such, a correction of three has been assumed for Part B. Once final piling locations are known, it is possible that in some areas the Kp factor would be 1.5, in which case the area within which potentially significant effects may occur would reduce. All pile depths have been assumed to be 15 m and the piling energy 60,000 joules. This information was provided by the Buildability Advisor for the Scheme.

**OPERATIONAL ROAD TRAFFIC NOISE AND AIRBORNE VIBRATION**

6.5.12. **Appendix 6.5: Source Information and Assumptions for Operational Road Traffic Noise Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) provides details of the assumptions and the source of the information used in the operational road traffic noise model which has been generated using CadnaA noise modelling software. **Table 6-17** provides a summary of limitations relating to the operational road traffic assessment.

**Table 6-17 – Limitations in Relation to the Operational Road Traffic Assessment**

| Parameter | Description |
|---|---|
| Future development | Receptors have not been included in the noise model for future planning applications but have been considered within **Chapter 16: Assessment of Cumulative Effects**, **Volume 4** of this ES (**Application Document Reference: TR010041/APP/6.4)**. |
| Pavement | Pavement corrections are dependent on road surface type, speed and number of lanes of coverage (further detail is provided in **paragraphs 6.5.13** to **6.5.20**). The corrections adopted are limited by the information available on existing and proposed road surface type. |
| Road speeds | It is recognised that the correction for speed within the CRTN method is only valid within the range 20 – 130 km/h. Based on the guidance in DMRB HD 213/11, the speeds associated with the provided traffic data have therefore been limited to this range. |
| Traffic flows | Roads with flows in all of the assessment scenarios that fall below 1,000 18-hour Annual Average Weekday Traffic (AAWT) have been excluded from the prediction exercise. This is based on the guidance in CRTN. |
| | The results of the traffic modelling undertaken to inform the design of Part B have been used as the basis for assessment of road traffic noise. In applying these figures, a number of assumptions have been incorporated, the details of these assumptions are presented in **Appendix 6.5: Source Information and Assumptions for Operational Road Traffic Noise Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). |

### Existing and Future Pavement

6.5.13. The noise levels produced by a particular section of road are dependent to an extent on the road surface that is present. A 'road surface correction' is applied to each road segment, which is dependent on the speed of the road and the road surface type and its condition.

6.5.14. Where the speed of a road is less than 75km/h, the noise produced is less dominated by tyre noise and, therefore, the road surface correction is not dependent on the road surface type.

6.5.15. Conversely, where the speed of the road is greater than 75 km/h, tyre noise becomes more dominant and, therefore, the road surface correction is dependent on the type and condition of surface.

6.5.16. For the existing Do-Minimum scenario, in line with **Chapter 2: The Scheme**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) the following has been assumed:

**a.** Road surface information for the A1 included sections of Hot Rolled Asphalt (HRA) and Low Noise Surface (LNS). This information was provided via Highways England Pavement Management System (HAPMS.

**b.** The local road network (the road network maintained by the Local Authority) would be surfaced with HRA. Detailed information of the road surface on the wider road network was not available and was therefore assumed to be HRA, as this is the most widely applied road surface [5].

6.5.17. In line with standard maintenance practices, by the future Part B Do-Minimum year (2038), all areas of LNS are assumed to have been replaced and well maintained.

6.5.18. In line with **Chapter 2: The Scheme**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**), for the Do-Something scenarios, the following has been assumed:

**a.** The entire length of the main alignment for Part B, other than bridge decks, would be laid with an LNS. For technical reasons, bridge decks would be laid with HRA.

**b.** All existing sections of LNS on the A1 beyond the Order Limits would remain.

**c.** All other links within the Order Limits, with the exception of bridge decks, would be laid with LNS.

**d.** The road surface type on the local authority road network would not change.

6.5.19. An LNS has higher noise absorption characteristics than alternative surfaces such as HRA and as such absorbs a proportion of the tyre noise. For this reason, it is only effective where tyre noise is dominant over engine noise.

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[5] Assessment of noise levels from the wider road network is predominantly based on the noise level change between scenarios. Therefore, provided the road surface does not change between the scenarios it is not of great consequence to the overall assessment.

6.5.20. The surface corrections that have been applied within the assessment are those stated for use within Annex 4 of the DMRB HD 213/11 (**Ref. 6.20**). The low noise characteristic of a surface is defined by its 'Road Surface Influence' (RSI) value. The DMRB advises that for calculations undertaken using CRTN (**Ref. 6.21**), the surface correction for thin surfacing systems should be assumed to be 0.7*RSI and its performance capped at a maximum of -3.5dB. It then goes on to say that if there is no information available for a specific surface, then a -2.5dB correction should be applied for existing low noise road surfaces and -3.5dB correction applied for a new low noise road surface. The effectiveness of LNS is dependent upon wear to and clogging of the surface and as such requires more cleaning and maintenance than alternative surfaces.

## 6.6. STUDY AREA

### CONSTRUCTION NOISE AND VIBRATION

6.6.1. Construction noise and vibration effects are expected to encompass a smaller area than that applicable to the operational stage assessment. This is because, based on available guidance and professional judgement, temporary construction noise and vibration is not expected to generate significant effects beyond 300 m from the area of activity. At greater distances other factors, such as meteorological conditions, have increasing influence and construction noise level predictions are considered less robust.

6.6.2. DMRB HD 213/11 (**Ref. 6.20**) states that:

*"As there is an expectation that disruption due to construction is a temporary issue, the area in which it is considered to be a nuisance is generally more localised than where the impacts of the road project are likely to be a cause of concern once it has opened to traffic. It has been shown that the impact of construction nuisance in one form or another diminishes rapidly with distance."*

Within BS5228-1:2009+A1:2014 Appendix F: Methods of Calculation it is stated "*At distances over 300m noise predictions have to be treated with caution, especially where a soft ground correction factor has been applied, because of the increasing importance of meteorological effects."*

6.6.3. The Construction Stage Study Area has therefore been set at 300 m from the boundary of construction activity associated with Part B and encompasses a number of baseline noise measurement locations which were agreed during consultation with NCC for the purpose of the construction stage assessment. In addition, where necessary, temporary sources outside of the 300 m Study Area such as construction traffic routes and diversions have also been considered.

### OPERATIONAL ROAD TRAFFIC NOISE

6.6.4. As set out during consultation with NCC, the Operational Road Traffic Noise Study Area and Calculation Area have been defined in accordance with DMRB HD 213/11 (**Ref. 6.20**):

a. Identify the start and end points of the physical works associated with Part B

b. Define a boundary 1 km from the carriageway edge of the routes identified in (a) above
c. Define a boundary 600 m from the carriageway edge around the route identified in (a) above and 600 m from any other affected routes within the boundary defined in (b) above. The total area within these 600 m boundaries is termed the Calculation Area.
d. Identify any affected routes beyond the boundary defined in (c) above.

6.6.5. DMRB HD 213/11 also requires that the Basic Noise Level (BNL)[6] is calculated for the wider network roads. The area considered has been informed by the Traffic Reliability Area (TRA)[7]. A 50 m buffer (from the edge of the carriageway) in line with DMRB HD 213/11 is defined around identified affected routes.

6.6.6. An affected route is one where there is a predicted change in the BNL of at least 1 dB $L_{A10,18h}$ in the short-term (on opening), or 3 dB $L_{A10,18h}$ in the long term (assessed between the opening year (2023) and the future year (2038))[8].

6.6.7. In accordance with the DMRB HD 213/11 (**Ref. 6.20**), the Operational Road Traffic Noise Study Area has been determined on the basis of the definition of Part B and affected roads identified within and outside of the main 1 km boundary. The detailed noise Calculation Area has been defined as within 600 m of the A1 (existing and proposed alignments) and any affected routes, which themselves lie within 1 km of Part B.

6.6.8. The Operational Road Traffic Noise Study Area has also been defined by the extent of the TRA such that any sensitive receptors that lie outside of the TRA have been excluded from the assessment as the noise levels and associated changes at these receptors would be considered unreliable.

6.6.9. **Figure 6.1: Operational Noise Calculation / Study Area**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) shows the extent of the Calculation Area for operational road traffic noise.

**OPERATIONAL AIRBORNE VIBRATION**

6.6.10. In accordance with DMRB HD 213/11 (**Ref. 6.20**), the Operational Airborne Vibration Study Area is defined as being within 40 m of any roads identified in the Operational Road Traffic Noise Study Area.

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[6] The Basic Noise Level is described in the CRTN. It does not relate to any specific receptor, but rather is a measure of source noise, at a reference distance of 10 m from the nearside carriageway edge of a specific length of highway. It is determined by obtaining the estimated noise level from the 18-hour traffic flow and then applying corrections for vehicle speed, percentage of heavy vehicles, gradient and road surface as described in CRTN.

[7] IAN 185/15 defines the TRA as "The TRA defines the sub-set of traffic data from the traffic model, that has been identified as suitable for informing the Environmental Assessment".

[8] Where a change above 1 dB $_{LA10,18h}$ in the short-term and 3 dB $_{LA10,18h}$ in the long-term is due to physical changes to the infrastructure surrounding the road (e.g. re-surfacing) or changes to the way in which the existing road is used, then DMRB HD 213/11 states that this should not be included as an 'affected road link' nor inform the Calculation Area.

## 6.7. BASELINE CONDITIONS

### PART B MAIN SCHEME AREA, (INCLUDING CHARLTON MIRES SITE COMPOUND)

6.7.1. The Study Area covers the A1 between Alnwick in the south to Ellingham in the north, running through a rural landscape with predominantly agricultural land uses either side of the road. There are relatively few dwellings in close proximity to the A1 and where these do exist, they are typically isolated or grouped in small clusters.

6.7.2. For areas remote from existing road traffic routes, existing baseline noise and vibration levels are expected to be low. As well as road traffic noise from the A1, other local roads in the area, such as the B6347, B6341 and B1340, are expected to dominate the existing noise and vibration environment for many sensitive receptors. The contribution of road traffic noise to existing baseline noise and vibration levels would be dependent on the separation distance between roads and receptor, and the traffic flow, composition and speed of vehicles on those roads.

6.7.3. The East Coast Main Line railway is located at a distance greater than 3 km to the east of Part B and is not expected to influence noise or vibration levels in the area. Other than industrial facilities such as the Lionheart Enterprise Park to the south of Alnwick, within proximity to the proposed Lionheart Enterprise Park Compound (eastern site and western site), there are minimal industrial / commercial noise sources that are expected to influence baseline noise levels within the vicinity of Part B. It is expected that baseline noise levels would also be influenced by noise associated with farming activities. Although there is a small private airfield located to the west of the A1 within the vicinity of Charlton Mires Farm House, it is expected that, given its proximity to the A1, which is the dominant noise source in this locality, the influence of air traffic noise on the baseline noise environment would be minimal.

6.7.4. The existing road traffic noise climate has primarily been determined using a 3D noise model populated with traffic flow data. Details of the noise modelling process are presented in **Appendix 6.5: Source Information and Assumptions For Operational Road Traffic Noise Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). However, a noise survey has been undertaken, which is described in **paragraphs 6.7.9 to 6.7.24**.

### LIONHEART ENTERPRISE PARK COMPOUND

6.7.5. The Lionheart Enterprise Park Compound is located immediately to the east of the Lionheart Enterprise Park. The baseline noise and vibration environment within the vicinity of the compound is expected to be dominated by industrial noise and vibration from the Enterprise Park, as well as road traffic noise and vibration from the A1 and other local surrounding routes close to the business park.

