

A1 Birtley to Coal House

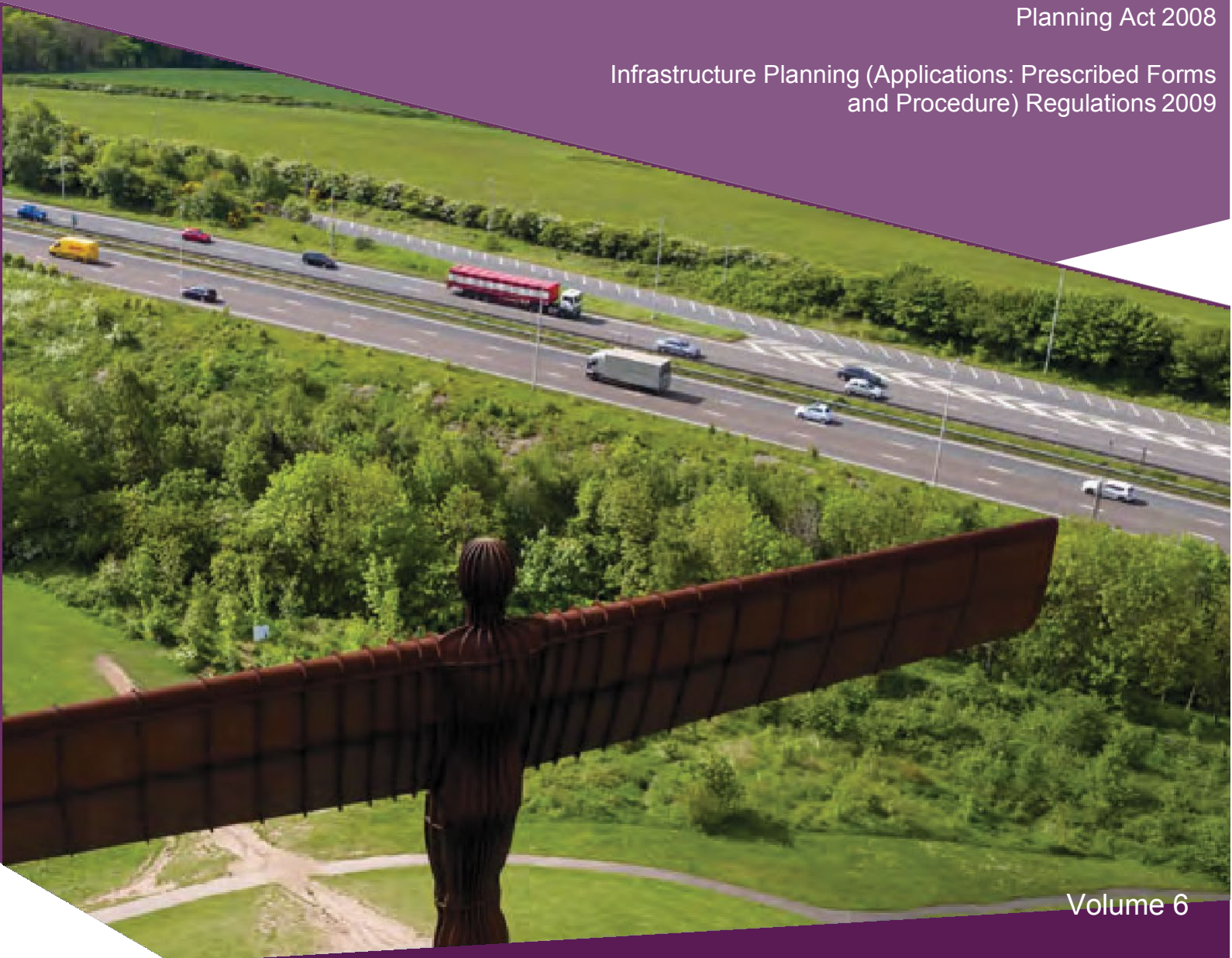
Scheme Number: TR010031

6.1 Environmental Statement Chapter 11 Noise and Vibration

APFP Regulation 5(2)(a)

Planning Act 2008

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



Infrastructure Planning

Planning Act 2008

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

**A1 Birtley to Coal House
Development Consent Order 20[xx]**

Environmental Statement

Regulation Reference:	APFP Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010031
Application Document Reference	TR010031/APP/6.1
Author:	A1 Birtley to Coal House Project Team, Highways England

Version	Date	Status of Version
Rev 0	14 August 2019	Application Issue

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11. NOISE AND VIBRATION

11.1. INTRODUCTION

- 11.1.1. This chapter reports the outcome of the noise and vibration assessment of the Scheme. This assessment has been carried out following the methodology set out in Design Manual for Roads and Bridges (DMRB) HD 213/11 (**Ref. 11.1**) and also accounting for the guidance contained within Interim Advice Note (IAN) 185/15 (**Ref. 11.2**). This chapter summarises the legislative and policy framework and describes the methodology followed for the assessment along with the assessment assumptions and limitations. The chapter identifies the potential impacts as a result of the Scheme, details the design, mitigation and enhancement measures that have been identified and reports the assessment of the significant effects of the Scheme. Details of monitoring that should be carried out for the Scheme are also provided. This chapter is intended to be read as part of the wider Environmental Statement (ES) and in conjunction with its associated figures and appendices.
- 11.1.2. The supporting figures to this chapter are **Figures 11.1-11.11** of this ES (**Application Document Reference TR010031/APP/6.2**). The supporting appendices to this chapter are **Appendices 11.1-11.17** of this ES (**Application Document Reference TR010031/APP/6.3**). A glossary of acoustic terms referred to in this chapter in **Appendix 11.1** of this ES (**Application Document Reference TR010031/APP/6.3**).
- 11.1.3. A full description of the Scheme is detailed in **Chapter 2 The Scheme (Application Document Reference TR010031/APP/6.1)**.

Allerdene Bridge Options

- 11.1.4. For this topic, the differences between Allerdene embankment option and Allerdene viaduct option, as detailed in **paragraphs 2.7.10 to 2.7.18** of this ES, affect the construction phase but not the operational phase noise and vibration assessment. The only difference between the options is the structure on which the road sits (the road alignment, width and elevation are identical). The differences between the options have no bearing on the operational phase assessments presented in this chapter, but both bridge options have been considered within the construction phase assessment.

11.2. COMPETENT EXPERT EVIDENCE

- 11.2.1. As detailed in **Table 11-1**, the professionals contributing to the production of this ES chapter have sufficient expertise to ensure the completeness and quality of this assessment.

Table 11-1 - Acoustic professional competence

Name	Role	Qualifications and professional membership	Expertise
<p>Jim Powlson - Associate Director (Specialist Consultants), WSP</p>	<p>Author</p>	<p>BSc (Hons) Audio Technology, First Class Member of the Institute of Acoustics (MIOA)</p>	<p>Over 15 years' experience in Acoustic consultancy and Environmental Impact Assessment (EIA). Preparation of Clyde Waterfront and Renfrew Riverside DMRB detailed stage noise and vibration assessment work (Renfrewshire Council 2016 – 2017). Preparation of Glasgow Airport Investment Area (GAIA) detailed stage noise and vibration assessment work (Renfrewshire Council 2016 – 2017). South East Manchester Multi Modal Strategy – A6 to M60 link, DMRB Detail Stage noise and vibration assessment (Stockport Council, 2017-2018).</p>
<p>Steve Fisher - Technical Director (Specialist Consultants), WSP</p>	<p>Reviewer</p>	<p>BA (Hons), Post Graduate Diploma in Acoustics and Noise Control Member of the Institute of Acoustics (MIOA)</p>	<p>Over 30 years' experience in Acoustic consultancy and EIA. Preparation of A1 Birtley to Coalhouse Stage 2 (Option Selection) Environmental Assessment Report Noise and Vibration chapter (Highways England, 2016 – 2017). Preparation of M3 junction 9 PCF Stage 2 Environmental Assessment Report Noise and Vibration chapter (Highways England, 2017 – 2018). Overseeing M27 junctions 4-11 Smart Motorway Stage 3 (Detailed Design) Environmental Assessment Report Noise and Vibration chapter (Highways England, 2017 – 2018).</p>

11.3. LEGISLATIVE AND POLICY FRAMEWORK

11.3.1. For a development of this nature, there is no specific all-encompassing legislation relating to all aspects of noise emission/noise impact. Noise legislation, where it does exist, tends to be either EC-derived and focused on specific items of noise-emitting plant or on more general

nuisance, such as that addressed by the provisions of the *Environmental Protection Act 1990* (**Ref. 11.3**).

- 11.3.2. In lieu of any all-encompassing legislation, assessing the effects of the Scheme during the construction and operational phases must draw on legislation and policy from a variety of sources. This assessment therefore makes reference to a number of legislative documents and local and national planning policy documents and other relevant guidance (refer to **paragraph 11.4.48**). Key documents are listed below with summaries of each document presented in **Appendix 11.2** of this ES (**Application Document Reference TR010031/APP/6.3**) Also presented below are tables summarising national and local policy objectives.

LEGISLATION

International

- a. Directive 2002/49/EC of the European Parliament – *Assessment and management of environmental noise* (better known as the Environmental Noise Directive - END) (**Ref. 11.4**).

- 11.3.3. This is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level. To pursue its stated aims, the END (**Ref. 11.4**) focuses on three action areas:

- a. The determination of exposure to environmental noise.
b. Ensuring that information on environmental noise and its effects is made available to the public.
c. Preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good.

National

- a. Control of Pollution Act (COPA) 1974 (**Ref. 11.5**)

- 11.3.4. The principal legislation covering demolition and construction noise is the CPA (1974) (**Ref 11.5**), Part III. Sections 60 and 61 of the Act give local authorities special powers for controlling noise arising from construction and demolition works, regardless of whether a statutory nuisance has been caused or is likely to be caused.

- a. Environmental Protection Act (EPA)1990 (**Ref. 11.3**)

- 11.3.5. Section 79 of the EPA (**Ref. 11.3**) 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.

- 11.3.6. Section 80 of the EPA (**Ref. 11.3**) (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.
- a. Land Compensation Act 1973 (LCA) (**Ref. 11.6**)
- 11.3.7. Part I of the LCA (**Ref. 11.6**) includes provision for compensation for loss in property value resulting from physical agents, including noise, linked to a new road scheme. Part II of the LCA is associated with the mitigation of injurious effect from public works, including noise from new roads.
- a. The Noise Insulation Regulations (NIR) 1975 (as amended 1988) (**Ref. 11.7**)
- 11.3.8. The NIR (1975) (**Ref. 11.7**) were made under powers inferred by Section 20 of Part II of the LCA (**Ref. 11.6**). Regulation 3 imposes a duty on authorities to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings, subject to meeting certain criteria given in the Regulation, as applicable in the case of new roads or carriageways. Regulation 4 provides 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 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.
- a. Environmental Noise (England) Regulations (2006) (S.I. 2006/2238) (EN(E)R) (**Ref. 11.8**)
- 11.3.9. These Regulations (as amended 2008, 2009, 2010) implement the END (**Ref. 11.4**). Under the END, strategic noise mapping of major roads, railways, airports and agglomerations has been completed across the UK.

POLICY

National

A summary of national policy relevant to the potential effects on noise and vibration is presented in **Table 11-2**.

Table 11-2 - Summary of national policy

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
<p>National Policy Statement for National Networks (NPS NN) 2014 (Ref. 11.9)</p>	<p><i>“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 (Ref. 11.10), National Planning Policy Framework (Ref. 11.11) and the Government’s associated planning guidance on noise.</i></p> <p><i>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.”</i></p> <p><i>“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:</i></p> <ul style="list-style-type: none"> <i>– Avoid significant adverse impacts on health and quality of life from noise as a result of the new development;</i> <i>– Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and</i> <i>– Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.”</i> 	<p>Due regard has been given to the NPSE (Ref. 11.10) as outlined above and the NPPF (Ref. 11.11) as outlined below, as well as associated guidance</p> <p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration impacts.</p> <p>Consideration has been given to noise mitigation options where any potential adverse impacts have been identified. Identified measures have been incorporated where appropriate.</p> <p>Enhancement measures have been considered along the length of the Scheme, with careful consideration given to balancing resulting effects with other disciplines (e.g. where a proposed acoustic barrier would reduce noise but could give rise to an associated visual impact).</p>

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
	<p><i>“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.”</i></p>	
<p>Noise Policy Statement for England 2010 (Ref. 11.10).</p>	<p><i>Paragraph 1.7 “Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:</i></p> <ul style="list-style-type: none"> – Avoid significant adverse impacts on health and quality of life; – Mitigate and minimise adverse impacts on health and quality of life; and – Where possible, contribute to the improvement of health and quality of life” <p>To assist in the understanding of the terms ‘significant adverse’ and ‘adverse’, the NPSE (Ref. 11.10) describes the following concepts that are currently being applied to noise impacts (paragraph 2.20):</p> <p><i>“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.”</i></p> <p><i>“LOAEL - Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.”</i></p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration impacts.</p> <p>Consideration has been given to noise mitigation options where any potential adverse impacts have been identified. Identified measures have been incorporated where appropriate.</p> <p>Enhancement measures have been considered along the length of the Scheme, with careful consideration given to balancing resulting effects with other disciplines (e.g. where a proposed acoustic barrier would reduce noise but could give rise to an associated visual impact).</p>

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
	<p><i>“SOAEL - Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.”</i></p>	
<p>National Planning Policy Framework 2019 (Ref. 11.11)</p>	<p><i>“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....”.</i></p> <p><i>“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:</i></p> <p><i>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;</i></p> <p><i>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;...”</i></p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration impacts.</p> <p>Consideration has been given to noise mitigation options where any potential adverse impacts have been identified. Identified measures have been incorporated where appropriate.</p> <p>Enhancement measures have been considered along the length of the Scheme, with careful consideration given to balancing resulting effects with other disciplines (e.g. where a proposed acoustic barrier would reduce noise but could give rise to an associated visual impact).</p> <p>Also, the assessment has included for the potential cumulative impacts of the Scheme operating simultaneously with the proposed Scotswood to North Brunton (SNB) Scheme.</p> <p>The completed assessment has considered tranquil recreational areas as noise sensitive receptors.</p>

Local/Regional

11.3.10. Whilst the Scheme is located solely within the Gateshead Council area, the noise Study Area for this assessment extends beyond this Council boundary into both the Sunderland City

Council and Newcastle City Council areas. Therefore, consideration has been given to local/regional planning policy pertinent to noise and vibration for each of these Local Planning Authorities. A summary of local/regional policy relevant to the potential effects on noise and vibration is presented in **Table 11-3**.