6.7.6. The closest sensitive receptors to the compound include four residential dwellings, a Livery Stables and a Bed and Breakfast, all within the vicinity of East Cawledge Farm at an approximate distance of 160 m to the north east of the Lionheart Enterprise Park Compound.

**MAIN COMPOUND**

6.7.7. The Main Compound is located to the north west of Eshott Airfield immediately to the north of the B6345 and to the east of the A1. The baseline noise and vibration environment within the vicinity of the compound is expected to be dominated by local road traffic sources and noise generated by operations at the adjacent airfield.

6.7.8. The local area surrounding the compound is rural, with eight residential receptors located at Thurston New Houses at a distance of approximately 230 m to the east, and 13 residential receptors the west beyond the A1 at a distance of approximately 400 m.

**NOISE SURVEY**

6.7.9. In accordance with DMRB HD 213/11 (**Ref. 6.20**) the operational road traffic noise assessment has been based on calculated noise levels using the methodology detailed in CRTN (**Ref. 6.21**) and Annex 4 of the DMRB HD 213/11. However, it is also appropriate to establish the baseline conditions by measurement at a sample of locations in the vicinity of Part B. A baseline noise survey has therefore been undertaken to inform the assessment of potential construction and operational stage noise effects. The results obtained during the baseline noise survey have been used to inform the selection of appropriate construction noise assessment criteria.

6.7.10. The baseline noise survey comprised attended and unattended monitoring at various locations in the vicinity of Part B (refer to **Figure 6.2: Baseline Noise Measurement Locations**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**)). The survey commenced at approximately 15:00 on Tuesday 11 September 2018 and concluded on Wednesday 19 September at approximately 09:30.

6.7.11. Due to problems with site access delaying the initial survey and reducing the useable time on site, coupled with the presence of other unforeseen circumstances such as the influence of barking dogs, it was necessary that additional measurements were undertaken at a small number of locations including LT3, ST3, ST4 and ST5 (refer to **Table 6-19**). Additional measurements were taken on 21 and 22 May 2019 commencing at approximately 10:00 on 21 May and concluding at approximately 12:00 the following day.

**Weather Conditions**

6.7.12. During attendance on site on 11, 12 and 13 September 2018, weather conditions were observed to be conducive to obtaining accurate and reliable noise measurement data, remaining dry with wind speeds generally below 5 m/s. During the remainder of the survey period, meteorological data has been obtained from www.wunderground.com for weather station IALNWICK14, which is the closest to Part B. **Appendix 6.7: Summary of Baseline Noise Survey Weather Conditions**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) presents the rainfall, wind speed and wind direction data for the remaining duration of the survey.

6.7.13. For the majority of the 21 and 22 May 2019 survey period, weather conditions were conducive to obtaining accurate and reliable noise measurements. A short period of rainfall was however observed during the evening of 21 May.

6.7.14. On analysis of this weather data, noise monitoring data collected during rainy periods and periods where wind speeds were consistently above 5 m/s have been discounted from the baseline measurement data. **Table 6-18** sets out periods which have been excluded.

**Table 6-18 – Periods Excluded due to Adverse Weather**

| Date | Period Start | Period End | Details |
|---|---|---|---|
| 18/09/18 | 07:15 | 09:15 | Data excluded due to rainfall |
| 21/05/19 | 18:50 | 20:00 | |
| 13/09/18 | 13:30 | 16:30 | Data excluded due to winds in excess of 5 m/s |
| 14/09/18 | 09:45 | 14:30 | |
| 18/09/18 | 12:40 | 17:05 | |
| 19/09/18 | 08:15 | 12:05 | |

6.7.15. A summary of the measured baseline noise levels is presented within **Appendix 6.8: Noise Monitoring Results**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

**Measurement Equipment**

6.7.16. The Class 1 sound pressure level measurement systems and handheld acoustic calibrators as detailed within **Appendix 6.6: Equipment Details**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) were used.

6.7.17. Each of the measurement systems had been calibrated to traceable standards within the previous 24 months, and the handheld calibrators within the previous 12 months. Using the paired hand-held calibrator for each system, the measurement chain was subject to field calibration at the beginning and end of each measurement. No significant calibration drifts arose.

6.7.18. At each measurement location, the microphone of the installed measurement system was fitted with a windshield.

**Measurement Locations**

6.7.19. The adopted measurement locations are shown in **Figure 6.2: Baseline Noise Measurement Locations**, **Volume 6 of this ES** (**Application Document Reference: TR010041/APP/6.6**) and summarised in **Table 6-19**. All measurements were undertaken in free-field conditions, and at a height of approximately 1.5 m above ground level.

**Table 6-19 – Baseline Noise Measurement Locations**

| Location | Description | Baseline Noise Environment |
|---|---|---|
| ST1 | West of Denwick Hamlet - within a field to the north of the B1340 to the west of dwellings overlooking the B1340 and at a distance of approximately 150 m to the east of the A1. | Dominated by road traffic noise from the B1340 and the A1. |
| ST2 | Heiferlaw Bank - within a small field to the north of Heiferlaw Bank, approximately 9 m to the west of the B6341 and 430 m to the west of the A1. | Dominated by road traffic noise from the A1 and occasional traffic pass-bys on the B6341. |
| ST3 | West Link Hall Farm - Within the front garden of West Link Hall Farm approximately 35 m to the west of the A1. | Dominated by road traffic noise from the A1. Occasional traffic noise from vehicles on the residential access road was also intermittently audible. |
| ST4 | 9 The Cottages - immediately to the east of the front gardens of the cottages at a distance of approximately 40 m to the west of the A1. | Dominated by noise from the A1. At night, the noise environment was also influenced by construction noise (e.g. vehicles / machinery idling, white noise reverse sirens and operatives talking) associated with night time roadworks that were underway at the time of the survey. |
| ST5 | East Cawledge Farm - to the south-west of the farm access track, approximately 380 m to the south-east of the A1. | Dominated by road traffic noise from the A1, with occasional vehicle pass-by events on the access track. |
| LT1 | Loaning Head Cottage - within the garden area to the north of Loaning Head Cottage, approximately 4 m from the B6341 and approximately 900 m to the west of the A1. | Dominated by distant road traffic noise from the A1, with local vehicle pass-by movements on the B6341 also contributing. |
| LT2 | Heckley Fence - within the rear garden of the dwelling, approximately 220 m to the west of the A1. | Natural sources such as rustling vegetation and bird song. Intermittent road traffic noise from the B6341 and more constant road traffic noise from the A1 was also present. |

| Location | Description | Baseline Noise Environment |
|---|---|---|
| LT3 | Rock Midstead - within the wooded area to the west of Rock Midstead Cottages at approximately 490 m to the east of the A1. | Baseline noise levels were influenced by distant, continuous road traffic noise from the A1 and rustling vegetation. |
| LT4 | Charlton Hall - within the garden area to the east of the dwelling at approximately 100 m to the east of the A1. | Dominated by road traffic on the A1. |

**Survey Results**

6.7.20. The baseline noise survey results for long-term unattended monitoring and shorter-term, often attended, monitoring are presented in

6.7.21. **Table** 6-20 and **Table 6-21** respectively.

6.7.22. Long-term unattended monitoring was undertaken at locations for which suitably secure or concealed measurement locations could be adopted. Shorter term measurements were undertaken at locations which were less secure, thus necessitating shorter and in some cases, attended measurements.

6.7.23. Details of the equipment used for the noise survey are presented within **Appendix 6.6: Equipment Details**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

**Table 6-20 – Long-term Unattended Noise Measurements**

| Location | | Date | Measured Noise Level (dB) | | | |
|---|---|---|---|---|---|---|
| | | | $L_{A10,18h}$ (06:00 – 00:00) | $L_{Aeq,16h}$ (07:00 – 23:00) | $L_{Aeq,8h}$[3] (23:00 – 07:00) | Highest $L_{AFmax, night}$ (23:00 – 07:00) |
| LT1 | Loaning Head Cottage | 11/09/18[1] | 61.1 | 60.2 | 54.0 | 83.1 |
| | | 12/09/18 | 62.4 | 61.2 | 51.1 | 79.2 |
| | | 13/09/18 | 62.5 | 61.7 | 50.4 | 82.4 |
| | | 14/09/18 | 62.5 | 61.3 | 51.9 | 84.9 |
| | | 15/09/18 | 61.4 | 60.8 | 50.5 | 78.6 |
| | | 16/09/18 | 59.0 | 59.1 | 51.4 | 84.5 |
| | | 17/09/18 | 62.2 | 62.3 | 50.1 | 81.6 |
| | | 18/09/18[2] | 60.5 | 60.2 | 52.8 | 81.3 |

| Location | | Date | Measured Noise Level (dB) | | | |
|---|---|---|---|---|---|---|
| | | | $L_{A10,18h}$ (06:00 – 00:00) | $L_{Aeq,16h}$ (07:00 – 23:00) | $L_{Aeq,8h}$[3] (23:00 – 07:00) | Highest $L_{AFmax, night}$ (23:00 – 07:00) |
| LT2 | Heckley Fence | 11/09/18[4] | 51.6 | 48.9 | 43.7 | 67.0 |
| | | 12/09/18 | 48.2 | 46.9 | 48.6 | 77.9 |
| | | 13/09/18 | 51.6 | 49.0 | 43.5 | 60.4 |
| | | 14/09/18 | 52.9 | 49.8 | 43.0 | 60.4 |
| | | 15/09/18 | 55.1 | 50.8 | 48.2 | 64.5 |
| | | 16/09/18 | 51.5 | 48.3 | 52.1 | 65.6 |
| | | 17/09/18 | 59.6 | 58.5 | 51.2 | 64.8 |
| | | 18/09/18[5] | 58.1 | 53.5 | 43.7 | 67.0 |
| LT3 | Rock Midstead | 21/05/19[8] | 55.6 | 62.2 | 55.9 | 81.0 |
| LT4 | Charlton Hall | 11/09/18[6] | 57.2 | 53.8 | 49.3 | 71.4 |
| | | 12/09/18 | 55.6 | 52.7 | 50.1 | 75.7 |
| | | 13/09/18 | 58.3 | 61.3 | 49.1 | 66.7 |
| | | 14/09/18 | 57.1 | 54.6 | 49.2 | 70.1 |
| | | 15/09/18 | 55.5 | 52.8 | 49.7 | 67.1 |
| | | 16/09/18 | 56.8 | 53.9 | 50.4 | 69.2 |
| | | 17/09/18 | 57.2 | 57.2 | 50.0 | 67.6 |
| | | 18/09/18 | 56.7 | 53.6 | 46.9 | 64.3 |
| | | 19/09/18[7] | 55.5 | 54.1 | 49.3 | 71.4 |

1. Commenced 15:47
2. Ended 10:12
3. 8-hour night starting 23:00 on date shown, concluding 07:00 the following day
4. Commenced 15:28
5. Ended 17:23
6. Commenced 16:12
7. Ended 10:40
8. Commenced at 12:03 on 21 May 2019 and concluded at 12:03 22 May 2019

**Table 6-21 – Short-Term Noise Measurements**

| Location | | Start Date and Time (mm:ss) | Duration (hh:mm) | Measured Noise Level (dB)[1] | | | |
|---|---|---|---|---|---|---|---|
| | | | | $L_{A10,18h}$ | $L_{Aeq,16h}$ | $L_{Aeq,8h}$ | Highest $L_{AFmax,\ night}$ |
| ST1 | West of Denwick | 12/09/1018, 12:00 | 24:00 | 65.7 | 63.7 | 52.7 | 80.4 |
| ST2 | Heiferlaw Bank | 12/09/1018, 11:00 | 24:00 | 54.8 | 56.0 | 47.1 | 77.9 |
| ST3 | West Link Hall Farm | 21/05/19, 10:30 | 24:00 | 66.9 | 63.4 | 59.3 | 84.4 |
| ST4 | 9 The Cottages | 13/09/18, 00:36 | 00:30 | - | - | 52.6 | 71.4 |
| | | 13/09/18, 03:15 | 00:30 | - | - | 55.9 | 80.4 |
| | | 21/05/19, 11:00 | 03:00 | 70.7[2] | 67.3[3] | - | - |
| ST5 | East Cawledge Farm | 13/09/18, 02:08 | 00:30 | - | - | 36.1 | 48.7 |
| | | 13/09/18, 04:39 | 00:30 | - | - | 38.6 | 54.4 |
| | | 21/05/19, 12:51 – 15:56 | 03:05 | 48.8[3] | 58.0[3] | - | - |

1. Where the measurement duration is less than the parameter period, noise levels representative of the measurement period have been provided.
2. $L_{A10,\ 18h}$ calculated using CRTN shortened measurement procedure
3. Representative of measurement period

6.7.24. A detailed breakdown of measured noise levels is presented in **Appendix 6.8: Noise Monitoring Results, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

**ACOUSTIC MODEL BACKGROUND NOISE**

6.7.25. To account for the potential contribution from sources not included in the acoustic model or excluded from the calculation (for example, as a result of the vehicle flow falling below the threshold for valid calculations of $L_{A10,\ 18h}$), a correction for existing ambient noise has been applied. This is especially relevant for more remote locations away from existing roads, where the noise model may be less accurate, (e.g. due to lower road traffic noise levels and the contribution of noise sources other than road traffic which are not incorporated within the noise model) and there is potential to underestimate noise levels.

6.7.26. To avoid overestimating the contribution of general ambient noise, the typical background $L_{A90}$ noise levels for day and night time periods were determined by analysing collected baseline noise measurement data at all measurement locations, with greatest consideration given to locations at which the lower typical $L_{A90}$ noise levels were recorded. The following noise levels were added to the noise model: 35 dB for the daytime and 25 dB for the night time (subsequent to conversion to $L_{night,outside}$ using TRL method 3). These underlying levels are conservative and are sufficiently low not to affect the noise levels in areas where road traffic noise is dominant but were applied to reduce the likelihood of existing noise levels in more remote areas being significantly underestimated, and hence the possibility of future changes in noise levels being overestimated.

## SENSITIVE RECEPTORS

### AddressBase Receptors

6.7.27. **Table 6-22** details the number of receptors that have been identified within the Calculation Area, as well as the names of the non-residential receptors.

**Table 6-22 – Noise-Sensitive Receptors within the Calculation Area**

| Receptor Type | Number of Receptors within Calculation Area | Receptor Name / Description |
|---|---|---|
| Residential | 77 | - |
| Other noise-sensitive – Holiday let/ accommodation/ short-term let. | 8 | Heckley Cottage, Rock Moor House, The Cottages (The Old Reading Rooms), Watermill Cottage, Rock Lodge, Charlton Hall, Charlton Mires, The Cottages. |
| Other noise-sensitive – Museum / gallery. | 1 | North Charlton Farm, The Armstrong Family and Farming Museum. |
| Other noise-sensitive – Racquet sports facility. | 1 | Tennis Court. |
| Other noise-sensitive – Equestrian. | 1 | Riding centre, Rock Moor House. |

### Noise Important Areas

6.7.28. The current Noise Action Plan for roads (**Ref. 6.30**) outlines numerous NIAs at Round 3 of the UK noise mapping project, identified in accordance with the requirements of the EU

Environmental Noise Directive (**Ref. 6.1**) and associated English regulations (**Ref. 6.4**). NIAs are locations where it has been identified that the 1% of the population that are affected by the highest noise levels are located, in order to identify the areas that require potential action to reduce noise levels.

6.7.29. There are no NIAs falling within the Operational Road Traffic Noise Study Area. The closest NIA is IA_ID 10001 located on the A1 at Ellingham Lodge is a distance of approximately 3.8 km to the north of the northern Study Area extents.

**Designated Areas and Footpaths**

6.7.30. A review of designated areas, for example, Site of Special Scientific Interests and key rights of way[9], has identified that there are no such sites within the Operational Road Traffic Noise Study Area.

6.7.31. There are no National Trails or Long Distance Routes within the Operational Road Traffic Noise Study Area.

6.7.32. **Figure 2.2: Environmental Constraints Plan: Part B**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) identifies existing Public Rights of Way (PRoW) within the vicinity of Part B, and the proposed PRoW are shown on the **Rights of Way and Access Plans** (**Application Document Reference: TR010041/APP/2.5**). Users of PRoW are transient, such that varying noise levels are experienced for only short durations at a time as they travel along their length. Part B is not expected to change the character of these PRoW. Therefore, the users of these PRoW have not been considered within the assessment as sensitive receptors.

6.7.33. Ecological receptors have not been considered within this chapter but are considered within **Chapter 9: Biodiversity** of this ES.

**FUTURE BASELINE**

**Opening Year (2023), Without Part B**

6.7.34. The operational stage road traffic noise assessment relies primarily on an appraisal of predicted road traffic noise levels. A detailed noise modelling exercise has therefore been undertaken for the required scenarios. **Table 6-1** in **Appendix 6.5: Source Information and Assumptions for Operational Road Traffic Noise Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) details the approach adopted in the completion of this noise modelling and prediction work. The road traffic data adopted within the noise model is set out in **Chapter 4** of the **Case for the Scheme** (**Application Document Reference: TR10041/APP/7.1**).

**Future Year (2038), Without Part B**

6.7.35. The DM2038 noise model has been used to determine the future baseline noise levels.

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[9] A ‘key’ right of way is defined as a national trail or long-distance path as identified from OS LandRanger mapping. It does not include other rights of way such as footpaths, bridleways or footways (pavements) etc.

**Table 6-23** and **Table 6-24** compare the number of noise sensitive receptors in the DM2023 scenario that are above the LOAEL and SOAEL (refer to **Table 6-23**) thresholds to those in the DM2038 scenario.

**Table 6-23 – Comparison of the Number of Dwellings above the LOAEL and SOAEL Thresholds in DM2023 and DM2038**

| Noise Level | Daytime | | | Night time | | |
|---|---|---|---|---|---|---|
| | DM2023 | DM2038 | Difference | DM2023 | DM2038 | Difference |
| Equal to / greater than SOAEL | 5 | 6 | +1 | 6 | 7 | +1 |
| Between LOAEL and SOAEL | 34 | 36 | +2 | 45 | 46 | +1 |
| Below LOAEL | 38 | 35 | -3 | 26 | 24 | -2 |

**Table 6-24 - Comparison of the Number of Other Sensitive Receptors above the LOAEL and SOAEL Thresholds in DM2023 and DM2038**

| Noise Level | Daytime | | | Night time | | |
|---|---|---|---|---|---|---|
| | DM2023 | DM2038 | Difference | DM2023 | DM2038 | Difference |
| Equal to / greater than SOAEL | 1 | 2 | +1 | 1 | 2 | +1 |
| Between LOAEL and SOAEL | 6 | 6 | 0 | 8 | 7 | -1 |
| Below LOAEL | 4 | 3 | -1 | 2 | 2 | 0 |

6.7.36. Without Part B, when considering the SOAEL, the future year shows a very slight worsening in noise levels at a small number of receptors.

6.7.37. In line with the guidance in DMRB HD 213/11, consideration has been given to the change in noise levels that would arise at identified receptors, in the long-term, without Part B (i.e. DM2023 and DM2038).

6.7.38. **Figure 6.3: Do Minimum Noise Level Change Plot**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) presents a noise level change contour map for this comparison showing the areas where noise level increases and decreases are predicted to arise in the absence of Part B.

6.7.39. In addition, the noise level changes predicted to arise at individual receptors within the Calculation Area have been tabulated according to the requirements of DMRB HD 213/11. **Table 6-25** presents the numbers of receptors within the Calculation Area subject to different noise level changes for the long-term scenario without Part B.

6.7.40. It should be noted that for any given dwelling or building, different noise level changes would arise on different façades. In accordance with DMRB HD 213/11 (**Ref. 6.20**), the assessment has been based on the façade point that is subject to the least beneficial change in noise, thereby representing an overall worst-case assessment.

**Table 6-25 – Noise-Sensitive Receptors, Long-term Noise Changes without Part B**

| Change in Noise Level | | Magnitude of Impact | Daytime | | Night time |
|---|---|---|---|---|---|
| | | | Number of Dwellings | Number of other Noise-Sensitive Receptors | Number of Dwellings |
| Increase in noise level $L_{A10,18h}$ | 0.1 – 2.9 | Negligible | 77 | 11 | 10 |
| | 3 – 4.9 | Minor | 0 | 0 | 0 |
| | 5 – 9.9 | Moderate | 0 | 0 | 0 |
| | >=10 | Major | 0 | 0 | 0 |
| No change | = 0 | No change | 0 | 0 | 0 |
| Decrease in noise level $L_{A10,18h}$ | 0.1 – 2.9 | Negligible | 0 | 0 | 0 |
| | 3 – 4.9 | Minor | 0 | 0 | 0 |
| | 5 – 9.9 | Moderate | 0 | 0 | 0 |
| | >=10 | Major | 0 | 0 | 0 |

6.7.41. **Table 6-25** shows that all properties are predicted to experience a negligible increase in noise levels in the future year as a result of natural traffic growth.

6.7.42. Traffic noise and airborne vibration nuisance assessments have been undertaken for the future year Do-minimum scenario and are presented in **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

## 6.8. POTENTIAL IMPACTS

### CONSTRUCTION

6.8.1. For pre-mitigation construction noise and vibration, predictions have been undertaken for each activity at assessment locations LT2 to LT4 and ST2 to ST5 as adopted for the purpose of the baseline noise survey. These locations are representative of noise sensitive receptors within their locality and fall within the 300 m Construction Stage Study Area.

Additional calculations have been undertaken at West Mires Cottages as this is the closest sensitive receptor location to the Charlton Mires Junction and Rock Lodge due to the proximity of this dwelling to Part B. The adopted construction noise assessment locations are identified within **Figure 6.4: Construction Noise Study Area**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**). This figure also identifies all the residential receptors within the 300 m construction assessment Study Area.

6.8.2. Following the BS5228-1 ABC assessment methodology, construction noise thresholds have been derived from the baseline survey measurement results, as presented in **Table 6-26**. Only measurement / assessment locations applicable to the construction noise assessment have been presented.