Table 11-3 - Summary of local/regional policy

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
Regional		
<p>The Core Strategy and Urban Core Plan for Gateshead and Newcastle Upon Tyne 2010-2030 (CSUCP) (Ref. 11.12)</p>	<p><i>“CS 14 Wellbeing and Health. The wellbeing and health of communities will be maintained and improved by:</i></p> <p><i>1. Requiring development to contribute to creating an age friendly, healthy and equitable living environment through:</i></p> <p><i>...[several points including]...</i></p> <p><i>iii. Preventing negative impacts on residential amenity and wider public safety from noise, ground instability, ground and water contamination, vibration and air quality...”</i></p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration effects including due regard to mitigation and enhancement measures.</p>
Local – Gateshead Council		
<p>The Gateshead Unitary Development Plan (Gateshead UDP) (Ref. 11.13)</p>	<p><i>“DC1 Environment. Planning permission will be granted for new development where it:</i></p> <p><i>...[several points including]...</i></p> <p><i>h) does not significantly pollute the environment with dust, noise, light, emissions, out-fall, or discharges of any kind.”</i></p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration effects including due regard to mitigation and enhancement measures.</p>
Local – Newcastle City Council		
<p>Saved policies from the Newcastle Upon Tyne Unitary Development Plan (Newcastle UDP)</p>	<p><i>“H2. Development which would harm the amenity of any dwelling, or group of dwellings will not be allowed. Impact on residential</i></p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration effects including due</p>

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
<p>(Ref. 11.14) as detailed in the Newcastle Development Plan Document (DPD) (Ref. 11.15)</p>	<p><i>amenity will be assessed with particular regard to:</i></p> <p>...[a number of points including]...</p> <p><i>e. ensuring that non-residential development and/or associated operations will not harm residential amenity through an increase in noise, disturbance, smells, fumes or other harmful effects.”</i></p> <p><i>“EN1.1. All development will be required to meet high standards of design in accordance with the following principles:</i></p> <p>...[a number of points including]...</p> <p><i>L. maximising the use of buildings, structures and land forms to screen noise sensitive development and spaces.”</i></p> <p><i>“POL7. Development which generates noise sufficient significantly [sic] to affect existing ambient sound or vibration levels in residential areas or other noise sensitive areas will only be allowed if it complies with the attenuation and monitoring requirements of the development control policy statement 22 - noise and vibration.”</i></p> <p>Paragraphs 1 to 5 of Development Control Policy Statement 22 (DCPS22) are concerned with noise sensitive development. Paragraphs 6 to 9 are duplicated as follows:</p> <p><i>“6. The City Council will not normally grant planning permission for new development</i></p>	<p>regard to mitigation and enhancement measures.</p> <p>The assessment has considered all residential properties within the Study Area, as well as other noise sensitive receptors.</p> <p>Mitigation and enhancement measures have been subject to design and optimisation prior to incorporation into the Scheme.</p> <p>The Scheme has been designed such that no receptors will be subject to significant adverse effects once operational.</p> <p>The appraisal of mitigation has included consideration to both treatment at source (low noise road surface) and intermediate measures (acoustic barriers).</p> <p>Construction phase mitigation would be secured through the Construction Environmental Management Plan (CEMP). An Outline CEMP has been produced as part of the Development Consent Order (DCO) Application (Application Document Reference TR010031/APP/7.4).</p>

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
	<p><i>proposals which are likely to be generators of noise and/or vibration where:</i></p> <ul style="list-style-type: none"> – New development is likely to generate levels of noise where it either increases the existing background noise level by more than 5 dBA; or – Cause the background level in the vicinity of noise sensitive properties to increase such that the noise exposure category of that vicinity is changed. <p><i>7. In all circumstances the City Council will take the following into account:</i></p> <ul style="list-style-type: none"> – The effectiveness of attenuation measures which can be provided to mitigate the levels of noise and/or vibration – Reduction of noise at source by, inter alia, improving the sound insulation of sensitive buildings; – Layout and design; and – Administrative measures e.g. limiting operating time of noise sources, restricting activities on the site. <p><i>8. Where either existing development causing noise or vibration might result in harm to proposed noise or vibration sensitive development, or where proposed development might generate potentially unacceptable levels of noise or</i></p>	

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
	<p><i>vibration, applicants will be required to provide an assessment of the likely impact and of the measures proposed to mitigate the impact.</i></p> <p><i>9. Agreements under Section 106 Town and Country Planning Act 1980 may be required to ensure effective long-term monitoring and compliance with planning conditions which may be imposed.</i></p>	
Local - Sunderland		
<p>City of Sunderland Unitary Development Plan (Sunderland UDP) (Ref. 11.16)</p>	<p><i>“EN5. Where development is likely to generate noise sufficient to increase significantly the existing ambient sound or vibration levels in residential or other noise sensitive areas, the council will require the applicant to carry out an assessment of the nature and extent of likely problems and to incorporate suitable mitigation measures in the design of the development. Where such measures are not practical, permission will normally be refused”.</i></p> <p><i>“T18 in all highway construction and improvement works special consideration will be given to:</i></p> <p><i>...[several points including]...</i></p> <p><i>(ii) implementation of landscaping, planting and other environmental improvements.”.</i></p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration effects including due regard to mitigation and enhancement measures.</p> <p>The Scheme has been assessed to consider all potentially significant effects that could arise during both the construction and operational phases.</p>

Highways England Policy

11.3.11. A summary of Highways England policy relevant to the potential effects on noise and vibration is presented in **Table 11-4**.

Table 11-4 - Summary of Highways England policy

Policy	Relevant policy objectives	Significance of impact of the Scheme on policy objective
<p>Road Investment Strategy (RIS) for the 2015/16 – 2019/20 Road Period (Ref. 11.7)</p>	<p>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. 11.7) 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 Noise Important Areas (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.</p> <p>All new and improved road schemes will, therefore, be expected to utilise low noise road surfaces as a default, and investigate noise attenuating barriers and other potential mitigation options, where practicable.</p>	<p>The Scheme has been designed to avoid giving rise to significant adverse noise and vibration effects.</p> <p>A low noise road surface is a committed mitigation measure for the Scheme and has been accounted for within the completed assessment.</p> <p>All NIAs falling within the operation phase noise Study Area have been considered within the appraisal, including the potential for noise mitigation as part of the delivery of the Scheme.</p>
<p>Highways England Delivery Plan (HEDP) (Ref. 11.8)</p>	<p>This plan reiterates that the Government has challenged Highways England to mitigate noise in at least 1,150 NIAs over RP1. Within the section entitled <i>Planning the long-term maintenance of the network</i>, there is reference that this will include ‘low noise surfacing of the network’ and that this will contribute significantly to achieving that target to mitigate 1150 NIAs.</p>	<p>As above.</p>
<p>Highways England Licence (Ref. 11.19)</p>	<p><i>"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."</i></p>	<p>As above.</p>

11.4. ASSESSMENT METHODOLOGY

SCOPE OF ASSESSMENT

- 11.4.1. A detailed assessment has been undertaken in accordance with DMRB HD 213/11 (**Ref. 11.1**).
- 11.4.2. The following aspects have been scoped in to the assessment:
- a. Construction noise on existing (and approved¹) noise sensitive receptors.
 - b. Diverted traffic noise (during construction) on existing (and approved¹) noise sensitive receptors.
 - c. Construction traffic noise on existing (and approved¹) noise sensitive receptors.
 - d. Construction vibration on existing (and approved¹) vibration sensitive receptors.
 - e. Operational road traffic noise on existing (and approved¹) noise sensitive receptors.
 - f. Operational road traffic induced airborne vibration on existing (and approved¹) vibration sensitive receptors.

APPROACH TO DESK STUDY

Existing Sensitive Receptors

- 11.4.3. Existing sensitive receptors within the Study Areas have been identified using AddressBase Plus[®] data and the results of the desk study.
- 11.4.4. The AddressBase Plus[®] data for the Study Areas has been processed with all entries allocated into the following categories:
- a. Residential
 - b. Temporary residential
 - c. Medical
 - d. Educational
 - e. Religious/place of worship
 - f. Community facilities sensitive
 - g. Community facilities other
 - h. Outdoor recreation parks
 - i. Not noise sensitive
 - j. Other
- 11.4.5. The approach adopted for processing these data is detailed in **Appendix 11.3** of this ES (**Application Document Reference TR010031/APP/6.3**). Data within the 'other' and 'non-sensitive' categories have been discarded from the assessment.

¹ E.g. a residential development that has planning approval but is yet to be constructed

- 11.4.6. The resulting residential dataset for the Study Areas has then been edited based on the results of the desk study (e.g. where no residential property has been identified, this entry has been removed, or where an additional residential property has been identified this has been added). This has included a review of the list of proposed developments (refer to **Appendix 15.2** of this ES (**Application Document Reference TR010031/APP/6.3**) to ensure that those major developments which have been granted planning approval, and subsequently built, are accounted for within the assessment.
- 11.4.7. In addition, manual corrections have been made, an example being that 'Joseph Swan Academy Playing Field' was categorised as 'Community Facilities – Sensitive', but has been reassigned to 'Outdoor recreation parks'.

Proposed/Approved Sensitive receptors

- 11.4.8. Consideration has been given to noise-sensitive developments which may have been granted planning permission since the last update of the AddressBase Plus® data, as well as planning applications for noise-sensitive development which have been made but are yet to be determined.
- 11.4.9. Paragraph A1.21 of DMRB HD 213/11 (**Ref. 11.1**) states:
- “Although noise calculations are based on future traffic flows, the impact of the changes can only be recorded for people living and using facilities in the affected area in the year the assessment is undertaken. Where planning permission for a residential development or any other sensitive receptor has been granted but for which construction has not started, the potential impacts on these locations should be estimated and reported separately.”*
- 11.4.10. As part of the wider assessment work, an update of the key planning applications list (i.e. those of a scale greater than a domestic level, for example) as prepared for the Scoping Report (**Ref. 11.20**) has been undertaken to include all development falling within Tier 1, 2 and 3 as per the PINS guidance. This includes all 'major development' and all Nationally Significant Infrastructure Projects (NSIPs), as submitted within the past three years. The uncertainty log has also been reviewed to incorporate any developments within 2km of the Scheme (refer to **Appendix 15.2** of this ES (**Application Document Reference TR010031/APP/6.3**)). This area is sufficient to fully encompass the area over which detailed receptor noise level calculations have been undertaken, the 'calculation area' (see **paragraph 11.6.10**).

NOISE MODELLING AND PREDICTION

- 11.4.11. The completed assessment work has necessarily drawn upon detailed modelling and prediction work, which has been undertaken following best practice and through the application of recognised calculation methods. Further detail on the adopted approaches can be found in **Appendix 11.4** of this ES (**Application Document Reference TR010031/APP/6.3**).

APPROACH TO ASSESSMENTS

- 11.4.12. As detailed within **Table 11-2** the aims of the Government's national noise policy (**Ref. 11.10**) are to avoid significant adverse impacts on health and quality of life, mitigate and minimise adverse impacts on health and quality of life; and where possible, contribute to the improvement of health and quality of life.
- 11.4.13. A noise level above the SOAEL (see **Table 11-2**) will be noticeable and disruptive and/or can cause adverse health effects. A noise level above the LOAEL (see **Table 11-2**) but below the SOAEL will increasingly cause changes in behaviour.
- 11.4.14. The term significant environmental effect is used within the EIA Directive (**Ref. 11.21**) to describe an environmental effect caused by a scheme that is of sufficient magnitude that it should be considered by the decision makers.
- 11.4.15. Consequently, the adopted assessment methodologies as described below, make a clear distinction as to whether the Scheme:
- a. Complies with national noise policy (appraisal against NOEL, LOAEL, and SOAEL).
 - b. Gives rise to significant environmental effects under the EIA Directive (**Ref. 11.21**) (i.e. whether an environmental effect is significant or not).

Compliance with National Policy – Defining NOEL, LOAEL and SOAEL

Construction Noise

- 11.4.16. The construction noise assessment has been undertaken based on the guidance contained within BS 5228-1:2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites. Part 1: Noise (BS 5228-1)* (**Ref. 11.22**).
- 11.4.17. Following this guidance, a series of construction noise level predictions have been undertaken for a sample of different anticipated working operations, and for a sample of the closest receptors to the Scheme and proposed construction compounds. Predictions have been undertaken for both the Allerdene embankment option and the Allerdene viaduct option as well as the initial enabling works associated with the relocation of the NGN facility.
- 11.4.18. Noise level predictions have been undertaken based on the methods detailed within BS 5228-1 (**Ref. 11.22**). These calculations have adopted source noise data selected from this Standard as well as plant types, numbers and associated 'on-times' as advised appropriate by the buildability support contractor. Further details are presented within **Appendix 11.5** of this ES (**Application Document Reference TR010031/APP/6.3**).
- 11.4.19. The results of the noise level predictions have been assessed by comparison against the NOEL, LOAEL, and SOAEL as defined in **Table 11-5**. The boundary between NOEL and LOAEL has been set at a level where the construction noise becomes the dominant source (where the construction noise level exceeds the existing level).
- 11.4.20. The SOAEL is set based on the ABC method as detailed within Section E3.2 (ABC assessment method) of BS 5228-1 (**Ref. 11.22**). The ABC method involves an assessment

category of A, B or C being applied to the receptor under consideration. This is selected according to the prevailing noise levels (in absence of the construction noise being appraised) for the period of assessment (e.g. day or night etc.). Each assessment category has associated assessment criteria applicable for works at different times. An exceedance of the assessment criteria indicates a potentially significant effect. Where the prevailing noise level is greater than that for which Category C applies, the assessment criterion equals the prevailing level.

- 11.4.21. The applicable ABC assessment criteria have therefore been used to define the SOAEL. These have been determined for each considered receptor drawing upon the results of the baseline noise survey.

Table 11-5 - Construction noise - effect level criteria

Construction noise level (x) ($L_{Aeq,T}$, dB)	Effect level
$x < \text{existing } L_{Aeq,T} \text{ noise level}$	NOEL
$\text{existing } L_{Aeq,T} \text{ noise level} < x < \text{applicable ABC assessment criteria}$	LOAEL to SOAEL
$\text{applicable ABC assessment criteria} < x$	SOAEL

Diverted Traffic Noise During Construction

- 11.4.22. 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 (i.e. NOEL, LOAEL and SOAEL – (see **Table 11-2**)) 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

- 11.4.23. A quantitative assessment of noise from construction traffic has been undertaken. This has included calculation of anticipated noise level changes along a sample of routes anticipated to be worst affected by construction traffic. Level changes of less than 1dB correspond to the NOEL based on the guidance contained within Table 3.1 of the DMRB HD 213/11 (**Ref. 11.1**) which is applicable to short term noise level changes. The effect level associated with changes above 1dB has been determined with consideration to the frequency of events, their duration and the overall magnitude of the change.

Construction Vibration

- 11.4.24. The construction vibration assessment has been undertaken based on the guidance contained within BS 5228-2:2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BS 5228-2) (**Ref. 11.23**). This guidance provides criteria that correspond both to different degrees of human response to vibration

and that apply to different kinds of structures. The human response criteria have been adopted in the assessment of impact on residential receptors, with the NOEL, LOAEL and SOAEL defined as detailed in **Table 11-6**.

- 11.4.25. Based on a review of the draft construction programme, construction phasing information provided by the buildability support contractor and the *Approval in Principle* (AIP) documents (**Ref. 11.24**) for key structures along the length of the Scheme, a sample of working operations with the potential to give rise to groundborne vibration have been identified (**Table 11.23**).
- 11.4.26. The distance of receptors to these working operations has been identified as well as the upper levels of vibration that may arise (based on stated confidence limits and the historic measurement data presented in BS 5228-2 (**Ref. 11.23**)). These have then been assessed based on **Table 11-6**, which applies to human perception.

Table 11-6 - Construction vibration - effect level criteria – human perception

Vibration level (x) (PPV, mm/s)	Effect level
$x < 0.3$	NOEL
$0.3 < x < 1.0$	LOAEL to SOAEL
$1.0 < x$	SOAEL

- 11.4.27. In addition, a potential impact has been identified on a retaining wall that forms part of the Bowes Railway SM. With respect to retaining walls, BS5228-2 (**Ref. 11.23**) suggests criteria of 10 mm/s at the toe and 40 mm/s at the crest '*should generally be adopted*' for '*slender and potentially sensitive masonry walls*', but also that where walls are in poor condition, the allowable values should be diminished, and that for continuous vibration the criteria should be reduced by a factor of 1.5 to 2.5 according to individual circumstances.
- 11.4.28. On the basis, for this receptor, vibration levels below 2mm/s at the toe correspond to the NOEL, levels between 2 and 4mm/s at the toe correspond to LOAEL to SOAEL and levels above 4mm/s at the toe correspond to SOAEL.

Road Traffic Noise

- 11.4.29. The assessment has been undertaken in accordance with the detailed assessment methodology contained with DMRB HD 213/11 (**Ref. 11.1**) which is summarised as follows:
- a. Consultation with the Environmental Health Departments of Gateshead Council and Newcastle City Council.
 - b. Completion of a series of Basic Noise Level (BNL) calculations for the full road traffic network considered within the Transport Assessment (TA) Report (**Application Document Reference: TR010031/APP/7.3**), and subsequent determination of the noise Study Area, calculation area, 1km boundary and wider area 50m buffers (as defined in

- paragraph 11.6.10).** BNLs have been determined following the methodology contained within the *Calculation of Road Traffic Noise* memorandum 1988 (CRTN) (**Ref. 11.25**).
- c.** Identification of noise and vibration sensitive receptors within the noise Study Area (see **paragraph 11.6.10**), including residential dwellings, schools, hospitals and designated areas, as well as NIAs.
 - d.** Completion of a detailed baseline noise survey with measurements at a sample of locations within the noise Study Area (see **paragraph 11.6.10**) and next to the local road network.
 - e.** Preparation of detailed road traffic noise models extending beyond the 1km boundary (see **paragraph 11.6.10**) for the following scenarios:
 - i.** Do Minimum (i.e. without the Scheme) Opening Year 2 (2023) – DM 2023.
 - ii.** Do Something (i.e. with the Scheme) Opening Year (2023) – DS 2023.
 - iii.** Do Minimum (i.e. without the Scheme) Design Year (2038) – DM 2038.
 - iv.** Do Something (i.e. with the Scheme) Design Year (2038) – DS 2038.
 - f.** Use of the above noise models to generate noise level change maps, and facilitate more detailed receptor specific noise level predictions within the calculation area (see **paragraph 11.6.10**).
 - g.** Preparation of noise level change contour maps for the noise Study Area (see **paragraph 11.6.10**).
 - h.** Use of the noise models to determine daytime and night-time receptor noise levels for the DM 2023, DS 2038, DM 2038 and DS 2038 scenarios.
 - i.** Determination of the receptor noise level changes for both daytime and night-time periods, for the comparisons required at the DMRB detailed assessment stage, that is:
 - i.** DM 2023 versus DM 2038 (Long-term change without the Scheme)
 - ii.** DM 2023 versus DS 2023 (Short-term change with the Scheme)
 - iii.** DM 2023 versus DS 2038 (Long-term change with the Scheme)
 - j.** Categorisation of the identified receptor noise level changes into change bands and preparation of the results in the tabular form required by the HD 213/11 (**Ref. 11.1**).
 - k.** Assessment of the receptor noise level change results by application of the HD 213/11 (**Ref. 11.1**) impact magnitude scales for both the short-term and long-term as applicable in each case (see **Appendix 11.2** of this ES (**Application Document**

² It should be noted that the DMRB HD 213/11 text refers to this assessment year as the 'baseline year'. To avoid confusion for the purpose of this assessment, the terminology used is 'opening year', and 'baseline year' is reserved for an assessment year specified prior to the Proposed Development opening. This is in order to make a clear differentiation between the noise assessment prediction model and the 'baseline survey'

Reference TR010031/APP/6.3)) and including consideration to the requirements of both national noise policy and *The EIA directive* (**Ref 11.21**).

- i.** Identification of affected routes outside the 1km boundary (see **paragraph 11.6.10**) including determination of the short-term and long-term noise level changes, and the number of receptors within 50m of these routes.
- m.** An assessment of noise nuisance by determination of the change in the percentage of people that would be bothered very much or quite a lot by road traffic noise both ‘with’ and ‘without’ the Scheme.
- n.** Qualitative consideration to road traffic noise impacts that could arise within the 1km boundary, but outside the calculation area (see **paragraph 11.6.10**).
- o.** Identification of the number of properties that would likely qualify under the NIR (**Ref. 11.7**) for noise insulation measures, or a grant in respect thereof, as a result of the Scheme.

11.4.30. Underpinning the above assessment work are detailed road traffic noise level calculations which have been undertaken for all identified receptors within the calculation area (see **paragraph 11.6.10**). Such calculations have been facilitated through the preparation of detailed computerised noise models. The approach to the noise modelling and prediction work is detailed within **Appendix 11.4** of this ES (**Application Document Reference TR010031/APP/6.3**).

11.4.31. The noise levels at each receptor have been used to determine the NOEL, LOAEL and SOAEL as detailed in **Table 11-7**.

Table 11-7 - Operational road traffic noise - effect level criteria

External noise level (x),		Effect level
Daytime (L_{A10,18h}), (façade, dB)	Night-time (L_{night,outside}), (Free-field, dB)	
x < 54.5dB	x < 40.0dB	NOEL
54.5dB < x < 67.5dB	40.0dB < x < 55.0dB	LOAEL to SOAEL
67.5dB < x	55.0dB < x	>SOAEL

11.4.32. The above effect levels have been determined for the DM 2023 and the DS 2023 and DS 2038 scenarios. Comparison of these results allows consideration of the change in effect levels that arise as a result of the Scheme overall.

Road Traffic Induced Airborne Vibration

11.4.33. As required by HD 213/11 (**Ref. 11.1**), the predicted residential receptor daytime 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 the Scheme. This assessment has been undertaken

for all residential receptors within the airborne vibration Study Area (see **paragraph 11.6.12**), which is defined as 40m from the Scheme and any other, 'affected' routes within the 1km boundary.

- 11.4.34. The assessment has been undertaken by application of the HD 213/11 (**Ref. 11.1**) 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 58dB $L_{A10,18h}$.
- 11.4.35. The approach to the determination of NOEL, LOAEL and SOAEL is therefore based on the criteria contained within **Table 11-7** but with the boundary between NOEL and LOAEL adjusted to 58dB $L_{A10,18h}$. This approach is summarised in **Table 11-8**.

Table 11-8 - Operational road traffic induced airborne vibration - effect level criteria (based on associated noise levels)

External noise level (x), façade dB	Effect level
Daytime ($L_{A10,18h}$)	
$x < 58\text{dB}$	NOEL
$58\text{dB} < x < 67.5\text{dB}$	LOAEL to SOAEL
$67.5\text{dB} < x$	>SOAEL

Compliance with EIA Regulations – Determining if effects are significant or not

- 11.4.36. Whether resulting environmental effects are significant or not has been determined by consideration to the resulting noise level changes or the NOEL, LOAEL and SOAEL, and the sensitivity of the receptor, but also with consideration to other factors such as the duration of impact, likely perception, context and circumstance where appropriate.

Construction Noise and Vibration

- 11.4.37. Given both the variable and finite nature of construction noise and vibration, whether an associated effect is significant or not has been determined with reference to the identified NOEL, LOAEL and SOAEL and the frequency/number of events, recognising that BS 5228-1 (**Ref. 11.22**) states:

“... 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.”

- 11.4.38. A significant effect has therefore been defined where the noise or vibration SOAEL is exceeded for 10 or more days (or nights) of working in any 15 consecutive days, or for a total number of days exceeding 40 in any 6 consecutive months.

- 11.4.39. This approach has been applied to high sensitivity receptors (e.g. dwellings or other buildings occupied by people undertaking noise or vibration sensitive activities).
- 11.4.40. Bespoke consideration has been given to other receptors, e.g. external recreation spaces where compliance with assessment criteria may be different in different areas, or footpaths where any criteria exceedance may only be experienced for a short period (i.e. as the user passes along that route).
- 11.4.41. The same approach has also been used in determining whether effects from changes in road traffic noise levels during possible traffic diversions or from construction traffic are significant or not.

Road Traffic Noise

- 11.4.42. The impact magnitude scales detailed within HD 213/11 (**Ref. 11.1**) for both the short-term (DM 2023 versus DS 2023) and long-term (DM 2023 versus DM 2038 and DM 2023 versus DS 2038) are presented in **Table 11-9** and **Table 11-10** respectively.

Table 11-9 - Operational road traffic noise - short-term impact magnitude

Noise change ($L_{A10,18h}$), dB	Impact magnitude
0	No Change
0.1 to 0.9	Negligible
1.0 to 2.9	Minor
3.0 to 4.9	Moderate
≥ 5.0	Major

Table 11-10 - Operational road traffic noise - long-term impact magnitude

Noise change ($L_{A10,18h}$), dB	Impact magnitude
0	No Change
0.1 to 2.9	Negligible
3.0 to 4.9	Minor
5.0 to 9.9	Moderate
≥ 10.0	Major

11.4.43. The determination of whether road traffic noise effects are significant or not has begun with the consideration to the magnitude of the noise level change in the short term. The approach adopted is detailed in **Table 11-11** (which incorporates the short term impact magnitude scale taken from **Table 11-9**). The identified 'likely significance' is then finalised through consideration of a combination of other factors or indicators, as detailed below **Table 11-11**, that provide additional context to the initial assessment.

Table 11-11 - Initial assessment of significance of effect (high sensitivity receptors)

Impact magnitude (short-term level change)	Short term noise level change (dB LA10,18h)	Likely significant effect¹
No Impact or Negligible	0.0 to 0.9 dB	Not Significant
Minor	1.0 to 2.9 dB	Likely to be Not Significant
Moderate	3.0 to 4.9 dB	Likely to be Significant
Major	5.0+ dB	Probably Significant
¹ Subject to consideration of a number of other factors/indicators		

11.4.44. The other factors that have been considered in the contextual assessment are as follows:

- a. Whether the short-term change is towards the bottom or top of the short-term noise level change band.
- b. The long-term change, with the Scheme (DM 2023 versus DS2 038) and without the Scheme (DM 2023 versus DM 2038) assessed based on the impact magnitudes in **Table 11-10**.
- c. The absolute noise levels with reference to the NOEL, LOAEL and SOAEL (which by design includes the sensitivity of the receptor).
- 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. The acoustic context, e.g. whether the Scheme 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.

11.4.45. The number of properties affected has not been considered as a factor in the final evaluation of significant effects. However, if significant environmental effects are predicted for a small

number of properties, this could be taken into account by the decision-maker when balancing overall the relative merits of the Scheme.

- 11.4.46. The emphasis when considering these contextual factors is whether the changes in noise would likely lead to changes in behaviour and response. This assessment has been undertaken by grouping together receptors that are similarly affected, rather than considering each receptor individually.
- 11.4.47. For external receptors covering a defined geographic area (e.g. parks or designated areas), the proportion of the site that is affected to different degrees has been considered. The overall judgement has been assessed by balancing the assessment results with the importance of the site and the duration of exposure for those who may visit the area.

Road Traffic Induced Airborne Vibration

- 11.4.48. The approach outlined above for road traffic noise has also been adopted in determining whether effects arising from road traffic induced airborne vibration are significant or not, but with this assessment limited to the airborne vibration Study Area (see **paragraph 11.6.12**).