**Table 6-26 – Construction Noise LOAEL and SOAEL Thresholds**

| Assessment Location | Daytime | | Night time | |
|---|---|---|---|---|
| | LOAEL Threshold | SOAEL Threshold | LOAEL Threshold | SOAEL Threshold |
| LT2 | 50 | 65 | 45 | 55 |
| LT3 | 60 | 65 | 55 | 58 |
| LT4 | 55 | 65 | 50 | 55 |
| ST2 | 56 | 65 | 47 | 55 |
| ST3 | 63 | 70 | 59 | 62 |
| ST4 | 67 | 75 | 53 | 55 |
| ST5 | 58 | 65 | 36 | 45 |
| West Mires Cottage [1] | 60 | 65 | 55 | 58 |
| Rock Lodge [2] | 63 | 70 | 59 | 62 |
| Thirston New Houses[3] | 49 | 65 | 43 | 50 |

1. Criteria derived based on noise measurements undertaken at LT3
2. Criteria derived based on noise measurements undertaken at ST3 which is at a similar distance from the A1
3. Criteria derived based on that derived and adopted within **Chapter 6: Noise and Vibration, Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.2**)

6.8.3. It is understood that some construction activities such as those associated with bridge construction, have the potential to be undertaken at night during road closures for safety reasons. Therefore, as a worst-case, the construction noise and vibration assessment has assumed both daytime and night time working.

### Construction Noise

6.8.4. Indicative, worst-case, noise levels have been predicted for each of the construction activities identified in **paragraph 6.4.24** in accordance with the guidance in BS 5228-1. Although it is unlikely that each of these activities would be undertaken at night without reduced operations, as a worst-case, noise levels applicable to each activity have been predicted for both daytime and night time periods. The predicted noise levels applicable to each adopted assessment location are presented in **Table 6-27**. Where noise levels are predicted to exceed the applicable SOAEL, the predicted levels are presented in bold text. As set out within **paragraphs 6.6.1** to **6.6.3**, given that temporary construction noise is not expected to generate significant effects beyond 300 m, where assessment locations are positioned at greater than 300 m from the predominant location of construction activity, predicted noise levels have not been presented.

6.8.5. Calculations undertaken in accordance with BS5228-1 (**Ref. 6.27**) have assumed that the full complement of plant for each activity is to operate together at a single point. Where assessment locations are positioned at a distance of less than 10 m from possible working areas, a distance of 10 m has been adopted within the calculations. Where assessment locations are located at greater distance from working areas, it has been assumed that all plant is located at the closest possible distance to the assessment location.

**Table 6-27 – Predicted Unmitigated Construction Noise Level, $L_{Aeq,T}$ dB (Free-field)**

| Assessment Location | Construction Activity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Site Clearance | | Earthworks | | Bridge Construction | | Road Construction | | Compound Operation | |
| | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| LT2 | **78** | **77** | **75** | **75** | **78** | **78** | 61 | **60** | - | - |
| LT3 | **78** | **77** | **75** | **75** | - | - | - | - | - | - |
| LT4 | **80** | **80** | **78** | **77** | - | - | 64 | **64** | - | - |
| ST2 | 47 | 47 | 45 | 44 | - | - | **76** | **76** | - | - |
| ST3 | **84** | **84** | **81** | **81** | - | - | **74** | **73** | - | - |

| Assessment Location | Construction Activity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Site Clearance | | Earthworks | | Bridge Construction | | Road Construction | | Compound Operation | |
| | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| ST4 | **84** | **84** | **81** | **81** | - | - | 70 | **69** | - | - |
| ST5 | - | - | - | - | - | - | - | - | 51 | 51 |
| West Mires Cottage | 56 | 55 | 53 | 53 | 56 | 55 | 52 | 51 | - | - |
| Rock Lodge | **84** | **84** | **81** | **81** | - | - | **80** | **79** | - | - |
| Thirston New Houses | - | - | - | - | - | - | - | - | 43 | 43 |

6.8.6. A list of equipment with assumed source levels and percentage on times used for the purposes of this assessment is provided in **Appendix 6.4: Source Information and Assumptions for Construction Noise Assessments**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

6.8.7. A number of the predicted noise levels presented within the table above exceed the applicable SOAEL. It should be noted however that the predicted levels represent a worst-case with all operational plant assumed to be at the closest possible working area to each receptor. Such noise levels are not likely to be experienced for extended durations for the majority of the works. For the large majority of the construction stage, lower noise levels are anticipated.

6.8.8. It is noted that there are a number of sensitive receptors which are located close to the Order Limits applicable to works on culverts, access tracks and PRoW, but are at significant distance from the predominant area of works (i.e. A1 carriageway, bridge works, compounds and main areas of earthworks). For these receptors and activities, it is assumed that construction works would be very short-term relative to the overall construction of Part B. Such properties / activities have therefore been excluded from this assessment but are included within the Construction Stage Study Area for which mitigation is set out within **Appendix 6.9: Construction Noise and Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

6.8.9. Where noise-sensitive receptors are predicted to experience noise levels exceeding the relevant SOAEL identified above, the aims of the NPSE are anticipated not to be met.

6.8.10. **Table 6-28** lists those receptors falling within a zone predicted to experience noise levels of 65 dB or greater due to earthworks activities which is anticipated to be one of the worst-case construction activities. A level of 65 dB is applicable to the daytime SOAEL at a number of the adopted noise assessment locations, however, based on the SOAEL thresholds presented within **Table 6-26**, it is evident that, at some receptors the threshold would be greater than 65 dB.

**Table 6-28 – Receptors within 65 dB Earthworks Zone**

| Receptor(s) | X Coordinate | Y Coordinate |
|---|---|---|
| The Old Reading Rooms | 416912 | 622934 |
| Rock Lodge | 417842 | 620026 |
| Charlton Hall | 417169 | 621936 |
| Charlton Mires | 417556 | 621036 |
| 1 – 12 The Cottages | 416875 | 622999 |
| Heckley Fence | 418716 | 617253 |
| Heiferlaw Bank | 418112 | 618261 |
| Rock Midstead Farmhouse | 418444 | 620426 |
| 2 West Link Hall Cottages | 417370 | 621255 |
| Charlton Mires | 417553 | 621049 |
| 1 Rock Midstead Cottages | 418370 | 620418 |
| Charlton Mires | 418224 | 620693 |
| 4 Rock Midstead Cottages | 418339 | 620407 |
| 3 Rock Midstead Cottages | 418351 | 620411 |
| 3 West Link Hall Cottages | 417398 | 621268 |
| 2 Rock Midstead Cottages | 418360 | 620414 |
| West Link Hall Farm | 417333 | 621281 |
| 4 West Link Hall Cottages | 417401 | 621262 |
| Rock Lodge | 417824 | 620021 |
| 1 West Link Hall Cottages | 417382 | 621264 |

6.8.11. There are no receptors falling within the zone predicted to experience noise levels of 65 dB or greater due to bridgeworks at Charlton Mires junction. There is one receptor (Heckley

Fence), which falls just within the 65 dB bridgeworks zone for Heckley Fence Accommodation Overbridge.

6.8.12. The assessment results presented above indicate where there could be adverse effect in terms of the NPSE, however, the context and duration of the impact also needs to be considered when determining the significance of effect in terms of the EIA Regulations. A significant construction effect would arise where noise or vibration levels are predicted to be above the SOAEL thresholds for more than 10 out of 15 days/nights, or any 40 days/nights in six consecutive months.

6.8.13. Therefore, it is appropriate to attempt to identify the receptors most at risk of significant effects from construction noise.

6.8.14. The majority of the construction activities for Part B are linear activities (i.e. road surfacing) or short-term activities (i.e. gantry construction), which are unlikely to impact individual receptors for sustained periods of time.

6.8.15. The two activities which have been identified as likely to represent the highest risk (i.e. the most likely to cause potentially significant effects) are bridge construction and earthworks. Site clearance is also more likely than some of the other identified activities to cause significant effects; however, it is expected that such effects would be transient, intermittent and would occur for a relatively short time period.

6.8.16. Bridge construction can be a high noise generating activity in a single location, nearby receptors can be adversely affected for sustained periods of time.

6.8.17. Earthworks is a high-risk activity, due to the scale of the earthworks potentially required in some areas.

6.8.18. Both bridge construction and earthworks could potentially exceed the durations of work identified in the Level 2 mitigation as set out within **Appendix 6.9: Construction Noise and Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). Where works extend beyond these durations, consideration would be given to temporary re-housing. The requirement or otherwise for an offer of temporary rehousing would be determined based upon the outcome of further detailed assessment adopting finalised construction methodology and phasing details to be provided by the main contractor. Such an assessment would be undertaken as part of the CEMP to be developed by the main contractor as set out in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**).

**Construction Traffic Noise**

6.8.19. The **Construction Traffic Management Plan** (**CTMP**) (**Application Document Reference: TR010041/APP/7.4**) provides information regarding the predicted traffic movements associated with the construction of Part B.

6.8.20. Part B would give rise to the generation of construction traffic that would access Part B using the existing road network, predominantly the A1. The predominant demand for construction vehicles is associated with the import of materials. Based on currently available estimates of expected movements, the maximum traffic applicable to imported materials is 74 lorries per day for quarter 4 of the construction stage. This is the average number per day spread over the full quarter. There would be peaks and troughs within this period where some days and weeks the movements would approach the maximum figure (83 movements per day) and some days and weeks movements would be minimal. Delivery routes are predominantly expected to be from the north or the south via the A1.

6.8.21. Construction traffic movements would also be generated from the operation of the construction compounds. It is anticipated that for the Lionheart Enterprise Park Compound there would be 36 daily movements with approximately 60% of these movements being from 4x4 / transit vehicles and 40% from lorries. The majority of movements would occur during the daytime, 07:30 to 17:30; however, some movements associated with traffic management may occur at any point within a 24 hour day. This includes five daily movements of a 4x4 pickup and four daily movements of a transit pickup.

6.8.22. For the Charlton Mires Site Compound, all movements would occur during daytime hours and would total 12 movements per day, with 75% being 4x4 / transit movements and 25% being lorry movements.

6.8.23. For the Main Compound, 23 daily movements are predicted from the Part B Scheme, with approximately 83% of these movements being from 4x4 / transit vehicles and 17% from lorries. As for the Lionheart Enterprise Park Compound, the majority of movements would occur during the daytime 07:30 to 17:30; however, some movements associated with traffic management may occur at any point within a 24 hour day. This includes five daily movements of a 4x4 pickup and four daily movements of a transit pickup. Routes between the compound sites would be via the A1.

6.8.24. Given that the majority of construction traffic would be routed along the A1, which has comparatively high existing traffic flows, including a substantial proportion of HGVs, it is evident that additional vehicle movements associated with construction operations would be well diluted within the overall flow. This coupled with a proposed speed reduction from 70 mph to 40 mph through the works, during the construction stage, indicates that associated changes in road traffic noise levels would not generate a 1 dB increase, or greater, from current levels. Therefore, effects as a result of Part B construction traffic movements are expected to be insignificant.

**Road Traffic Diversions During Construction**

6.8.25. Temporary diversions would be required to facilitate the efficient delivery of Part B (refer to the **Construction Traffic Management Plan** (**CTMP**) (**Application Document Reference: TR10041/APP/7.4**)). The diversion route for the closure of the A1 between Brownieside and the A1 on the B6347 is split into northbound and southbound diversions. The northbound diversion would be via the B1340 and the southbound diversion route would be via the B6348 and A697. Some of these diversion routes pass existing noise-sensitive receptors such as those at Preston, Chathill, Swinhoe, Christon Bank, Rennington, and Denwick (southbound route) and Longhorsley, Longframlington, Powburn, Haugh Head, Wooler, and Chatton (northbound route). There is therefore the potential for temporary impacts to arise.

6.8.26. A key principle in the development of the **CTMP** (**Application Document Reference: TR10041/APP/7.4**) has been to maintain single lane traffic in each direction on the A1 for the majority of the construction period, with the exception of carriageway closures for tie-in works, surfacing, bridge beam installations and installation of some of the traffic management. The majority of carriageway closures would be overnight (typically 21:00 or 22:00 to 05:00) but some closures may also occur between 20:00 Saturday to 14:00 Sunday or 22:00 Friday to 05:00 Monday.