DATA SOURCES

- 11.4.49. The following data sources have been used to inform the completed assessment:
- a. A site-specific 3D topographic model of the existing route corridor (including previous Metro Centre upgrades to the A1 north-west of junction 67 (Coal House).
 - b. The Scheme traffic data provided by the WSP Transportation team.
 - c. The Scheme traffic model uncertainty log (**Ref. 11.26**).
 - d. LiDAR Digital Terrain Model (DTM) with 1 and 2m spacing, the areas surrounding the Scheme where coverage was available.
 - e. OS Terrain5[®] data for the areas around the Scheme where LiDAR data were not available.
 - f. OS MasterMap[®] data for the Scheme and surrounding area, including buildings layer and kerb lines.
 - g. Information on local developments subject to planning submission/approval as presented in **Chapter 15 Cumulative and Combined Assessment** of this ES (**Application Document Reference TR010031/APP/6.1**).
 - h. Freely available aerial photography for the site.
 - i. Freely available street view photography for the site.
 - j. The 3D design for the Scheme being assessed including associated earthworks.
 - k. OS AddressBase Plus[®] data for the noise Study Areas.
 - l. Natural England databases for the identification of Areas of Outstanding Natural Beauty (AoNB), National Parks (NP), Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI).
 - m. English Heritage databases of Scheduled Monuments (SM).
 - n. The Highways England NIA database.
 - o. The results of the baseline noise survey and site observations.

- p.** Existing road surface information for the current A1 route corridor and on/off slips (north bound and south bound) provided by highway engineers A-one+.
- q.** Chapters 1 to 4 of this ES (**Application Document Reference TR010031/APP/6.1**) including the committed development list presented in Appendix 15.2 of this ES (**Application Document Reference TR010031/APP/6.1**).
- r.** The Gateshead Council planning portal to obtain additional information on approved residential planning applications.
- s.** Construction programme, working methods and plant detail provided by the buildability support contractor.
- t.** AIP (**Ref. 11.24**) documents for the main structures and retaining walls proposed along the length of the Scheme.
- u.** The outcome of the site visit and the associated baseline noise survey have also been used to inform the assessment. The details of the site visit and the noise survey are presented in **Appendix 11.6** and **Appendix 11.7** of this ES (**Application Document Reference TR010031/APP/6.3**).

POLICY AND GUIDANCE

- 11.4.50. A summary of applicable policy is presented in **Section 11.3** above.
- 11.4.51. It is necessary that the completed assessment draws upon applicable guidance from a number of different sources. Key documents are listed below with summaries of each document presented in **Appendix 11.2** of this ES (**Application Document Reference TR010031/APP/6.3**).
- a.** Planning Practice Guidance (PPG) (**Ref. 11.27**)
 - b.** BS 5228-1:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites. Part 1: Noise (BS 5228-1) (**Ref. 11.22**)
 - c.** BS 5228-2:2009+A1: 2014: Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration (BS 5228-2) (**Ref. 11.23**)
 - d.** DMRB HD 213/11 (**Ref. 11.1**)
 - e.** CRTN 1998 (**Ref. 11.25**)
 - f.** Transport Research Laboratory (2002). Converting the UK traffic noise index LA_{10,18hr} to EU noise indices for noise mapping (**Ref. 11.28**).

CONSULTATION

- 11.4.52. Whilst the Scheme is located solely with the Gateshead Council area, the operational traffic noise 1km boundary (see **paragraph 11.6.10**) extends into the Sunderland City Council area. Consultation has therefore been undertaken with the environmental health departments of both of these councils.
- 11.4.53. In accordance with DMRB HD 213/11 (**Ref. 11.1**) the dealing Environmental Health Officer (EHO) from each council were asked to provide/confirm:
- a.** Available information on known local sources of noise and vibration across the area, including those known to give rise to complaint.

- b.** Any specific noise or vibration related local planning policies.
- c.** National noise and vibration policies that are considered particularly relevant to the local area.
- d.** Any known local receptors, that could be particularly sensitive to noise and vibration (e.g. dwellings, medical facilities, research centres).
- e.** Sources of historic noise or vibration complaints.

11.4.54. To further assist, each Council was provided with web links to the Preliminary Environmental Information Report (PEIR) (**Ref. 11.29**) and the Scoping Report (**Ref. 11.20**), including the general arrangement drawings as contained within the PEIR, and were requested to provide comment on the noise and vibration assessment methodology which was proposed to be followed, as detailed within these documents.

11.4.55. The full details of the completed consultation can be found in **Appendix 11.8** and **Appendix 4.4** of the ES (**Application Document Reference: TR010031/APP/6.3**). Gateshead Council have responded confirming that their Environmental Health department are happy with the consultation details provided and that they offer no comments at this this time.

11.5. ASSESSMENT ASSUMPTIONS AND LIMITATIONS

11.5.1. The following key limitations are associated with the completed assessment work:

- a.** The completed assessment is based on a 'Do Something' scenario that includes for the effect of both the Scheme and the SNB Scheme. The effects of these Schemes are not included within the Do Minimum scenarios. The reported effects therefore represent a cumulative assessment as arising within the adopted Scheme Study Area. **Appendix 11.4** of this ES (**Application Document Reference: TR010031/APP/6.3**) details a series of validity checks that have been carried to confirm that this approach represents a worst-case.
- b.** Due to the extent of the Study Area, it has been necessary to make a number of assumptions in the noise modelling and prediction process, these include assumptions regarding building and storey heights. It should however be noted that at the core of the assessment is an appraisal of noise level changes, and the same assumptions have been applied in both the DM and DS noise models as used in the determination of the noise level changes. Further details on these assumptions are detailed within **Appendix 11.4** of this ES (**Application Document Reference: TR010031/APP/6.3**).
- c.** Night-time noise level predictions have been undertaken by application of day to night conversion factors. Method 3 as described within TRL report *Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping* (**Ref. 11.28**) has been adopted. Separate corrections have been applied to the individual noise level contributions from different road types, e.g. motorways and urban/suburban routes.
- d.** At this stage the precise details of the construction works including associated plant, working hours, programme and methodology are not known. The construction noise and vibration assessments are therefore necessarily based on a number of stated assumptions, and advice provided by the buildability support contractor.

- e. Due to the large size of the AddressBase® dataset, it has been necessary to group different classification codes into a smaller number of categories (see **Appendix 11.3** of this ES (**Application Document Reference: TR010031/APP/6.3**)).
- f. A number of 'global' settings have been necessary as part of the modelling exercise including ground absorption (see **Appendix 11.4** of this ES (**Application Document Reference: TR010031/APP/6.3**)).

11.5.2. The draft DCO contains powers of lateral and vertical deviation. The EIA has taken the Limits of Deviation (LoD) into account and the approach taken is described in **Chapter 4 Environmental Assessment Methodology, paragraph 4.5.4** of this ES (**Application Document Reference: TR010031/APP/6.1**). The outputs of the assessment are not considered likely to change materially as a result of the power of deviation.

11.6. STUDY AREA

11.6.1. Separate Study Areas have been adopted for each impact that has been assessed, to reflect the guidance applicable to that impact, and the likely geographic extent of potential associated significant effects.

CONSTRUCTION NOISE STUDY AREA

11.6.2. DMRB HD 213/11 (**Ref. 11.1**) 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 (Ref 4) that the impact of construction nuisance in one form or another, diminishes rapidly with distance.”

11.6.3. In addition, whilst Volume 11 Section 3 Part 3 of the DMRB *Disruption due to construction* has recently been withdrawn, this stated:

“Disruption due to construction is generally a more localised phenomenon than the impacts of a scheme once it has opened to traffic. One study has shown that at least half the people living within 50 metres either side of the site boundary were seriously bothered by construction nuisance in one form or another, but that beyond 100 metres less than 20% of the people were seriously bothered...”

11.6.4. Drawing upon the above text, the Study Area for construction noise has therefore been determined based on a 100m buffer around areas requiring construction works for the delivery of the Scheme, including proposed carriageway works, structure works and the proposed construction compounds.

11.6.5. The construction noise Study Area is presented in **Figure 11.1** of this ES (**Application Document Reference TR010031/APP/6.2**).

DIVERTED TRAFFIC NOISE DURING CONSTRUCTION STUDY AREA

11.6.6. The assessment of changes in road traffic noise levels during diversions has considered the extent of the proposed diversion routes.

CONSTRUCTION TRAFFIC NOISE STUDY AREA

- 11.6.7. The assessment of construction traffic has considered the local road traffic routes proposed to be used to access the site compounds (not the wider network where this traffic would be dispersed), and those routes linking the compounds with the works areas.

CONSTRUCTION VIBRATION STUDY AREA

- 11.6.8. The Study Area for construction vibration has been determined in the same way as for construction noise, but with the buffer distance extended from 100m to 200m, such that potential perception of groundborne vibration from percussive ground works (e.g. potential impact piling) is fully accounted for. Based on the historic groundborne vibration measurement data presented within BS5228-2 (Ref. 11.23) significant effects are not expected to arise beyond this distance.

- 11.6.9. The construction vibration Study Area is also presented in **Figure 11.1** of this ES (**Application Document Reference: TR010031/APP/6.2**).

OPERATIONAL ROAD TRAFFIC NOISE STUDY AREA

- 11.6.10. The Study Area for operational road traffic noise has been determined in full accordance with DMRB HD 213/11 (Ref. 11.1), as detailed in **Appendix 11.2** of this ES (**Application Document Reference: TR010031/APP/6.3**). Applying this guidance, the full noise Study Area comprises the following:

- a. The 1km boundary (a 1km buffer around the Scheme and any existing routes that are being bypassed or improved)
- b. The road traffic noise 600m 'calculation area' (a 600m buffer of all new and 'affected routes' within the 1km boundary. An 'affected route' is one where there is a possibility of a 1dB change in the short term (upon opening) or a 3dB change in the long term (to the future design year))
- c. The wider area 50m buffers (50m buffers around affected routes that are outside the 1km boundary)

- 11.6.11. The above are presented in **Figure 11.2** of this ES (**Application Document Reference TR010031/APP/6.2**).

OPERATIONAL ROAD TRAFFIC VIBRATION STUDY AREA

- 11.6.12. The Study Area adopted for the assessment of road traffic induced airborne vibration is the same as the noise calculation area, but with the 600m buffer reduced to 40m in accordance with DMRB HD 213/11 (Ref. 11.1). This Study Area is also presented in **Figure 11.2** of this ES (**Application Document Reference: TR010031/APP/6.2**).

11.7. BASELINE CONDITIONS

- 11.7.1. The baseline conditions have been established through a combination of consultation, a desk study, site visits and a baseline environmental noise survey.

SENSITIVE RECEPTORS

11.7.2. **Appendix 11.9** of this ES (**Application Document Reference: TR010031/APP/6.3**) provides details on the receptors that have been identified within the operational road traffic noise Study Area. Consideration has been given to both 'Address Based' receptors such as residential dwellings (including those that are both proposed / approved and existing) and 'Non Address Based' receptors such as NIAs, designated areas, footpaths and other cultural assets. A summary of the identified receptors is as follows:

- a. 5666 Residential.
- b. Three temporary residential.
- c. 15 Educational.
- d. Six Religious/place of worship.
- e. Seven Community facilities sensitive.
- f. Eight Outdoor recreation parks.
- g. 17 NIAs (of which 12 are within the Calculation Area, one is within the 1km boundary (but not within the calculation area), and 4 are within the wider area 50m buffers (but not within or overlapping the calculation area).
- h. Two SM's.
- i. Four key rights of way (of which one is both a Bridleway and a National Trail).
- j. 2 Other cultural assets (Longacre Wood and the Angel of the North).

BASELINE NOISE SURVEY

11.7.3. Whilst the operational road traffic noise assessment is based on calculated noise levels using the methodology detailed in CRTN (**Ref. 11.25**), in accordance with DMRB HD 213/11 (**Ref. 11.1**) it is also appropriate to establish the baseline noise conditions by measurement at a sample of locations in the vicinity of the Scheme.

11.7.4. A detailed baseline noise survey has therefore been undertaken to:

- a. Allow a comparison of the measured and predicted road traffic noise levels.
- b. Inform the selection of appropriate construction noise assessment criteria in accordance with BS 5228-1 (**Ref. 11.22**).

11.7.5. **Appendix 11.6** and **Appendix 11.7** of this ES (**Application Document Reference: TR010031/APP/6.3**) provide further information regarding the baseline noise survey, including:

- a. Survey approach and dates
- b. Measurement equipment
- c. Measurement locations (see **Figure 11.3** of this ES (**Application Document Reference: TR010031/APP/6.2**))
- d. Weather conditions

Survey Results

- 11.7.6. A full breakdown and summary of the baseline noise survey results is presented in **Appendix 11.11** of this ES (**Application Document Reference: TR010031/APP/6.3**). **Table 11-12** below details the measured noise level data adopted within this assessment.

Table 11-12 - Adopted baseline noise levels, free-field, dB(A)

Measurement Location / Type	LA_{10,18h}	L_{Aeq,12h} (daytime)	L_{Aeq,8h} (night-time)
A (continuous measurement)	74.8	73.9	68.7
B (continuous measurement)	66.1	66.0	60.1
1 (short term spot measurements)	-*	57.4	44.3
2 (short term spot measurements)	-*	55.6	54.0
3 (short term spot measurements)	-*	58.5	52.2
4 (short term spot measurements)	-*	63.5	56.4
* LA _{10,18h} noise level data only required from Locations A and B (model verification purposes) and not accurately determinable from short term spot measurements)			

MODELLED DO MINIMUM 2023

- 11.7.7. **Appendix 11.4** of this ES (**Application Document Reference TR010031/APP/6.3**) details the approach adopted in the completion of this noise modelling and prediction work.
- 11.7.8. **Table 11-13** presents a comparison of the predicted DM 2023 road traffic noise levels within the measurement results for Locations A and B (long-term monitoring locations).

Table 11-13 - Comparison of predicted DM 2023 road traffic noise levels with levels measured at Locations A and B, LA_{10,18h} free-field, dB

Measurement location	Measured level LA_{10,18h}	DM 2023 modelled level	Difference between measured and modelled levels
A	74.8	74.9	+0.1dB

Measurement location	Measured level LA10,18h	DM 2023 modelled level	Difference between measured and modelled levels
B	66.1	69.4	+3.3dB

11.7.9. It can be seen from **Table 11-13** that for both measurement locations, the measured and predicted road traffic noise levels are within approximately 3dB of each other, with a difference of only 0.1dB identified for Location A. As would be expected, given that the modelled results are for five years after the measurement results, the modelled results are slightly higher than the measured results. Overall, the comparison shows good correlation between measured and modelled results, sufficient to confirm the accuracy of the completed noise modelling work.

DM 2023 Road Traffic Noise

11.7.10. **Figure 11.4** of this ES (**Application Document Reference: TR010031/APP/6.2**) presents the resulting road traffic noise contour map generated from the DM 2023 noise model.

11.7.11. The DM 2023 noise model has also been used to predict noise levels at individual receptors within the calculation area (see **paragraph 11.6.10**). These have been categorised according to the NOEL, LOAEL and SOAEL effect levels for noise, as defined in **Table 11-7**. The results of these categorisations are presented in **Table 11-14**.

Table 11-14 - Noise – DM2023 - Number of receptors in each effect level

Effect level	Daytime (18 hours, 06:00 to 00:00)		Night-time (8 hours, 23:00 to 07:00)	
	Number of dwellings	Number of other receptors	Number of dwellings	Number of other receptors
NOEL	2093	7	960	3
LOAEL to SOAEL	3104	30	3883	32
>SOAEL	469	9	823	11

DM 2023 Road Traffic Induced Airborne Vibration

11.7.12. The DM 2023 noise model results have also been used to determine the equivalent results for airborne vibration based on the effect level definitions presented in **Table 11-8**, as applicable to this source. The results of these categorisations are presented in **Table 11-15** and are limited to dwellings within the airborne noise Study Area (see **paragraph 11.6.12**), and for the daytime period only, based on the requirements of DMRB HD 213/11 (**Ref. 11.1**).

Table 11-15 - Airborne vibration - DM 2023 - Number of dwellings in each effect level

Effect level	Daytime (18 hours, 06:00 to 00:00)
	Number of dwellings
NOEL	5
LOAEL to SOAEL	222
>SOAEL	97

MODELLED DO MINIMUM 2038 (FUTURE BASELINE)

11.7.13. The DM 2038 noise model has been used to determine the future baseline noise levels. This model is based on the baseline traffic flow data expanded to the design year (2038) in addition to flows associated with those developments that fall within the top two (most likely) bands of the *Proposed Developments Uncertainty Log (Ref. 11.26)*, but with the exception that the proposed SNB Scheme is not included³.

DM 2038 Road Traffic Noise

11.7.14. **Figure 11.5** of this ES (**Application Document Reference: TR010031/APP/6.2**) presents the resulting road traffic noise contour map generated from the DM 2038 noise model.

11.7.15. **Table 11-16** below presents the predicted DM 2038 noise levels for individual receptors categorised according to the NOEL, LOAEL and SOAEL effect levels for noise, as defined in **Table 11-7**. Presented in brackets are the change in numbers from the equivalent data for DM 2023 as taken from **Table 11-4**.

Table 11-16 - Noise - DM 2038 - number of receptors in each effect level, and change compared to DM 2023

Effect level	Daytime (18 hours, 06:00 to 00:00)		Night-time (8 hours, 23:00 to 07:00)	
	Number of dwellings	Number of other receptors	Number of dwellings	Number of other receptors
NOEL	1985 (-108)	6 (-1)	830 (-130)	1 (-2)

³ This Scheme is included within the DS models such that the impact assessment accounts for the cumulative (worst-case) effects of both the Scheme and SNB Scheme operating simultaneously.

Effect level	Daytime (18 hours, 06:00 to 00:00)		Night-time (8 hours, 23:00 to 07:00)	
	Number of dwellings	Number of other receptors	Number of dwellings	Number of other receptors
LOAEL to SOAEL	3128 (+24)	29 (-1)	3959 (+76)	30 (-2)
>SOAEL	553 (+84)	11 (+2)	877 (+54)	15 (+4)

- 11.7.16. It can be seen from **Table 11-16** that, without the Scheme, there is a general shift in the number of receptors towards higher effect levels. i.e. the number of receptors within the NOEL decreases over time, whilst the number of receptors above the SOAEL increases over time. Over the whole calculation area (see **paragraph 11.6.10**), a net increase in noise levels is therefore expected over time without the Scheme.
- 11.7.17. **Figure 11.6** of this ES (**Application Document Reference: TR010031/APP/6.2**) presents a noise level change contour map for the DM 2023 versus DM 2038 comparison, showing the areas where noise level increases and decreases are predicted to arise without the Scheme.
- 11.7.18. It can be seen that along the length of the Scheme, noise level changes are predicted to remain neutral (less than ± 1 dB). This is also identified to be the case for the majority of the surrounding area, although noise level increases of between circa 1 and 3dB are predicted to arise around a small number of local routes including:
- a. Saltwell Road South
 - b. Hertford
 - c. Chowdene Bank
 - d. Harlow Green Lane (southern end only close to Durham Road)
 - e. Trafford
 - f. The link between Durham Road and Hertford
 - g. Lamesley Road (between Hags Lane and Moor Mill Lane)
 - h. Banesley Lane
- 11.7.19. No notable areas are predicted to be subject to noise level decreases of more than 1dB.
- 11.7.20. In line with the guidance in DMRB HD 213/11 (**Ref. 11.1**), consideration has been given to the change in noise levels that would arise at individual receptors without the Scheme (DM 2023 versus DM 2038).
- 11.7.21. **Table 11-17** presents the numbers of receptors within the calculation area (see **paragraph 11.6.10**) subject to different noise level changes for this comparison.

Table 11-17 - Noise - DM 2023 vs DM 2038 - long-term road traffic noise level changes without the Scheme

Change in noise level		Daytime (18-hour 06:00 – 00:00)		Night-time (8-hour 23:00 – 07:00)
		Number of dwellings	Number of other receptors	Number of dwellings
Increase in noise level, L _{A10,18h} daytime, L _{night,outside} night-time (Adverse)	0.1 to 2.9	4559	34	552
	3.0 to 4.9	0	0	0
	5.0 to 9.9	0	0	0
	10.0+	0	0	0
No Change	0	320	4	146
Decrease in noise level, L _{A10,18h} daytime, L _{night,outside} night-time (Beneficial)	0.1 to 2.9	787	8	199
	3.0 to 4.9	0	0	0
	5.0 to 9.9	0	0	0
	10.0+	0	0	0

11.7.22. From **Table 11-17** it can be seen that for the baseline situation (without the Scheme), the majority of receptors would be subject to noise level increases, with smaller numbers associated with no change and decreases. However, noise level changes would be generally low, and are all predicted to be less than 3dB. The guidance contained within **Table 11-11** applies to short term noise level changes, not long term changes as considered in this ‘without scheme’ comparison. Notwithstanding this, applying this guidance as a worst case confirms that, without the Scheme, effects at all receptors would be **not significant**.

DM 2038 Road Traffic Induced Airborne Vibration

11.7.23. The DM 2038 noise model results have also been used to determine the equivalent results for airborne vibration for this scenario.

11.7.24. **Table 11-18** presents the predicted DM 2038 noise levels for individual receptors categorised according to the NOEL, LOAEL and SOAEL effect levels for airborne vibration, as defined in **Table 11-8**. Presented in brackets are the change in numbers from the equivalent data for DM 2023 as taken from **Table 11-15**.

Table 11-18 - Airborne vibration - DM 2038 - number of receptors in each effect level, and change compared to DM 2023

Effect level	Daytime (18 hours, 06:00 to 00:00)
	Number of dwellings
NOEL	2 (-3)
LOAEL to SOAEL	182 (-40)
>SOAEL	140 (+43)

- 11.7.25. It can be seen from **Table 11-18** that, without the Scheme, there is a general shift in the number of receptors towards higher effect levels. i.e. the number of receptors within the NOEL and NOEL to SOAEL decreases over time, but the number of receptors above the SOAEL increases over time. A net increase in airborne vibration levels is therefore expected over time.
- 11.7.26. **Figure 11.6** of this ES (**Application Document Reference TR010031/APP/6.2**) presents a noise level change contour map for the DM 2023 versus DM 2038 comparison including the airborne vibration Study Area. The noise level increases and decreases within the airborne vibration Study Area generally depict where increases and decreases in airborne vibration will also arise without the Scheme (provided that the absolute noise level is greater than 58dB LA_{10,18h}), which can be determined from **Figure 11.4** and **Figure 11.5** of this ES (**Application Document Reference TR010031/APP/6.2**).
- 11.7.27. It can be seen that along the length of the Scheme, changes are predicted to remain neutral (less than ± 1 dB). This is also identified to be the case for the majority of the surrounding area, although small increases are predicted to arise around a small number of local routes including:
- a. Saltwell Road South
 - b. Hertford
 - c. Harlow Green Lane (southern end only close to Durham Road);
 - d. The link between Durham Road and Hertford
 - e. Lamesley Road (between Hags Lane and Moor Mill Lane)
 - f. Banesley Lane
- 11.7.28. Without the Scheme, the majority of the local area is predicted to be subject to negligible increases in airborne vibration.
- 11.7.29. The change in airborne vibration nuisance without the Scheme (DM 2023 versus DM 2038) has also been assessed by considering predicted receptor daytime noise levels.

11.7.30. Predictions have been undertaken for all dwellings within the airborne vibration Study Area (see **paragraph 11.6.12**), with the resulting noise level changes categorised within **Table 11-19**.

Table 11-19 - Airborne vibration - DM 2023 vs DM 2038 - long-term road traffic noise level changes without the Scheme

Change in noise level		Daytime (18-hour 06:00 – 00:00)
		Number of dwellings
Increase in noise level, L _{A10,18h} daytime (Adverse)	0.1 to 2.9	283
	3.0 to 4.9	0
	5.0 to 9.9	0
	10.0+	0
No Change	0	18
Decrease in noise level, L _{A10,18h} daytime (Beneficial)	0.1 to 2.9	23
	3.0 to 4.9	0
	5.0 to 9.9	0
	10.0+	0

11.7.31. From **Table 11-19** it can be seen that for the baseline situation (without the Scheme), the majority of receptors would be subject to increases in airborne vibration, with small numbers associated with no change and decreases. However, all changes would be low, with all receptors subject to noise level changes of less than 3dB. The guidance contained within **Table 11-11** applies to short term changes, not long-term changes as considered in this ‘without scheme’ comparison. Notwithstanding this, applying this guidance as a worst case confirms that, without the Scheme, effects at all receptors are identified to be **not significant**.

11.8. POTENTIAL IMPACTS

11.8.1. Design, mitigation and enhancement measures that are incorporated into the Scheme and to be adopted during its construction are presented in **Section 11.9** below. Prior to the implementation of these measures, there is the potential for impacts to arise (adverse and beneficial). These are considered further below.

CONSTRUCTION PHASE

Construction Noise

- 11.8.2. The construction activities that would be required in the delivery of the Scheme include site mobilisation, site clearance, earthworks, retaining wall construction, bridge works (including formation of piers and abutments and placement of beams), central reserve hardening, road construction (pavement works) and bridge removal works (existing Allerdene Bridge).
- 11.8.3. These construction works would employ various methods including the use of plant such as cranes, excavators, dumper trucks, vibratory rollers, generators, and compressors. There are a number of noise sensitive receptors along the length of the Scheme that are within the construction noise Study Area as depicted in **Figure 11.1** of this ES (**Application Document Reference TR010031/APP/6.2**). A number of receptors are in close proximity to the Scheme and/or in the vicinity of structures such as Kingsway Viaduct, Allerdene Bridge, North Dene Footbridge, Longbank Bridleway Underpass, Eighton Lodge south underbridge and proposed retaining walls. More concentrated works can be expected at these localities.
- 11.8.4. Whilst the majority of construction works would be undertaken during daytime working hours, some out-of-hours working will be required, for example when night-time rail possessions are necessary for the removal of the existing Allerdene Bridge and formation of the new Allerdene Bridge.
- 11.8.5. Construction noise levels above the SOAEL are therefore anticipated to arise during some works. Whilst such impacts would be temporary, consideration has been given to mitigation measures within **Section 11.9** below.

Road Traffic Diversions During Construction

- 11.8.6. A number of temporary diversions will be required to facilitate the efficient delivery of the Scheme (see **Appendix 11.12** of this ES (**Application Document Reference: TR010031/APP/6.3**)). Some of these diversion routes pass existing noise sensitive receptors, so there is the potential for temporary impacts to arise.

Construction Traffic Noise

- 11.8.7. The Scheme will give rise to the generation of construction traffic which will access the site using the existing road network, passing existing noise sensitive receptors (see **Appendix 11.13** of this ES (**Application Document Reference: TR010031/APP/6.3**)). Therefore, there is the potential for temporary impacts to arise.

Construction Vibration

- 11.8.8. The construction of the Scheme will include the use of techniques that have the potential to give rise to groundborne vibration, such as piling works and the use of vibratory rollers. There are a number of vibration sensitive receptors along the length of the Scheme that are within the construction vibration Study Area as depicted in **Figure 11.1** of this ES (**Application Document Reference TR010031/APP/6.2**). Therefore, there is the potential for temporary

impacts to arise. Whilst such impacts would be temporary, consideration has been given to mitigation measures within **Section 11.9** below.

OPERATIONAL PHASE

Operational Road Traffic Noise

- 11.8.9. The Scheme has the potential to give rise to both short-term and long-term noise level changes at noise sensitive receptors.
- 11.8.10. Direct adverse impacts that could arise include those as result of changes in the route alignment (e.g. at Allerdene Bridge) and those arising from the additional lanes facilitated by the Scheme and associated lane re-alignment.
- 11.8.11. Direct beneficial impacts that could arise include noise level reductions arising from new / replacement low noise Thin Surface Course System (TSCS) on the A1 mainline and on/off slips, and new or enhanced acoustic screening.
- 11.8.12. Indirect impacts (both adverse and beneficial) include changing noise levels as a result of the redistribution of traffic on the surrounding road network once the Scheme is operational.
- 11.8.13. Given the potential for adverse impacts, consideration has been given to mitigation measures within **Section 11.9** below.