6.8.27. When closures are required these would follow the diversion routes presented at **Appendix 7** of the **CTMP** (**Application Document Reference: TR010041/APP/7.4**), which identifies the southbound and northbound routes.

6.8.28. It is not possible to accurately predict noise impacts from road diversions associated with the construction of Part B without detailed information on traffic flows with and without the diversion in place. However, in order to minimise the potential impacts from road diversions, mitigation and management measures have been included for Part B. These are described within **paragraphs 6.9.3** to **6.9.14** and are presented within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**).

6.8.29. It is anticipated that there would be 17 nights of southbound diversions and 17 nights of northbound diversions required during the construction of Part B, however, details of specific dates for A1 carriageway closures are to be developed. It is however expected that diversion conditions on any given local route would constitute only a very small proportion of the full construction programme. Therefore, provided that the management measures set out within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) are adhered to, effects as a result of traffic diversions are expected to not be significant.

### Construction Vibration

6.8.30. Percussive piling may be used during the bridge construction works for Part B.

6.8.31. **Table 6-29** presents the extent of the SOAEL zone for any activity involving percussive pilling. The SOAEL zone is applicable to both day and night time working. The vibration levels have been calculated in accordance with the formulae contained in BS 5228-2 Table E.1 and presents a worst-case. In reality, it is likely that working practices and ground conditions would result in lower vibration levels and thus a smaller SOAEL zone.

6.8.32. For the construction vibration SOAEL zone, the predicted PPV at ground level from percussive piling is calculated. The propagation of vibration over distance is predicted (in accordance with calculation methodology within BS 5228-2) to determine the distance at which the SOAEL would no longer be exceeded. This is referred to as the SOAEL zone.

**Table 6-29 – SOAEL Zone for Percussive Piling**

| Construction Activity | SOAEL Zone, m |
|---|---|
| Percussive piling | 160 |
| Note: The calculated SOAEL zone distance is outside the prediction range of the calculation in BS:5228-2 (**Ref. 6.28**). However, in order to present a worst-case approach at this stage the calculated distance has not been limited. Once more detail on the geology of the area and the exact piling technique is known, a more detailed vibration assessment should be undertaken prior to construction works commencing. | |

6.8.33. Although percussive piling presents the construction activity expected to generate the greatest levels of ground borne vibration, additional calculations have been undertaken for the use of vibratory rollers which may be used during road construction works and therefore may have a wider ranging use along the length of Part B when compared to the more localised piling associated with bridge construction. The vibration levels have been calculated in accordance with the formulae contained within BS 5228-2 (**Ref. 6.28**) and the associated distance buffer within which vibration levels are at or above the SOAEL (1.0 mm/s PPV) is presented within **Table 6-30**.

**Table 6-30 – SOAEL Zone for Vibratory Rollers**

| Construction Activity | SOAEL Zone, m |
|---|---|
| Vibratory rollers | 23 |
| Note: Assumes 2 drums, 0.4 mm amplitude, drum width of 1.3 m, e.g. small ride on roller.<br>Calculations incorporate a 5% chance of exceeding the criteria and are applicable to the start up and run down of machinery. During steady state operation, vibration levels would be lower. | |

6.8.34. It should be noted that the assessments presented within **Table 6-29** and **Table 6-30** are general in nature and are not specific to any one site but do provide an appropriate basis for assessment based on recognised and accepted standards and techniques. Furthermore, there may be a variety of different potential vibration generating activities employed other than those considered. However, the vibration levels and associated distances can be used to determine the typical distances at which significant adverse effects could be registered (within an associated confidence limit). It is also necessary that consideration is given to the duration of effect when determining significance.

6.8.35. It can be seen from **Figure 6.5: Construction Vibration SOAEL Zones**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) that there is one dwelling which falls within the SOAEL Zone applicable to percussive piling at Heckley Fence. No dwellings, other than those to be demolished, fall within the percussive piling SOAEL zone applicable to Charlton Mires junction.

6.8.36. For vibratory rollers, the identified receptors falling within the SOAEL Zone are presented within **Figure 6.5: Construction Vibration SOAEL Zones**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**). These receptors are scattered along the length of Part B within 23 m of the Order Limits.

6.8.37. Where sensitive receptors are located in the SOAEL zones identified above, they are non-compliant with the NPSE (**Ref. 6.10)**.

6.8.38. A significant construction effect in the context of EIA Regulations would only arise where noise or vibration levels are predicted to be above the SOAEL thresholds for more than 10 out of 15 days/nights in six consecutive months.

### OPERATION

#### Operational Noise

6.8.39. Detailed pre-mitigation noise predictions have been carried out for a total of 77 residential receptors and 11 non-residential noise-sensitive receptors within the Calculation Area. The non-residential receptors include seven holiday let / accommodation /short-term lets, a museum, a tennis court, a dog kennels and a riding centre.

6.8.40. All noise levels and noise changes are presented for both the short-term and the long-term. For the long-term noise impacts, a comparison has been made between the noise levels with Part B in the design year (DS2038) and the noise levels without Part B in the opening year (DM2023). This comparison includes the change in noise level as a result of Part B as well as general traffic growth.

6.8.41. **Figure 6.6: Short Term Noise Level Change**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**), and **Figure 6.7: Long Term Noise Level Change**, **Volume 6** of this ES present noise level change contour maps for the short-term and long-term comparison respectively.

#### Comparison of the Operational Road Traffic Noise Effects with the aims of the NPSE

6.8.42. **Table 6-31** and **Table 6-32** show the comparison between the number of dwellings above and below the operational LOAEL and SOAEL in the short-term and the long-term respectively. This comparison has been based on the highest noise level predicted on any façade being representative of a particular sensitive receptor. This is considered appropriate as it represents a worst-case scenario for potential health effects.

**Table 6-31 – Short-term NPSE Summary – Number of Dwellings**

| Noise Level | Daytime | | | Night time | | |
|---|---|---|---|---|---|---|
| | DM2023 | DS2023 | Difference | DM2023 | DS2023 | Difference |
| Equal to / greater than SOAEL | 5 | 3 | -2 | 6 | 3 | -3 |
| Between LOAEL and SOAEL | 34 | 32 | -2 | 45 | 48 | +3 |
| Below LOAEL | 38 | 42 | +4 | 26 | 26 | 0 |

6.8.43. In the short-term, Part B is predicted to result in a decrease in the number of properties above the SOAEL, which indicates a slight overall beneficial effect as a result of Part B. This is due to Part B moving the A1 to the east and away from the existing A1 alignment within the vicinity of Patterson Cottage and West Link Hall Cottages. Furthermore, during the day, there is a slight reduction in the number of properties between the LOAEL and SOAEL, with an increase in those below the LOAEL.

**Table 6-32 – Long-term NPSE Summary – Number of Dwellings**

| Noise Level | Daytime | | | Night time | | |
|---|---|---|---|---|---|---|
| | DM2023 | DS2038 | Difference | DM2023 | DS2038 | Difference |
| Equal to / greater than SOAEL | 5 | 3 | -2 | 6 | 6 | 0 |
| Between LOAEL and SOAEL | 34 | 38 | +4 | 45 | 46 | +1 |
| Below LOAEL | 38 | 36 | -2 | 26 | 25 | -1 |

6.8.44. In the long-term, during the day, Part B is predicted to result in an overall reduction in the number of dwellings above the SOAEL. For both the day and night, there is also predicted to be a reduction in the number dwellings subject to noise levels below the LOAEL with an increase in the number of dwellings subject to noise levels between the LOAEL and SOAEL.

6.8.45. **Table 6-33** and **Table 6-34** show the same comparisons for the Other Sensitive Receptors within the Operational Road Traffic Noise Study Area.

**Table 6-33 – Short-term NPSE Summary – Number of Other Sensitive Receptors**

| Noise Level | Daytime | | | Night time | | |
|---|---|---|---|---|---|---|
| | DM2023 | DS2023 | Difference | DM2023 | DS2023 | Difference |
| Above SOAEL | 1 | 0 | -1 | 1 | 0 | -1 |
| Between LOAEL and SOAEL | 6 | 7 | +1 | 8 | 9 | +1 |
| Below LOAEL | 4 | 4 | 0 | 2 | 2 | 0 |

6.8.46. In the short-term, during the day, Part B is predicted to result in the reduction in noise levels such that at one Other Sensitive Receptor, Patterson Cottage Boarding Kennels, noise levels reduce to below the SOAEL which indicates a slight beneficial effect as a result of Part B. This is due to Part B moving the A1 alignment to the east and away from the existing A1 alignment within the vicinity of Patterson Cottage.

**Table 6-34 – Long-term NPSE Summary – Number of Other Sensitive Receptors**

| Noise Level | Daytime | | | Night time | | |
|---|---|---|---|---|---|---|
| | DM2023 | DS2038 | Difference | DM2023 | DS2038 | Difference |
| Above SOAEL | 1 | 1 | 0 | 1 | 1 | 0 |
| Between LOAEL and SOAEL | 6 | 7 | +1 | 8 | 8 | 0 |
| Below LOAEL | 4 | 3 | -1 | 2 | 2 | 0 |

6.8.47. In the long-term, during the day, Part B plus traffic growth is predicted to result in an overall reduction of one Other Sensitive Receptor experiencing noise levels below the LOAEL and an increase of one receptor experiencing noise levels between the LOAEL and SOAEL. In the long-term with Part B plus natural traffic growth, noise levels at The Old Reading rooms are predicted to increase from being between the LOAEL and SOAEL such that they are above the SOAEL, noise levels at Patterson Cottage Boarding Kennels are expected to reduce from being above the SOAEL such that they fall between the LOAEL and SOAEL, and noise levels at Watermill Cottage are expected to increase from below the LOAEL such that they fall between the LOAEL and SOAEL.

6.8.48. Overall, in terms of the LOAEL and SOAEL threshold levels, Part B is not expected to change the category into which most receptors fall. Part B, in the short-term, is predicted to result in a reduction of a small number of receptors categorised as being above the SOAEL and between the LOAEL and SOAEL and result in an increase in the number of receptors categorised as being below the LOAEL, thus suggesting a beneficial effect. In the long-term, particularly during the day, there is predicted to be a slight reduction in the number of receptors categorised as being above the SOAEL but also a slight reduction in the number of receptors categorised as being below the LOAEL.

### Operational Road Traffic Noise – DMRB HD 213/11 Assessment

6.8.49. Whilst the above summary of pre-mitigation noise levels in terms of the LOAEL and SOAEL suggests that Part B would not have a particularly adverse or beneficial impact on noise-sensitive receptors, when the individual changes in noise level at each receptor are considered, the assessment indicates slightly more beneficial impact at a number of sensitive receptors. This is because noise levels can change notably, but still fall in the same noise threshold band (i.e. remain within the above SOAEL band).

6.8.50. **Table 6-35** shows the predicted short-term change in noise level for all modelled receptors within the Calculation Area, sorted into the noise change bands following the DMRB HD 213/11 (**Ref. 6.20**) magnitude of impact categories. Although negligible noise changes are referred to in the tables and discussion, it should be noted that these changes would most likely be imperceptible at sensitive receptors.