Road Traffic Induced Airborne Vibration

- 11.8.14. Noise level increases and decreases arising as a result of the Scheme could also give rise to a change in airborne vibration levels at local sensitive receptors. The mitigation measures identified for noise would also reduce potential airborne vibration impacts.

11.9. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

DESIGN

- 11.9.1. As detailed in **paragraph 2.7.1** of this ES the following mitigation measures have been incorporated into the design of the Scheme and these measures have therefore been accounted for in the determination of whether operational phase effects are significant or not:
 - a.** Installation of a TSCS for all sections of the A1 and slip roads up to the roundabouts but excluding the roundabout circulatory.
 - b.** Installation of an acoustic barrier next to the A1 north-bound carriageway, to tie into or overlap with the existing bund west of the northbound carriageway at Lockwood Avenue and provide a more continuous acoustic screen to the Birtley area, including North Dene and Crathie.
- 11.9.2. In addition, the Scheme design includes for a concrete centre reserve along the full length of the Scheme. This has been included within the completed noise modelling as an acoustic barrier of one metre in height.
- 11.9.3. The alignment of the acoustic barrier at Birtley is presented in **Figure 11.7a** of this ES (**Application Document Reference TR010031/APP/6.2**). Following a cost/benefit analysis,

the height of this barrier has been confirmed at 3m above local ground for its full length. This height is sufficient to ensure that the upper floor windows of adjacent two storey properties would be fully screened.

- 11.9.4. The above noise mitigation measures would also serve to mitigate potential airborne vibration impacts.

MITIGATION

Construction Phase

Construction Noise

- 11.9.5. The adoption of Best Practicable Means, as defined in Section 72 of the *Control of Pollution Act 1974* (**Ref. 11.5**), is usually the most effective means of controlling noise from construction sites. Such measures have been included within the Outline CEMP (**Application Document Reference TR010031/APP/7.4**), and include the following:
- a. The contractor and their sub-contractors would at all times apply the principle of Best Practicable Means (BPM) as defined in Section 72 of the Control of Pollution Act (**Ref. 11.5**) and carry out all work in such a manner as to avoid or reduce any disturbance from noise (and vibration).
 - b. Guidance given in BS 5228-1 (**Ref. 11.22**) (Section 8 - *Control of noise* and Annex B - *Noise sources, remedies and their effectiveness*) would be followed and advice and training on noise minimisation given to staff during site induction procedures.
 - c. All plant brought on to site would 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 (**Ref. 11.22**). Each plant item would be well maintained and operated in accordance with manufacturers' recommendations and in such a manner as to minimise noise emissions.
 - d. Electrically powered plant would be preferred, where practicable, to mechanically powered alternatives.
 - e. Sound reduced plant fitted with suitable silencers, or operated within enclosures would be used.
 - f. Pneumatic tools would be fitted with silencers or mufflers.
 - g. Deliveries to site would be programmed and routed to minimise disturbance to local residents.
 - h. Items of plant operating intermittently would be shut down in the periods between use.
 - i. Stationary plant would be located so that the noise effect at receptors is minimised and items of static plant would be noise attenuated using methods based on the guidance and advice given in BS 5228-1 (**Ref. 11.22**).
 - j. Careful selection of construction methods would be implemented, for example, breaking-out of concrete structures using low noise methods such as munching or similar, rather than percussion breaking.
 - k. Whilst remaining fit for purpose, the plant and equipment selected for use will be noise reduced/lowest noise emission models e.g. within the lower range of expected noise

emission levels based on the example data contained with BS5228-1 (Ref. 11.22). Particular care over plant selection would be taken for works required during out-of-hours/night-time periods, for example, associated with the formation of the new Allerdene Bridge and removal of the existing Allerdene Bridge, where night-time rail possessions are anticipated to be required.

- i.** Temporary acoustic barriers and other noise containment measures such as screens, sheeting and acoustic hoarding at the site boundary (and where required around individual plant) would be erected to minimise noise breakout and reduce noise levels at potentially affected receptors.
- m.** There would be a considerate and neighbourly approach to relations with local residents, with particular care given to the timing and regularity of works that are undertaken within any one area. For example, appropriate periods of respite will be allowed where the generation of high noise levels is unavoidable at sometimes, e.g. due to the proximity of works.
- n.** For out-of-hours/night-time works that are programmed for the formation of the new Allerdene Bridge and removal of the existing Allerdene Bridge (where rail possessions are anticipated to be required), local residents would be provided with advanced notice via means of a local letter drop, public notice or other such communication.
- o.** A construction noise monitoring programme would be undertaken for all out-of-hours work to install the new Allerdene Bridge and to remove the existing Allerdene Bridge. This programme will include an active feedback loop to the construction contractor by means of a visual or alert based system allowing live monitoring of compliance with appropriate construction noise criteria.
- p.** If a temporary significant noise (or vibration) effect cannot reasonably be prevented, and the works being undertaken are crucial to progressing the Scheme, liaison with the local authority would be undertaken to agree that best mitigation techniques are being applied and therefore that associated effects are minimised. This would include agreement with the local authority regarding the nature, timing and duration of works. Community consultation would also be carried out as appropriate.
- q.** The site manager, or other appointed site representative, would be responsible for logging all received environmental noise and vibration comments/complaints, as well as the action that is taken in response to each point raised, and whether this was successful. Where not successful, supplementary actions would be carried out and resulting effects logged. The contact details for the site representative would be openly advertised so that local residents have a point of contact in case of any issues arising. The site representative would be responsible for keeping an open line of contact with local residents and advising the timing and programming of potentially noisy works.

11.9.6. The above measures apply to the whole Scheme including both the Allerdene embankment option and the Allerdene viaduct option.

- 11.9.7. With the above measures in place, as much as a 10dB noise reduction can typically be achieved. For the purpose of this assessment a more conservative 5dB benefit has been assumed within the completed construction noise level predictions.
- 11.9.8. All of the above measures would be secured through the CEMP which would be prepared by the contractor and approved by the Secretary of State in consultation with the local authority. An Outline CEMP (**Application Document Reference TR010031/APP/7.4**) has been prepared as part of this application.

Construction Vibration

- 11.9.9. BPM would be implemented in order to minimise construction generated vibration. Many of the measures listed for noise above would also help to minimise vibration. In particular, all plant items would be properly maintained and operated according to manufacturers' recommendations and in such a manner as to avoid causing excessive vibration and methods of work would be chosen that create the least vibration.
- 11.9.10. A construction vibration monitoring programme would be undertaken where driven piling works are required, or where vibratory rollers are to be used in the immediate vicinity of sensitive receptors. This programme would include an active feedback loop to the construction contractor by means of a visual or alert based system allowing live monitoring of compliance with appropriate construction vibration criteria.
- 11.9.11. Where piling works are required for the extension of Longbank Bridleway Underpass, these would be completed using a rotary bored (i.e. non-impulsive) method. Monitoring would be carried out to identify if the retaining wall associated with Bowes Railway SM (1003723) is damaged during construction. The condition of the wall would be compared with the baseline condition detailed in **Appendix 6.3** of this ES (**Application Document Reference: TR010031/APP/6.3**). If any of the wall is damaged it would be repaired on a like for like basis using the agreed conservation strategy set out in **Section 6.9 of Chapter 6 Cultural Heritage** of this ES (**Application Document Reference: TR010031/APP/6.1**).
- 11.9.12. These mitigation measures would be incorporated into the CEMP.

Operational Phase

Road Traffic Noise

- 11.9.13. In addition to the design measures detailed within **paragraphs 11.9.1-11.9.3**, to the following measures have been considered:
- a. Potential changes to the existing 2.5m high acoustic barrier on the west side of the A1 junction 67 (Coal House) northbound on-slip at Lady Park.
 - b. Potential acoustic screening for Longacre Wood.
 - c. Potential acoustic screening for noise sensitive receptors in the vicinity of the A1 in general.
 - d. Potential mitigation/enhancement measures for NIAs.

- 11.9.14. A review of the existing acoustic barrier at Lady Park has identified that the new alignment of the northbound on-slip at junction 67 (Coal House) conflicts with the eastern end of the current barrier alignment. It is therefore proposed that the easternmost 45m of this barrier will be realigned to the back edge of the proposed slip road verge, (such that the full length of the barrier sits at the back edge of the carriageway. This is a slight change and the revised alignment for this barrier can be seen in **Figure 11.7b** of this ES (**Application Document Reference TR010031/APP/6.2**). This barrier will be retained with a height of 2.5m along its full length.
- 11.9.15. To assist in the identification of possible further mitigation/enhancement measures along the length of the Scheme, consideration has been given to both the noise level changes that are predicted to arise at identified receptors, as well as the resulting noise levels in absolute terms, including whether these levels would be above the LOAEL or above the SOAEL.
- 11.9.16. The following criteria have been applied in the determination of those areas which qualify for consideration of additional mitigation. These criteria have been derived such that mitigation is considered where significant adverse effects are likely to be registered (see **paragraphs 11.4.40 to 11.4.45**):
- a. Receptors where there is a DM 2023 v DS 2023 noise level increase of greater than 3dB or a DM 2023 v DS 2038 noise level change of greater than 5dB; and
 - b. A predicted free-field noise level of between 52.0 and 65.0dB LA_{10,18h} (free-field)⁴ in either the DS 2023 or DS 2038.
or
 - c. Receptors where there is a DM 2023 v DS 2023 or DM 2023 v DS 2038 noise level increase of greater than 1dB; and
 - d. A predicted noise level of greater than 65.0dB LA_{10,18h} (free-field)⁵ in either the DS 2023 or DS 2038.
- 11.9.17. The criteria are set such that further consideration has been given to mitigation where either:
- a. The noise level increase is moderate or greater and the noise level with the Scheme would fall in the between the LOAEL and the SOAEL or
 - b. The noise level change is greater than +1dB and the resulting DS 2023 or DS 2038 noise level is above SOAEL.
- 11.9.18. In addition, consideration has been given to whether neutral noise level changes, increases or decreases are predicted at NIAs.

⁴ Equivalent to between 54.5 and 67.5dB LA_{10,18h} façade (between the LOAEL and SOAEL).

⁵ Equivalent to equivalent to 67.5dB LA_{10,18h} façade, (SOAEL)

- 11.9.19. To facilitate consideration of the above criteria, the noise contour plots listed below have been prepared. These include for the benefits that would arise as a result of proposed TSCS, the Birtley barrier, the concrete central reserve and the changes to the Lady Park acoustic barrier.
- a. **Figure 11.8** of this ES (**Application Document Reference: TR010031/APP/6.2**) – Absolute noise level – DS 2023.
 - b. **Figure 11.9** of this ES (**Application Document Reference: TR010031/APP/6.2**) – Absolute noise level – DS 2038.
 - c. **Figure 11.10** of this ES (**Application Document Reference: TR010031/APP/6.2**) – Noise level change – DM 2023 v DS 2023.
 - d. **Figure 11.11** of this ES (**Application Document Reference: TR010031/APP/6.2**) – Noise level change – DM 2023 v DS 2038.
- 11.9.20. From **Figure 11.10** and **Figure 11.11** of this ES (**Application Document Reference: TR010031/APP/6.2**), it can be seen that noise level reductions are generally predicted along the length of the Scheme, which is as a result of the proposed TSCS and the Birtley barrier (see **paragraphs 11.9.1 to 11.9.3** and **2.7.1**). The degree of decrease is dependent upon both the projected DM and DS vehicle speeds, as well as the nature of the surface that is present in the DM scenarios, e.g. greater reductions arise where there is currently no low noise road surface, and at speeds where such a surface is more effective at reducing noise levels.
- 11.9.21. Noise level increases on the main route corridor are generally only predicted where alignment changes are proposed, e.g. at Allerdene Bridge, or in very close proximity to the mainline, where this is subject to widening.
- 11.9.22. A review of **Figures 11.8-11.11** of this ES (**Application Document Reference TR010031/APP/6.2**) has identified that, with the exception of the north-western portion of Longacre Wood, there are no areas where the above criteria are predicted to be exceeded (and therefore where significant effects are expected).
- 11.9.23. Noise level increases within NIAs on the mainline are limited to less than 1dB in the short term (negligible) and therefore not significant. For NIAs not on the A1, the potential for applying mitigation measures is limited, but in any case, increases within these NIAs are again limited to less than 1dB (negligible) and therefore not significant.
- 11.9.24. With regard to Longacre Wood, only a small portion of this receptor exceeds the criteria set out above and noise level increases generally remain low in this area. For the vast majority of the area comprising this receptor, the above criteria are met. When accounting for this receptor being subject to transient/short-term occupation for leisure purposes, e.g. dog walking, rather than being subject to permanent occupancy, resulting effects are **not significant** so further consideration to noise mitigation for this receptor is considered unwarranted.

11.9.25. Therefore, no further mitigation is warranted beyond the design measures detailed in **paragraphs 11.9.1-11.9.426**, and the minor realignment of the Lady Park barrier as detailed in **paragraph 11.9.14**.

Road Traffic Induced Airborne Vibration

11.9.26. The mitigation measures detailed above for road traffic noise would also serve mitigate potential road traffic induced airborne vibration.

11.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

CONSTRUCTION PHASE

Construction Noise

11.10.1. **Table 11-20** details the locations at which construction noise level predictions have been undertaken as well as the closest construction working areas to each location (as detailed in **paragraphs 2.9.3 – 2.9.65** in this ES) and the applicable daytime and night-time assessment criteria. These locations are also presented in **Figure 11.1** of this ES (**Application Document Reference TR010031/APP/6.2**).