**Table 6-35 – Short-term Traffic Noise Changes (DMRB HD 213/11 Table A1.1)**

| Change in Noise Level | | Magnitude of Impact | Daytime | |
|---|---|---|---|---|
| | | | Number of Dwellings | Number of Other Sensitive Receptors |
| Increase in noise level $L_{A10,18h}$ | 0.1 – 0.9 | Negligible | 43 | 5 |
| | 1 – 2.9 | Minor | 0 | 0 |
| | 3 – 4.9 | Moderate | 0 | 0 |
| | >=5 | Major | 0 | 0 |
| No change | = 0 | No change | 2 | 0 |
| Decrease in noise level $L_{A10,18h}$ | 0.1 – 0.9 | Negligible | 20 | 2 |
| | 1 – 2.9 | Minor | 7 | 3 |
| | 3 – 4.9 | Moderate | 5 | 0 |
| | >=5 | Major | 0 | 1 |

6.8.51. From the table above, it is evident that Part B ranges from having negligible adverse impacts to major beneficial impacts (at Patterson's Cottage Boarding Kennels) due to the online widening of the A1 in the Do-Something scenario and in the absence of mitigation. The majority of noise-sensitive receptors are predicted to experience a negligible increase in noise level (i.e. an increase which they are unlikely to perceive). Major beneficial impacts are predicted at one Other Sensitive Receptor (Patterson Cottage Boarding Kennels) located to the west of the existing A1. Moderate beneficial impacts are predicted to be experienced at five dwellings. These impacts are as a consequence of the new online widening distributing traffic further to the east and at a greater distance from dwellings to the west of the existing A1.

6.8.52. **Table 6-36** shows the predicted long-term changes in noise level for all modelled receptors within the Calculation Area, sorted into the noise change bands following the DMRB HD 213/11 (**Ref. 6.20**) magnitude impact categories.

6.8.53. The long-term impacts are similar to those anticipated in the short-term, with the majority of properties experiencing a negligible change in noise level.

**Table 6-36 – Long-term Traffic Noise Changes (DMRB HD 213/11 Table A1.2)**

| Change in Noise Level | | Magnitude of Impact | Daytime | | Night time |
|---|---|---|---|---|---|
| | | | Number of Dwellings | Number of Other Sensitive Receptors | Number of Dwellings |
| Increase in noise level $L_{A10,18h}$ | 0.1 – 2.9 | Negligible | 52 | 6 | 6 |
| | 3 – 4.9 | Minor | 0 | 0 | 0 |
| | 5 – 9.9 | Moderate | 0 | 0 | 0 |
| | >=10 | Major | 0 | 0 | 0 |
| No change | = 0 | No change | 1 | 0 | 0 |
| Decrease in noise level $L_{A10,18h}$ | 0.1 – 2.9 | Negligible | 22 | 4 | 1 |
| | 3 – 4.9 | Minor | 2 | 0 | 2 |
| | 5 – 9.9 | Moderate | 0 | 1 | 1 |
| | >=10 | Major | 0 | 0 | 0 |

**Traffic Noise Nuisance Assessment**

6.8.54. The results of traffic noise nuisance assessment are presented in **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

6.8.55. For situations where noise increases are predicted, the noise nuisance calculations, as described in the DMRB HD 213/11 (**Ref. 6.20**), give greater weight to the potential abrupt short-term change in noise nuisance as a result of the opening of Part B.

6.8.56. Following the road traffic noise nuisance calculation methodology described in **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**), as shown in **Table 6-1** of

**Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES, for the Do-Something scenarios, all dwellings have a change in nuisance level of less than 30%.

6.8.57. It is clear that the results of the road traffic noise nuisance assessment are directly comparable to the operational road traffic noise assessment provided from **paragraph 6.8.49** onwards. Therefore, as these assessments are intrinsically linked, no further consideration of operational road traffic noise nuisance is presented in this chapter.

**Operational Vibration**

### Ground-Borne Vibration

6.8.58. Older roads that experience a high traffic flow (such as the existing A1), are likely to have an uneven surface due to deterioration over time. As new highways are likely to have a smoother surface, the level of road traffic ground-borne vibration is likely to be reduced as the effects of potholes and cracks are eliminated. Furthermore, DMRB HD 213/11 (**Ref. 6.20**) states "*no evidence has been found to support the theory that traffic induced vibrations are a source of significant damage to buildings…Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances*". Consequently, ground-borne vibration at receptors as a result of operational road traffic from Part B is considered unlikely to be significant.

### Traffic Airborne Vibration Assessment

6.8.59. The DMRB HD 213/11 (**Ref. 6.20**) states (in paragraph A6.21) that:

"*The relationship between the percentage of people bothered by largely airborne vibration and this noise exposure index [the $L_{10,\ 18hr}$ noise level] is similar to that for noise nuisance except that the percentage of people bothered by vibration is lower at all exposure levels.*"

6.8.60. The DMRB HD 213/11 also notes that the consideration of airborne vibration nuisance is only appropriate for dwellings within 40 m of a carriageway. It is also noted that noise levels below 58 dB $L_{10}$ should be considered to not cause any bother to residents.

6.8.61. The results of the road traffic airborne vibration nuisance assessment are presented in **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

6.8.62. As described in the DMRB HD 213/11 (**Ref. 6.20**) the assessment of airborne road traffic vibration nuisance is based on the results of the road traffic noise nuisance assessment. As shown in **Table 6-2** of **Appendix 6.3: Noise and Airborne Vibration Nuisance Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**), all relevant properties are expected to experience a percentage change in bother of less than 10% which would relate to a negligible impact or less. As such, it is deemed that no operational road traffic airborne nuisance significant effects would occur as a result of Part B and this is given no further consideration in the chapter.

**Noise Insulation Regulations**

6.8.63. In order to qualify for compensation under the NIR (**Ref. 6.5**), four criteria must be fulfilled as presented in **paragraph 6.4.90.**

6.8.64. There are no dwellings which are predicted to meet all four criteria. As such, based on the assessed design, no further consideration of eligibility for noise insulation is required.

**Requirement for Mitigation**

6.8.65. Whilst the impact magnitudes described above are a guide as to where significant effects might occur and therefore where mitigation may or may not be required, it is appropriate to consider the context of the predicted noise changes.

6.8.66. **Table 6-37** and corresponding **Figure 6.8: Determination of Significance – Receptor Groups**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) sets out groups of receptors based primarily on their short-term magnitude of impact as well as contextual factors to determine whether a significant effect is anticipated.

6.8.67. Given that Part B results in changes to the existing road layout, it is appropriate to give the most weight to the short-term changes as this would be the most noticeable change for residents in the area.

**Table 6-37 – Specific Noise-Sensitive Receptor Summary and Determination of Significance – Operational Road Traffic Noise**

| Receptor Group (refer to Figure 6.7, Volume 6 of this ES for locations) | Number of Dwellings / Other Sensitive Receptors | Short-Term Magnitude of Impact (and contextual factors) | Justification of Significance | Significance |
|---|---|---|---|---|
| Group 1 | 5/1 | Major and Moderate (Decrease) | Part B would improve the noise climate at these properties. As the magnitudes of impact are predicted to be moderate or major, the noise level changes are deemed significant. | Significant (beneficial) |
| Group 2 | 27/5 | Minor and Negligible (Decrease) | Part B would improve the noise climate at these properties. As the magnitudes of impact are predicted to be minor or negligible, the noise level | Not Significant |

| Receptor Group (refer to Figure 6.7, Volume 6 of this ES for locations) | Number of Dwellings / Other Sensitive Receptors | Short-Term Magnitude of Impact (and contextual factors) | Justification of Significance | Significance |
|---|---|---|---|---|
| | | | changes are deemed not significant. | |
| Group 3 ● | 45/5 | No change/ Negligible (Increase) | Part B either does not alter the noise level at receptors or the increases are considered unlikely to be perceptible. Consequently, the noise level changes are deemed not significant. | Not Significant |

## 6.9. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

### DESIGN

6.9.1. The surface of the road for Part B in its entirety would be laid with LNS (apart from structures, where HRA would be laid) which is the quietest road surface type.

6.9.2. An **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) has been produced and accompanies the DCO Application. This contains measures to control noise and vibration during construction. The Outline CEMP sets out best practice measures aimed at reducing and / or mitigating noise levels generated during construction activities. The Outline CEMP would be developed into a CEMP by the main contractor. The associated noise mitigation measures are presented within **Appendix 6.9: Construction Noise And Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

### MITIGATION

#### Construction Noise

6.9.3. As discussed in **paragraphs 6.4.79** to **6.4.81** and **Table 6-8**, where noise levels at representative sensitive receptors are predicted to exceed the relevant SOAEL for different construction activities, there is the potential for a significant effect (in terms of the EIA Regulations (**Ref. 6.3**)) to occur.

6.9.4. A significant effect would occur if construction noise or vibration levels exceed the SOAEL for more than 10 out of 15 days/nights or 40 days/nights in any six consecutive months.

Therefore, given that it is possible for these time periods to be exceeded, to avoid significant adverse construction effects, mitigation measures would be required.

6.9.5. As detailed within **Appendix 6.9: Construction Noise and Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**), mitigation has been considered in terms of two 'levels' within 300 m of the activity (the construction noise assessment area). Level 1 mitigation would be applicable for any construction activity where there are predicted to be no receptors experiencing noise levels above the SOAEL for that specific activity. Levels 1 and 2 mitigations would be applicable for any construction activity where there are receptors predicted to experience noise levels above the SOAEL for that specific activity. This approach is set out in **Table 6-38**.

**Table 6-38 – Construction Mitigation Measures**

| | Are Sensitive Receptors Predicted to Exceed the SOAEL | Required Mitigation Measures |
|---|---|---|
| Each construction activity | NO | Level 1 |
| | YES | Level 1 and Level 2 |

6.9.6. Note that where activities are linear, i.e. along the length of Part B, such as road surfacing, it is appropriate to split the activity into individual segments. There are likely to be some segments where no sensitive receptors would experience noise levels above the SOAEL, where only Level 1 mitigation would be required, but also some sections where sensitive receptors are within distances at which the SOAEL is likely to be exceeded, and, therefore, Levels 1 and 2 mitigation is applicable.

### Level 1 Mitigation Measures

6.9.7. The Level 1 mitigation measures, which are required for all construction activities, are listed in full in **Appendix 6.9: Construction Noise And Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). As a summary, the Level 1 mitigation measures include, but are not limited to use of best practicable means (BPM), as set out within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), at all times. The use of BPM to control emissions can constitute a ground of defence against charges that a nuisance is being caused under Part III of the CoPA 1974 or Part III of the EPA 1990 (**Ref. 6.7**). Such measures may include but not be limited to the following:

a. The main contractor and their sub-contractors shall at all times apply the principle of Best Practicable Means as defined in Section 72 of the CoPA 1974 and carry out all work in such a manner as to avoid or reduce any disturbance from noise (and vibration) as far as is practicable.

b. Guidance given in BS 5228-1 (Section 8 - Control of noise and Annex B - Noise sources, remedies and their effectiveness) should be followed as far as is practicable and advice and training on noise minimisation given to staff during Site induction procedures.
c. All plant brought on to Site should comply with the relevant EC/ UK noise limits applicable to that equipment or should be no noisier than would be expected based on the noise levels quoted in BS 5228-1.
d. Each plant item should be well maintained and operated in accordance with manufacturers' recommendations and in such a manner as to minimise noise emissions.
e. Items of plant operating intermittently should be shut down in the periods between use.
f. Where feasible, all stationary plant should be located so that the noise effect at receptors is minimised and, if practicable, every item of static plant when in operation should be sound attenuated using methods based on the guidance and advice given in BS 5228-1.
g. Careful selection of construction methods and plant should be investigated and utilised, for example, breaking-out of concrete structures using, if required, low noise methods such as munching or similar, rather than percussion breaking.
h. Where practicable, works (including deliveries) would be programmed to minimise working outside of normal working hours.
i. Maintaining good public relations with residents that may be affected by noise from construction works.