Table 11-20 - Construction noise assessment locations and criteria

Assessment location	Construction working areas in the vicinity	Daytime ABC Criterion	Night-time ABC Assessment Criterion
1 - Willowbeds Farm (west of main compound)	NGN, 1, 3, 4, 6 and 8	A (65)	B (50)
2 - Lamesley Vicarage and Cottages (south of main compound)	1, 2, 4, 6 and 8	A (65)	B (50)
3 - Dwellings on Salcombe Gardens (north of Allerdene Bridge working compound)	NGN, 1, 2, 3, 4, 6, 7 and 8	A (65)	C (55)
4 - The Hawthornes, Eighton Lodge Residential Care Home and neighbouring dwellings (north-west of second compound)	1 and 8	B (70)	>C (56.4)
5 - Dwellings at Long Bank Northside (south of Longbank Bridleway working compound)	1, 5 and 8	B (70)	<C (60.1)
6 - Dwellings on the north side of Banesley Lane and Coach Road	3	C (75)	>C (68.7)
7 - Dwellings on the south side of Woodford	4 and 5	A (65)	C (55)
8 - Edrose Cottage and neighbouring dwellings at Low Eighton	5	B (70)	>C (56.4)
9 - Dwellings at Crathie	5	B (70)	>C (60.1)
10 - Dwellings at Northside (south of A1)	5	B (70)	>C (60.1)

Assessment location	Construction working areas in the vicinity	Daytime ABC Criterion	Night-time ABC Assessment Criterion
11 - South View, Northside (north of A1)	5	B (70)	>C (60.1)
12 - Dwellings on Bewicke View, Birtley	5	A (65)	C (55)

- 11.10.2. The Scheme would be constructed by a contractor who is yet to be appointed. Therefore, the techniques and technologies to be employed cannot be known with absolute certainty at this stage. To inform this assessment, the buildability support contractor has provided an example construction programme which included construction activities, ‘working teams’, associated plant, plant ‘on’ times and plant sound power level data for each working area/team.
- 11.10.3. This programme has been reviewed and a sample of reasonable worst case construction activity scenarios have been identified for appraisal. Calculations have been undertaken for both ‘worst’ and ‘average’ cases. The worst case assumes all plant associated with the applicable working teams operating at the closest part of the working area to each assessment location. The average case assumes the same works operating in the middle of each working area.
- 11.10.4. Full details can be found in **Appendix 11.5** of this ES (**Application Document Reference TR010031/APP/6.3**) including the calculated construction noise levels and an assessment of these levels (including a 5dB mitigation benefit) against the assessment criteria and the LOAEL and the SOAEL.
- 11.10.5. Daytime construction noise levels above the LOAEL and the SOAEL have been predicted to arise, but to ensure compliance with national policy, the noise mitigation measures detailed in **paragraph 11.9.5** will be adopted to minimise predicted adverse effects and avoid giving rise to levels above the SOAEL wherever possible.
- 11.10.6. **Table 11-21** details where the with mitigation noise levels remain above the SOAEL for the daytime period.

Table 11-21 - Predicted average and worst case daytime ‘with mitigation’ construction noise levels above the SOAEL

Construction works (see Chapter 2, paragraph 2.9.3)	Scenario (see Appendix 11.5)	Average case above the SOAEL	Worst case above the SOAEL
NGN Works	A	None	None
	B	None	None

Construction works (see Chapter 2, paragraph 2.9.3)	Scenario (see Appendix 11.5)	Average case above the SOAEL	Worst case above the SOAEL
	C	None	None
	D	None	None
	E	None	None
Site mobilisation	A	None	Locations 2 and 3
	B	None	Locations 2 and 3
	C	None	None
Works on the East Coast Main Line (ECML)	A	None	None
To and through the approach at junction 67 (Coal House)	A	None	None
	B	None	None
	C	None	None
	D	None	None
	E	None	None
Allerdene Bridge (Allerdene embankment option)	A	None	None
	B	None	None
	C	None	None
	D	None	None
	E	None	None
Allerdene Bridge (Allerdene viaduct option)	A	None	None
	B	None	None
	C	None	None
	D	None	None
	E	None	None
East of Allerdene Bridge to junction 65 (Birtley)	A	None	Locations 5, 9, 10, 11 and 12
	B	None	Locations 5, 9, 10, 11 and 12
	C	None	Locations 5, 10, 11 and 12
	D	None	Locations 5, 10, 11 and 12
Tie-in works	A	None	None

Construction works (see Chapter 2, paragraph 2.9.3)	Scenario (see Appendix 11.5)	Average case above the SOAEL	Worst case above the SOAEL
	B	None	None
	C	None	None
Removal of Allerdene Bridge and approaches	A	None	None
	B	None	None
Site demobilisation	A	None	None
	B	None	Locations 2 and 3

11.10.7. For the ‘average case’, which represents the majority of the construction period, noise levels are not predicted to be above the SOAEL for daytime working. The resulting effects are therefore **not significant**.

11.10.8. When considering the worst-case, which is representative of short periods where the works are undertaken in closest proximity to existing receptors, predicted levels mostly remain below the SOAEL. Levels above the SOAEL have however been identified to arise for a small number of scenarios, as follows:

- a. Site mobilisation – Scenario A (Site clearance) - Locations 2 and 3.
- b. Site mobilisation – Scenario B (Site entrance/car parks) - Locations 2 and 3.
- c. East of Allerdene Bridge to junction 65 (Birtley) – Scenario A (Harden reserve) - Locations 5, 9, 10, 11 and 12.
- d. East of Allerdene Bridge to junction 65 (Birtley) – Scenario B (Widening site clearance) - Locations 5, 9, 10, 11 and 12.
- e. East of Allerdene Bridge to junction 65 (Birtley) – Scenario C (Widening Earthworks) - Locations 5, 10, 11 and 12.
- f. East of Allerdene Bridge to junction 65 (Birtley) – Scenario D (Road Marking and finishes) - Locations 5, 10, 11 and 12.
- g. East of Allerdene Bridge to junction 65 (Birtley) – Scenario B (Reinstatement) - Locations 2 and 3.

11.10.9. However, the identified works at areas 1 and 8 are associated with the setup and reinstatement of the proposed construction compounds and would not arise for more than 10 days in any 15 day period, or more than 40 days in any 6 month period. Also, the reserve hardening and road marking and reinstatement work would be transient, moving along the Scheme as it progresses, such that the same time criterion would not be exceeded at any of the identified receptors.

- 11.10.10. The majority of the widening works (site clearance and earthworks) would be undertaken on the northside of the A1, whereas Locations 5, 9, 10, and 12 are all located on the south side of the road. Again therefore, the worst case works are not expected to occur for more than 10 days in any 15 day period or 40 days in any six month period.
- 11.10.11. The only remaining impact area is Location 11 (Bowes Incline) which is in close proximity to the required site clearance and widening works on the north side of the A1. There is therefore greater potential for the time criteria to be exceeded during the identified worst case works. However, one of the committed mitigation measures within **paragraph 11.9.5** is *“There would be a considerate and neighbourly approach to relations with local residents, with particular care given to the timing and regularity of works that are undertaken within any one area. For example, appropriate periods of respite will be allowed where the generation of high noise levels is unavoidable at sometimes, e.g. due to the proximity of works.”*
- 11.10.12. Taking into account the mitigation measures identified in **paragraph 11.9.5** above, the resulting effects are identified to be **not significant**.
- 11.10.13. In addition to daytime works, some evening and night-time works would be required. The majority of such out-of-hours works will be occasional, with each period associated with a limited area of works, for example an overnight closure to facilitate localised reserve hardening or road planing/surfacing, the removal of North Dene Footbridge or the installation of gantries. These works would be for no more than one to two nights or one weekend at any one time. Therefore, as defined in **paragraph 11.4.35** the resulting effects are **not significant**.
- 11.10.14. More regular out-of-hours works would be required in the vicinity of Allerdene Bridge, including ECML possessions to facilitate the removal of the existing Allerdene Bridge and also for temporary work and bridge beam installation for the new Allerdene Bridge. Up to 17 weekends of out-of-hours work may be required in the case of the Allerdene embankment option.
- 11.10.15. Additional construction noise levels predictions have therefore been undertaken for night-time construction works for the following aspects: Works on the ECML and Allerdene Bridge (as described in **Chapter 2** of this ES (**Application Document Reference TR010031/APP/6.1**)). The results of these predications are also presented and assessed in **Appendix 11.5** of this ES (**Application Document Reference: TR010031/APP/6.3**).
- 11.10.16. Night-time construction noise levels above the LOAEL and the SOAEL have been predicted to arise, but to ensure compliance with national policy, noise mitigation measures as detailed in **paragraph 11.9.5** would be adopted to minimise predicted adverse effects and avoid giving rise to levels above the SOAEL wherever possible.
- 11.10.17. **Table 11-22** below, details where the ‘with mitigation’ night-time noise levels remain above the SOAEL.

Table 11-22 - Predicted average and worst case ‘with mitigation’ night-time construction noise levels above the SOAEL

Construction works (see paragraph 2.9.3)	Scenario	Average case above the SOAEL	Worst case above the SOAEL
Works on the ECML	A	None	None
Allerdene Bridge (Allerdene embankment option)	A	Locations 1, 2, 3	Locations 1, 2, 3, 7
	B	Location 1	Location 1, 2, 3
	E	Locations 1, 2, 3, 7	Locations 1, 2, 3, 7
	F	None	Locations 1, 3, 7
Allerdene Bridge (Allerdene viaduct option)	A	Locations 1, 2, 3	Locations 1, 2, 3, 7
	B	Location 1	Location 1, 2
	D	Locations 1, 2, 3	Locations 1, 2, 3, 7
	E	Location 1	Locations 1, 2, 3, 7
	F	None	Locations 1, 3, 7

11.10.18. The worst case assessment considers the levels that would be generated when works are undertaken at the closest point to each considered location, which would be for just a few days in each case. The resulting effects from such worst case works are therefore **not significant**.

11.10.19. However, it remains that noise levels above the SOAEL have been identified to arise for a small number of the scenarios considered when undertaken at more typical separation distances (the average case), and which therefore have greater potential to arise over a longer period of time. These are as follows:

- a. Allerdene Bridge (Allerdene embankment option) – Scenario A (Site Clearance) – Locations 1, 2 and 3.
- b. Allerdene Bridge (Allerdene embankment option)– Scenario B (Earthworks) – Location 1.
- c. Allerdene Bridge (Allerdene embankment option) – Scenario E (Waterproofing/joints) – Locations 1, 2, 3 and 7.
- d. Allerdene Bridge (Allerdene viaduct option) – Scenario A (Site clearance) – Locations 1, 2 and 3.
- e. Allerdene Bridge (Allerdene viaduct option) – Scenario B (Excavation in front of piles) – Location 1.
- f. Allerdene Bridge (Allerdene viaduct option) – Scenario D (Bored piling) – Locations 1, 2 and 3.
- g. Allerdene Bridge (Allerdene viaduct option) – Scenario E (Pile cap) – Location 1.

- 11.10.20. Night-time works at Allerdene Bridge have the potential to arise for up to 17 consecutive weekends, with noise levels above the SOAEL identified for several different working scenarios.
- 11.10.21. At Location 7, noise levels above the SOAEL are only identified for one working scenario, so would be of short duration and **not significant**.
- 11.10.22. At Locations 1, 2 and 3 (Willowbeds Farm, Lamesley Vicarage and Cottages and dwellings on Salcombe Gardens), noise levels above the SOAEL are identified for several working scenarios so would occur more frequently and are therefore considered **significant**.

Road Traffic Diversions During Construction

- 11.10.23. A key principle in the development of the Construction Traffic Management Plan (Appendix B of the Outline CEMP (**Application Document Reference: TR010031/APP/7.4**)) has been to maintain at least two lanes of traffic in each direction on the A1, but with the usual exceptions for full closures, as required to facilitate some night working, off peak working and for certain other activities including changing from one TM scheme to another as the works progress.
- 11.10.24. When closures are required these will follow the Area 14 diversion routes that are currently in place. **Appendix 11.12** of this ES (**Application Document Reference TR010031/APP/6.3**) provides detail on these diversion routes (four northbound and four south bound) as well the number and duration of closures that are anticipated.
- 11.10.25. A total of approximately 45 closures are anticipated to be required in each direction, each using one or other of the eight diversion routes. However, these closures would be spread over the course of the three year construction programme and also over the local area.
- 11.10.26. For the most part, the diversion routes utilise existing main A roads, often dual carriageways. These routes are already subject to a reasonably high traffic flow which limits the proportional change in flow associated with their use under diversion conditions and reduces the potential for adverse effects. In addition, whilst some routes pass next to existing residential areas/receptors, some routes used for the diversions, for example Kingsway South and Kingsway North, pass through commercial/industrial areas (Team Valley Trading Estate) which are not noise sensitive, or pass through more rural areas that are more sparsely populated.
- 11.10.27. Regardless, the overarching factor is that diversion conditions on any given local route would constitute only a very small proportion of the full three-year construction programme. Therefore, effects as a result of traffic diversions would be **not significant**.

Construction Traffic Noise

- 11.10.28. A series of road traffic noise level calculations have been undertaken to determine the change in noise levels that would arise from construction traffic movements. Calculations have been undertaken for all 14 traffic 'gateways' leading to and from the site. Additional details can be found in **Appendix 11.13** of this ES (**Application Document Reference TR010031/APP/6.3**).

11.10.29. It has been identified that:

- a. Most construction related vehicles are anticipated to access the works site via the A1 from the north and south (gateways W01 and W09).
- b. The greatest predicted changes in noise levels are along the A1 south of the Scheme (north bound and south bound) and the B1296, for which changes of +0.1dB are identified (negligible, see **Table 11-9**).

11.10.30. On the basis set-out above it is considered that effects as a result of construction traffic would be **not significant**.

Construction Vibration

11.10.31. A review of available Scheme construction information has identified those works/areas and construction methods which by their nature have an increased risk of giving rise to perceptible levels of groundborne vibration at local receptors. These are presented in **Table 11-23**. This table includes consideration of both the Allerdene embankment option and the Allerdene viaduct option. The closest vibration sensitive receptor to each reference/working scenario has been identified.