6.9.8. Unless for safety or engineering reasons, the number of instances of a particular diversion route being used would be limited to:

a. Less than 10 days/nights in any 15 consecutive days/nights
b. Less than 40 days/nights in any consecutive six months

6.9.9. Where more than one construction activity is undertaken in the same area at the same time, the cumulative effects of those activities need to be considered such that the SOAEL is not exceeded regardless of the number of construction activities taking place.

### Level 2 Mitigation Measures

6.9.10. Level 1 and Level 2 mitigation measures are required where noise or vibration levels at sensitive receptors are predicted to exceed the SOAEL and there is the potential for a significant adverse effect to occur.

6.9.11. The full Level 2 mitigation measures, which are required for all construction activities where sensitive properties are predicted to experience noise levels above the SOAEL, are listed in full in **Appendix 6.9: Construction Noise And Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). As a summary, the Level 2 mitigation measures include, but are not limited to:

a. Unless for safety or engineering reasons, construction works that cause noise or vibration levels at sensitive receptors above the relevant SOAEL would not exceed the following durations:
   i. 10 days/nights in any 15 consecutive days/nights

ii. 40 days/nights in any consecutive six months

6.9.12. If the above durations need to be exceeded, temporary re-housing would be offered to residents for the duration of relevant works. Such offers would be made following further, more detailed assessment adopting detailed construction methodologies and phasing information to be provided by the main contractor. The updated assessment would be undertaken as part of the detailed design and any required measures would be included within the CEMP. The requirement or otherwise for the offer of temporary re-housing would be determined based on the outcome of this assessment.

6.9.13. Temporary acoustic barriers and other noise containment measures such as screens and acoustic hoarding at Part B boundary should be erected where appropriate to minimise noise breakout and reduce noise levels at potentially affected receptors.

6.9.14. Notwithstanding the above advice, where identified as being necessary, the construction process would be monitored closely to ensure noise effects are minimised, so far as is reasonably practicable, as set out in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**). Any such monitoring protocols would also be incorporated into the construction method statements prepared by the main contractor.

**Construction Vibration**

6.9.15. The mitigation measures presented within **paragraphs 6.9.1** to **6.9.14** are also pertinent to the mitigation of construction generated vibration, and would be adhered to at all times.

6.9.16. Where practicable, those activities which, by their very nature, can impart significant levels of vibration into the ground, should be substituted with alternatives that generate less vibration. If alternative plant cannot be sourced, then efforts should be made to minimise the use of such plant.

6.9.17. Notwithstanding the above advice, where identified as being necessary, the construction process would be monitored closely to ensure vibration effects are minimised, so far as is reasonably practicable, as set out in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**). Any such monitoring protocols should also be incorporated in construction method statements prepared by the main contractor.

**Operation**

**Mitigation for Significant Noise Effects**

6.9.18. **Table 6-37** identifies that Part B does not give rise to significant adverse noise effects at any of the identified noise-sensitive receptors. As such, mitigation is not required in relation to operational noise effects associated with Part B.

**ENHANCEMENT MEASURES**

6.9.19. No enhancement measures are proposed for the construction stage of Part B. The mitigation measures described above are sufficient in reducing potential noise and vibration impacts as far as reasonably possible.

**Enhancement in Accordance with the NPSE**

6.9.20. As discussed in **paragraphs 6.4.74** to **6.4.78**, for Part B to be compliant with the NPSE (**Ref. 6.10**), provided that mitigation / enhancement measures are considered sustainable (refer to **paragraph 6.9.22**), noise levels between the LOAEL and SOAEL should be mitigated and reduced to a minimum, and above the SOAEL should be avoided.

6.9.21. In accordance with the three policy aims of the NPSE, noise levels above the SOAEL should be mitigated where possible to minimise significant adverse effects; noise levels between the LOAEL and SOAEL should be mitigated where possible to minimise adverse noise effects, and for all receptors, mitigation and enhancement measures should be considered to improve the noise environment.

6.9.22. However, it is also stated that the above aims should be achieved within the context of Government policy on sustainable development, although this concept is not clearly defined. For this assessment, enhancement has been considered sustainable based on the following three tests (based on professional judgement and the NPSE):

a. Noise enhancement in the form of acoustic screening has only been considered within the Order Limits, where noise levels are dominated by the A1 and where the enhancement measure would not restrict access to property. In addition, for noise enhancement to be included, it should ideally provide a meaningful benefit. In this case a meaningful benefit has been taken as a reduction in noise levels of at least 3 dB as this is generally considered a level which could be perceived by residents.
b. Noise bunds have been considered first, as these are generally the most sustainable form of enhancement. The exact monetary cost of a bund is dependent on a number of variables such as the area of land uptake required and whether excess material is available. Noise bunds have only been specified where (as stated above) they are predicted to give a meaningful benefit to residential receptors.
c. Where it is not possible to construct a noise bund in the desired location, noise barriers should be considered. However, in order for these to be sustainable in line with the aims of the NPSE, they must have a 'value for money' score of 1 or greater. This is based on the comparison of the monetised acoustic benefits of a barrier[10] and the cost of installing the barrier. So, where the value for money is 1 or more, the monetary acoustic benefits outweigh the cost of installing the barrier.

6.9.23. Where the above tests are not met, enhancement measures are not proposed.

6.9.24. Part B would be deemed policy compliant provided noise mitigation is considered for receptors with noise levels above LOAEL and where the above three tests are met.

[10] The value for money analysis of noise barriers has taken the marginal values reported in Defra's report 'Environmental noise: valuing impacts on sleep disturbance, annoyance, hypertension, productivity and quiet', November 2014. These values consider average figures for the UK population and omit specific health statistic figures from the communities being assessed

6.9.25. When considering the year of opening (2023) Part B Do-Something scenario, noise levels from Part B are predicted to exceed the LOAEL at 35 dwellings and 7 other sensitive receptors during the day, and enhancement measures should, therefore, be considered. These properties are also subject to noise levels exceeding the LOAEL within the Part B Do-Minimum scenario.

6.9.26. Many of these properties are generally quite isolated and are not sufficiently close to Part B for a noise barrier or bund to provide meaningful benefit. For those receptors close to Part B, calculations have been undertaken to determine the level of noise reduction likely to be achieved by acoustic screening in the form of a barrier of between 2 and 3 m in height. Where it has been determined that a benefit of at least 3 dB may be achieved, value for money analysis has been undertaken. This analysis has been undertaken for barriers located along Part B alignment adjacent to the following sensitive receptors:

a. West Lodge – one property 68 m to the east of Part B.
b. West Link Hall Cottages – five properties to the west of Part B at an approximate distance of 45 m.
c. Patterson Cottage – 30 m to the west of Part B.
d. Rock Lodge – 65 m to the west of Part B.
e. Rock Nab – two properties at 255 m to the west of Part B.
f. The Cottages – including 13 dwellings at distances ranging from 30 m to 90 m from Part B.

6.9.27. Mitigation appraisals undertaken for the above noise-sensitive receptors identify that barriers would not provide adequate value for money. This is because long barriers are required to achieve meaningful acoustic benefits (at least 3 dB) at single or small groups of receptors.

6.9.28. These appraisals have been undertaken to determine whether it is appropriate to progress to more detailed appraisals incorporating comprehensive consideration to barrier length and alignment in view of possible constraints. Noise barrier mitigation does not meet the required value for money score; therefore, they haven't been considered further. For all properties considered, enhancement in the form of a noise barrier is not considered sustainable in the context of the aims of the NPSE (**Ref. 6.10)**.

6.9.29. Alongside the appraisal of potential noise barriers, consideration has been given to the implementation of noise bunds at the locations listed above. From this appraisal it has been concluded that at all locations, constraints surrounding the availability of land within the Order Limits, limit the height and extent of possible bunds to such a degree that meaningful acoustic benefits cannot be achieved.

## 6.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

### CONSTRUCTION

6.10.1. The context of construction noise and vibration in relation to the receptor under consideration and the surrounding environment as well as the duration of the impact needs to be considered in determining the significance of effect with regard to the EIA Regulations. The key aspects in terms of determining significance are the predicted noise or vibration level, whether this level is above the SOAEL, and the duration of the construction works.

**Construction Noise**

6.10.2. With appropriate mitigation in place, including compliance with CoPA, it is expected that noise levels experienced at nearby sensitive receptors would be reduced from those presented within **Table 6-27**, however, at this stage, it is difficult to quantify the level of noise reduction which can be achieved. For the closest properties to the construction works, where it is practicable to place acoustic screening such that direct line of sight to the works can be completely blocked, it is possible that attenuation of approximately 10 dB can be achieved. The practicability of screening is dependent upon the geometry between the source and receiver. For example, when operations are undertaken at height during bridge construction, it is possible that acoustic screening would not practicably achieve valuable acoustic benefits. The location and number of dwellings which would benefit from acoustic screening would therefore be determined following further, detailed assessment based on detailed information regarding construction methodologies to be employed and their precise locations. Such information would be provided by the main contractor. Based on a review of the position of receptors with respect to Part B, prior to undertaking such a detailed assessment, it is likely that local screening would be most appropriately considered at receptor locations represented by the adopted construction assessment locations LT2, ST3, LT4, ST4 and Rock Lodge, (refer to **Figure 6.4: Construction Noise Study Area**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**)) and receptors within their close proximity. Such locations are representative of the closest sensitive receptors to Part B.

6.10.3. Given the predicted construction noise levels presented within **Table 6-27,** it is likely that, even with best practice mitigation in place, noise levels above the SOAEL would still be experienced. Depending on the duration of exposure to such noise levels, it is therefore also likely that significant adverse effects would remain for the closest receptors to Part B. For such receptors, to reduce potential effects such that they are not significant, it is necessary that Level 2 mitigation as described in **Appendix 6.9: Construction Noise and Vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**), is implemented in its entirety. This would include, limiting the duration of relevant activities to no more than 10 days/nights in any 15 consecutive days/nights and no more than 40 days/nights in any consecutive six months and the offer of temporary rehousing where these durations need to be exceeded. With these measures in place, no significant residual effects (in terms of the EIA Regulations) are predicted for construction noise.

**Construction Vibration**

6.10.4. In general, residual effects are expected to be insignificant for the majority of the construction stage, however, given that sensitive receptors have been identified within the construction vibration SOAEL zones, it is possible that, even with best practice mitigation in place, vibration levels above the SOAEL would still have the potential to be experienced for worst case operations. Depending on the duration and exposure of such levels, it is therefore also possible that significant effects would remain for Part B. For such receptors, to reduce the potential effects such that they are not significant, it may be necessary that Level 2 mitigation, as described in **Appendix 6.9: Construction Noise and vibration Mitigation Clauses**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**), is implemented. This would include, limiting the duration of relevant activities to no more than 10 days/nights in any 15 consecutive days/nights and no more than 40 days/nights in any consecutive six months and the offer of temporary rehousing where these durations need to be exceeded. With these measures in place, no significant residual effects (in terms of the EIA Regulations) are predicted for construction vibration.

**OPERATION**

**Comparison of the Operational Road Traffic Noise Effects with the aims of the NPSE**

6.10.5. Given that the mitigation appraisal has concluded that mitigation is not warranted, the comparison of the operational road traffic noise effects with the aims of the NPSE remains unchanged from that reported in **Section 6.8**.

6.10.6. In the short-term, at three properties (Patterson Cottage, 3 West Link Hall Cottages and 4 West Link Hall Cottages) during the day, Part B is predicted to result in a decrease in noise levels such that the Do-Something 2023 level drops below the SOAEL. At 11 The Cottages, Part B is predicted to result in an increase in noise levels such that the Do-Something 2023 level increases to be above the SOAEL where in the 2023 Do-Minimum scenario it is just below the SOAEL. There is therefore a net reduction of two properties experiencing noise levels above the SOAEL. At four properties (Chestnut House, Rock Nab, The Granary and Golden Moor Cottage), the 2023 Do-Something level drops below the LOAEL.

6.10.7. In the future year (2038), during the day, Part B is predicted to result in an overall reduction of two dwellings experiencing noise levels above the SOAEL. For the 2038 Do-Something scenario, noise levels reduce to below the SOAEL at Patterson Cottage, 3 West Link Hall Cottages and 4 West Link Hall Cottages. Noise levels increase to above the SOAEL at 11 The Cottages where in the 2023 Do-Minimum scenario it is just below the SOAEL. There is also predicted to be an overall decrease of two properties experiencing noise levels below the LOAEL. Considering **Table 6-24**, however, it is evident that this shift (below LOAEL to above LOAEL) is also apparent when comparing the 2023 and 2038 Do-Minimum scenarios, thus indicating that the increase in noise levels is at least in part, as a result of natural traffic growth.

6.10.8. When considering Other Sensitive Receptors, in the short term, it is evident that Part B is predicted to result in a reduction in noise levels such that, at one receptor (Patterson Cottage Boarding Kennels), the 2023 Do-Something noise level drops below the SOAEL. In the long-term with Part B plus natural traffic growth, noise levels at The Old Reading rooms are predicted to increase from being between the LOAEL and SOAEL such that they are above the SOAEL, noise levels at Patterson Cottage Boarding Kennels are expected to reduce from being above the SOAEL such that they fall between the LOAEL and SOAEL, and noise levels at Watermill Cottage are expected to increase from below the LOAEL such that they fall between the LOAEL and SOAEL. This increase is also apparent in the Do-Minimum comparison suggesting that noise level increases at this receptor, at least in part, are due to natural traffic growth and not a result of changes brought about by Part B.

6.10.9. Based on the consideration of mitigation and noise level predictions, Part B is deemed to be policy compliant.

**Operational Road Traffic Noise – DMRB HD 213/11 Assessment**

6.10.10. Given that Part B is not expected to result in significant adverse noise effects, it has not been necessary to consider mitigation measures. The assessment of operational effects presented within **Section 6.8** therefore still stands.

**Future developments**

6.10.11. It is appropriate to consider the significance of effects on future developments within the Operational Noise and Vibration Calculation Area. From the list of committed developments within **Appendix 16.1: Cumulative Short List**, **Volume 4** of this ES (**Application Document Reference: TR010041/APP/6.4**), a planning application for one noise sensitive development has been submitted. This application includes a proposed single storey side extension with terrace seating area, tennis court and lighting at Heckley House. Given that this receptor (prior to extension) has been incorporated within the assessment, further consideration is not necessary.

**Wider Network Noise Level Changes**

6.10.12. DMRB HD 213/11 (**Ref. 6.20**) also requires that noise level changes are considered outside of the 1 km main boundary from Part B.

6.10.13. To consider this, the change in BNLs (which are the noise levels at a notional distance of 10 m from the section of road in question) has been determined for the links beyond the 1 km boundary. For all links, minor adverse changes are predicted at worst, these are not significant.

**SIGNIFICANT NOISE EFFECTS**

6.10.14. Given that, there are no predicted significant adverse operational noise effects, measures to mitigate significant operational noise effects have not been considered (refer to **Table 6-37).**

**UPDATED DMRB GUIDANCE**

6.10.15. The outputs of the DMRB sensitivity test as described in **Section 6.4** (**paragraph 6.4.12**), can be found in **Appendix 6.10: Noise and Vibration DMRB Sensitivity Test**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). The findings of the study are summarised below.

6.10.16. The methodology used to undertake the construction Noise and Vibration assessment for Part B is similar to that recommended in LA 111. The potential for changes to the conclusions of the construction noise and vibration assessment as a result of LA 111 is very low and therefore no further appraisal is necessary.

6.10.17. In relation to operational noise, it has been identified that LA 111 includes a number of key changes in the assessment methodology compared to HD 213/11 which it replaces. A number of the identified changes are considered unlikely to affect the conclusions of the operational road traffic noise and vibration assessment presented in this chapter. However, the following identified changes were considered to warrant further consideration:

a. Traffic speeds – For the derivation of vehicle speeds, LA 111 requires the use of pivoted traffic speeds rather than speed banding and pivoting as required by IAN 185/15.
b. Significance of effects – LA 111 requires that assessment is undertaken at facades of sensitive receptors experiencing the greatest magnitude of change between the do-minimum and Do-something scenarios in the Short -Term and Long-Term rather than the least beneficial change as was the case using the HD 213/11 guidance.

6.10.18. As part of the study, the operational road traffic noise levels and changes described in this chapter, were recalculated using pivoted (rather than pivoted and banded) speeds and reanalysed using the different approach to determine the representative noise change at each receptor (i.e. the façade with the greatest magnitude of change).

6.10.19. LA 111 (**Ref. 6.29**) notes that the short-term noise level changes should be used initially when determining potential EIA significant effects. It is therefore appropriate to compare the results of the short-term noise level changes following both HD 213/11 (**Ref. 6.20**) and LA 111 (**Ref. 6.29**) methodology. This analysis considers the different methods of selecting a representative noise change for each building as discussed above.

6.10.20. **Table 6-39** below shows a comparison between the results generated using the original HD 213/11 (**Ref. 6.20**) and IAN 185/15 methodology (**Ref. 22**) and the LA 111 (**Ref. 6.29**) methodology. For simplicity only the daytime results are presented in the following table for residential properties, the night time results follow broadly the same pattern.

**Table 6-39 - Short-term Magnitudes of Impact at Residential Properties for HD 213/11 and IAN 185/15 Methodology Compared to LA 111 Methodology**

| Adverse/Beneficial | Magnitude of Impact | HD 213/11 and IAN 185/15 Methodology | LA 111 Methodology |
|---|---|---|---|
| Beneficial | Major | 0 | 1 |
| | Moderate | 5 | 4 |
| | Minor | 7 | 20 |

| Adverse/Beneficial | Magnitude of Impact | HD 213/11 and IAN 185/15 Methodology | LA 111 Methodology |
|---|---|---|---|
| | Negligible adverse/beneficial and no change | 65 | 41 |
| Adverse | Minor | 0 | 11 |
| | Moderate | 0 | 0 |
| | Major | 0 | 0 |

**Significance of effects**

6.10.21. The following paragraphs focus on the potential for the LA 111 (**Ref. 6.29**) methodology to give rise to additional significant adverse noise effects which would result in a change in the conclusions of the Noise and Vibration assessment. Whilst it appears likely that LA 111 methodology would also increase the number of significant beneficial effects, these are less critical to the provision of mitigation.

6.10.22. LA 111 (**Ref. 6.29**) states that receptors with a minor short-term noise level change and which are also predicted to experience noise levels above the SOAEL have the potential to be significant. Following analysis of the calculated receptor noise levels, it is evident that, for the 11 receptors which are predicted to experience minor adverse short-term noise level changes, noise levels are below the SOAEL. The LA 111 (**Ref. 6.29**) methodology is therefore not expected to change the conclusions of the Noise and Vibration assessment presented within this chapter.

6.10.23. As highlighted by **Table 6-39**, there is an increase in minor and major beneficial magnitude of impacts.

6.10.24. Following HD 213/11 (**Ref. 6.20**), there were no dwellings predicted to experience major beneficial impacts as a result of Part B. Following the LA 111 (**Ref. 6.29**) methodology, there is 1 receptor which is predicted to experience a major beneficial impact.

**Proposed Mitigation**

6.10.25. Given that the LA 111 (**Ref. 6.29**) methodology does not change the conclusions of the noise and vibration assessment presented within this chapter with respect to significant adverse effects, the appraisal of mitigation measures is also not expected to change.

**Summary**

6.10.26. It is identified within this chapter that significant adverse effects are not predicted during the operational stage. It is expected that this assessment of significance will not change following the application of LA 111. Further consideration of mitigation is therefore expected not to be required following the application of LA 111.

**ASSESSMENT PARAMETERS**

6.10.27. **Chapter 2**: **The Scheme**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) presents the Assessment Parameters. **Table 6-40** below considers these in relation to the potential for each assessment parameter to change the conclusions of this chapter.

**Table 6-40 - Consideration of Assessment Parameters**

| Assessment Parameter | Brief Description | Justification |
|---|---|---|
| Parameter 1 | Up to a 650 mm increase or 250 mm decrease in height for Heckley Fence Accommodation Overbridge has been considered in order to accommodate a 400 mm increase in the depth of the structural beam and a 250 mm increase or decrease in the finished road levels on the A1. | As this bridge would not carry road traffic, the increase in bridge height does not include any alterations to the assessed road network and therefore would not change the operational stage assessments. This parameter does not change the location of the overbridge and would not result in changes to the construction stage assessments. Therefore, it is unlikely that this would alter the conclusions of this chapter. |
| Parameter 2 | Up to a 900 mm increase or 500 mm decrease in height of Charlton Mires Junction Overbridge has been considered in order to accommodate a 400 mm increase in the depth of the structural beam and a 500 mm increase or decrease in the finished road levels on the A1. Inclusion of a topsoil storage area within the Order Limits surrounding Charlton Mires Junction. | The increase in height of Charlton Mires Junction is not expected to significantly affect the propagation of operational road traffic noise or vibration and is therefore not expected to change the operational stage assessments. This parameter does not change the location of the junction and would not result in changes to the construction stage assessments. It is therefore unlikely that this would alter the conclusions of this chapter. |
| Parameter 3 | Realignment of the Northern Powergrid Circuit 7.5 km of 66 kV EHV transmission cable may be | It is expected that this parameter would not change the construction activities and locations as applied |

| Assessment Parameter | Brief Description | Justification |
|---|---|---|
| | provided within the new highway boundary, which would entail greater amount of permanent land take, but remove the need to interfere with private land after completion of the works as a result of the operation or maintenance of the cable. This option would mean a slightly different landscaping treatment within the wider highway boundary. | within the construction stage noise and vibration assessments. It is therefore unlikely that this parameter would change the conclusions of the construction noise and vibration assessments.<br>This parameter would not change the assessed road traffic network and therefore would not change the conclusions of the operational noise and vibration assessments. |

## 6.11. MONITORING

### CONSTRUCTION

6.11.1. As summarised within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), the main contractor would review the need for and scope of noise and vibration monitoring and reporting that is necessary to ensure and demonstrate compliance with all noise and vibration commitments and any CoPA section 61 consent(s).

### OPERATION

6.11.2. No monitoring is proposed to support the operational noise and vibration assessment.

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**Ref. 6.21** Department of Transport and Welsh Office (1988). Calculation of Road Traffic Noise

**Ref. 6.22** Highways England (2015). Interim Advice Note (IAN) 185/15 Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality and Volume 11, Section 3, Part 7 Noise.

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