11.10.32. Drawing on the historic measurement data detailed within BS 5228-2 (**Ref. 11.23**) and the empirical prediction procedures presented within this Standard as well as TRL RR 246: 1990: *Traffic induced vibration in buildings* (**Ref. 11.31**) (applicable to Heavy Vehicle induced vibration), and TRL Report 429: 2000: *Groundborne vibration caused by mechanical construction works* (**Ref. 11.32**) (as applicable to vibratory rollers), the distances at which the adopted human perception assessment criteria may be exceeded, have been determined for a sample of typical vibration operations. Additional detail is presented in **Appendix 11.14** of this ES (**Application Document Reference TR010031/APP/6.3**).

11.10.33. These distances have been used to determine the resulting effect levels for each scenario that has been appraised, with the results presented in **Table 11-23** below.

Table 11-23 - Construction vibration - key works effect level – human perception

Reference ¹	Structure	Anticipated form	Works	Source data	Closest receptor distance to works (m)	Effect level
A (NGN)	Divert intermediate pressure mains	Micro tunnel	Bored micro-tunnel	Rotary bored piling	180	NOEL
B (3)	Retaining Wall Structure 001 (north of junction 67 Coal House south-bound off-slip)	Precast reinforced concrete cantilever wall identified as preferred solution	Driven sheet piling works (temporary works to facilitate installation)	Piling – driven cast in place	55	SOAEL
C (3)	Retaining Wall Structure 002 (south of junction 67 north-bound on-slip)	Steel sheet piled retaining wall identified as preferred solution	Driven sheet piling	Piling – driven cast in place	40	SOAEL
D (3)	Kingsway Viaduct	Reinforced concrete piers/abutments with piled foundations	Driven sheet piling (temporary walls along banks of River Team)	Piling – driven cast in place	195	LOAEL

Reference ¹	Structure	Anticipated form	Works	Source data	Closest receptor distance to works (m)	Effect level
			Bored piling	Rotary bored piling	170	NOEL
E (3)	Retaining Wall Structure 005 (south of junction 67 Coal House south-bound on-slip)	Contiguous Bored Pile Wall identified as preferred solution	Bored piling	Rotary bored piling	210	NOEL
F1, Allerdene embankment option (4)	Allerdene Bridge	Reinforced concrete abutments with piled foundations	Driven sheet piling (for construction of abutments relative to live railway lines)	Piling – driven cast in place	165	LOAEL
			Bored piling	Rotary bored piling	165	NOEL
F2, Allerdene viaduct option (4)	Allerdene Bridge	Reinforced concrete abutments with piled foundations	Driven sheet piling to temporarily retain existing carriageway at northern and southern extents	Piling – driven cast in place	165	LOAEL

Reference ¹	Structure	Anticipated form	Works	Source data	Closest receptor distance to works (m)	Effect level
			Bored piling	Rotary bored piling	165	NOEL
G (5)	Widening of Eighton Lodge North Underbridge	Reinforced concrete wingwalls/abutments with piled foundations	Bored piling	Rotary bored piling	85	NOEL
H (5)	Widening of Eighton Lodge South Underbridge	Reinforced concrete wingwalls/abutments with concrete pad foundations, or piled foundations if ground conditions dictate	Bored piling	Rotary bored piling	170	NOEL
I (5)	Longbank Bridleway Underpass (extension to northern side)	Corrugated steel buried structure on reinforced concrete piled foundations	Bored piling	Rotary bored piling	82	NOEL
J (5)	North Dene Footbridge	New structural steel bow truss. Steel trestles/columns on south-west side, reinforce concrete bank seat on reinforced earth bank on north-east side.	Piling	Piling – driven cast in place	25	SOAEL

Reference ¹	Structure	Anticipated form	Works	Source data	Closest receptor distance to works (m)	Effect level
K (5)	Retaining Wall Structure 006 (south of junction 65 Birtley south-bound off-slip)	King post retaining wall identified as preferred solution	Bored piling	Rotary bored piling	25	LOAEL
L (2-6)	Along the length of the Scheme	Ground profiling and levelling works	Ground works including use of vibratory rollers.	Vibratory rollers	10	SOAEL

Notes:

1. Construction working area is identified in brackets after the reference

- 11.10.34. From **Table 11-23** it can be seen that for many of the considered construction working operations, vibration levels will remain below the LOAEL for human perception, but that levels above the LOAEL and the SOAEL have been predicted to arise in some cases. To ensure compliance with national policy, the vibration mitigation measures detailed in **paragraphs 11.9.5 and 11.9.9 to 11.9.10** will be adopted to minimise predicted adverse effects and avoid giving rise to levels above the SOAEL wherever possible.
- 11.10.35. Levels above the LOAEL are identified for some rotary bored piling works, with higher levels (i.e. above the SOAEL) only identified where driven piling works or vibratory roller works are undertaken in closest proximity to receptors. These works are summarised as follows:
- a. Driven piling works for Retaining Structure 001 – Working Area 3 – Receptors at Lady Park.
 - b. Driven sheet piling works for Retaining Structure 002 – Working Area 3 – Receptors at Lady Park.
 - c. Driven sheet piling works for North Dene Footbridge (SW side – Working Area 5 – Receptors at Crathie.
 - d. Use of vibratory rollers for ground profiling and levelling works – along the length of the Scheme – Receptors within 23m (various).
- 11.10.36. However, the duration of these works will be such that levels above the SOAEL would not arise at any given receptor for more than 10 days in any 15 day period, or more than 40 days in any six month period. Therefore, the resulting effect would be **not significant**.
- 11.10.37. In addition to the above appraisal based on human perception, a potential impact has been identified on a short section of retaining wall on the east side of the Longbank Bridleway Underpass (reference I (5)) in **Table 11-23**, that forms part of the Bowes Railway SM.
- 11.10.38. This section of retaining wall is approximately 40m in length, and it is proposed that the western-most 17m would be removed to facilitate the underpass extension. This will leave an approximate two metres distance between the eastern end of the underpass extension and the closest part of the wall to be retained. The nature of the underpass design is that the closest piling works (if required) to the section of wall to be retained would be at a distance of approximately three to four metres.
- 11.10.39. If required, piling works at this location would be undertaken following a rotary bored piling method. Based on the historic measurement data presented within BS5228-2, vibration levels approaching 2mm/s (LOAEL) would be expected at worst. It is also a mitigation measure within **Chapter 6 Cultural Heritage** of the ES (**Application Document Reference: TR010031/APP/6.1**) that the section of wall to be retained would be repaired and enhanced to offset the loss of the 17m section. The resulting effect would therefore be **not significant**.

OPERATIONAL PHASE

Road Traffic Noise

- 11.10.40. This Scheme has included a number of design measures to reduce noise levels. To ensure compliance with the principles of the NPSE, consideration has also been given to additional

noise mitigation/enhancement measures for the full Scheme extents, but as detailed in **paragraph 11.9.24** no such additional measures have been identified as warranted.

- 11.10.41. Including for the design measures detailed in **paragraphs 11.9.1 to 11.9.3** and **Figure 11.8 and Figure 11.9** of this ES (**Application Document Reference: TR010031/APP/6.2**) present the noise contour maps generated from the DS 2023 and DS 2038 noise models respectively.
- 11.10.42. **Table 11-24** presents the predicted DS 2023 noise levels for individual receptors categorised according to the NOEL, LOAEL and SOAEL effect levels. Presented in brackets are the change in numbers from the equivalent data for DM 2023 as taken from **Table 11-14**. **Table 11-25** presents the equivalent data for the DS 2038 scenario.

Table 11-24 - DS 2023 - Noise - number of receptors in each effect level, and change compared to DM 2023

Effect level	Daytime (18 hours, 06:00 to 00:00)		Night-time (8 hours, 23:00 to 07:00)	
	Number of dwellings	Number of other receptors	Number of dwellings	Number of other receptors
NOEL	2278 (+185)	8 (+1)	1100 (+140)	2 (-1)
LOAEL to SOAEL	3034 (-70)	31 (+1)	3931 (+48)	33 (+1)
>SOAEL	354 (-115)	7 (-2)	635 (-188)	11 (0)

Table 11-25 - DS 2038 - Noise - number of receptors in each effect level, and change compared to DM 2023

Effect level	Daytime (18 hours, 06:00 to 00:00)		Night-time (8 hours, 23:00 to 07:00)	
	Number of dwellings	Number of other receptors	Number of dwellings	Number of other receptors
NOEL	2136 (+43)	7 (0)	1016 (+56)	2 (-1)
LOAEL to SOAEL	3133 (+29)	29 (-1)	3927 (+44)	31 (-1)
>SOAEL	397 (-72)	10 (+1)	723 (-100)	13 (+2)

- 11.10.43. It can be seen that with the Scheme, there is a general shift in the numbers of receptors towards lower effect levels, i.e. the numbers of receptors within the NOEL and between the LOAEL and SOAEL generally increase, whilst the numbers of receptors within the SOAEL generally decrease. This demonstrates a clear beneficial effect as a result of the Scheme, with a net decrease in noise levels.
- 11.10.44. In line with the guidance in DMRB HD 213/11 (**Ref. 11.1**), as well as the absolute noise levels as appraised above, consideration has also been given to the change in noise levels that will arise at individual receptors with the Scheme, in both the short-term (DM 2023 vs DS 2023) and the long-term (DM 2023 vs DS 2038).
- 11.10.45. **Table 11-26** presents the numbers of receptors within the calculation area (see **paragraph 11.6.10**) subject to different noise level changes in the short-term.
- 11.10.46. **Table 11-27** presents the equivalent data for the long-term and also includes, in brackets, the change in receptor numbers compared to the scenario without the Scheme as taken from **Table 11-17** above.

Table 11-26 - Noise - DM 2023 vs DS 2023 - short-term road traffic noise level changes with the Scheme

Change in noise level		Daytime (18-hour 06:00 – 00:00)		Night-time (8-hour 23:00 – 07:00)
		Number of dwellings	Number of other receptors	Number of dwellings
Increase in noise level, LA _{10,18h} daytime, L _{night,outside} night-time (Adverse)	0.1 to 0.9	674	7	34
	1.0 to 2.9	2	2	0
	3.0 to 4.9	0	0	0
	5.0+	0	0	0
No Change	0	511	5	115
Decrease in noise level, LA _{10,18h} daytime, L _{night,outside} night-time (Beneficial)	0.1 to 0.9	3114	19	376
	1.0 to 2.9	1183	13	197
	3.0 to 4.9	101	0	50

Change in noise level	Daytime (18-hour 06:00 – 00:00)		Night-time (8-hour 23:00 – 07:00)
	Number of dwellings	Number of other receptors	Number of dwellings
5.0+	81	0	51

Table 11-27 - DM 2023 vs DS 2038 - long-term road traffic noise level changes with the Scheme

Change in noise level		Daytime (18-hour 06:00 – 00:00)		Night-time (8-hour 23:00 – 07:00)
		Number of dwellings	Number of other receptors	Number of dwellings
Increase in noise level, L _{A10,18h} daytime, L _{night,outside} night-time (Adverse)	0.1 to 2.9	2428 (-2131)	21 (-13)	305 (-247)
	3.0 to 4.9	0 (0)	0 (0)	0 (0)
	5.0 to 9.9	0 (0)	0 (0)	0 (0)
	10.0+	0 (0)	0 (0)	0 (0)
No Change	0	741 (+421)	3 (-1)	82 (-64)
Decrease in noise level, L _{A10,18h} daytime, L _{night,outside} night-time (Beneficial)	0.1 to 2.9	2357 (+1570)	22 (+14)	375 (+176)
	3.0 to 4.9	72 (+72)	0 (0)	41 (+41)
	5.0 to 9.9	68 (+68)	0 (0)	45 (+45)
	10.0+	0 (0)	0 (0)	0 (0)

11.10.47. Noise level increases are identified to be less than 3dB in all cases, whilst noise level decreases of more than 5dB are predicted to arise for some areas. Overall, a net decrease (benefit) in noise levels is identified due to the Scheme.

Noise Level Change Maps, NIAs and Wider Area

11.10.48. **Figures 11.10 and 11.11** of this ES (**Application Document Reference R010031/APP/6.2**) present the noise level change maps for the DM 2023 vs DS 2023 and DM 2023 vs DS 2038

comparisons respectively. These depict the short-term and long-term noise level increases and decreases that are predicted to arise with the Scheme, and cover the full 1km boundary (see **paragraph 11.6.10**).

- 11.10.49. The noise level changes at NIAs in the vicinity of the Scheme including outside the 1km boundary, are detailed in **Tables 10.1, 10.2 and 10.3** of **Appendix 11.10** of this ES (**Application Document Reference TR010031/APP/6.3**). Noise level increases for all NIAs in the vicinity of the Scheme are predicted to be less than 1dB in the short term (negligible) and therefore **not significant**.
- 11.10.50. NIA 2451 (Birtley), includes a notable cluster of properties at North Dene and Crathie that benefit from the Scheme, being subject to moderate to major noise level decreases, giving rise to an effect that is **significant (beneficial)**.
- 11.10.51. **Appendix 11.15** of this ES (**Application Document Reference TR010031/APP/6.3**) lists the affected routes that fall outside the 1km boundary, including the changes in BNL that are predicted for each of these routes, and the number of dwellings that have been counted within 50m. Relevant planning applications falling within the 50m buffers have also been identified.

Summary of Effects

- 11.10.52. **Table 11-28** presents a summary of the operational road traffic noise effects arising as a result of the Scheme.

Table 11-28 - Summary of operational road traffic noise effects

Receptor/receptor group/groups	Magnitude of impact	Significance of effect	Justification for significance of effect
Lady Park (NIA 2498)	No impact to negligible increases	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting noise level in absolute terms. Small noise level increases in the long-term on the south façades of these dwellings (facing away from the A1) are accounted for in the 'Banesley Lane' row of this table.
North Dene and Crathie area (area screened by proposed Birtley barrier) (NIA 2451)	Moderate to major decreases	Significant (beneficial)	In the long term, decreases will remain similar to those identified for the short term, but the associated impact magnitude is tempered to be 'moderate' beneficial. Such decreases remain significant. The assessment has also accounted for the high sensitivity

Receptor/receptor group/groups	Magnitude of impact	Significance of effect	Justification for significance of effect
			of the receptors, and the resulting noise level in absolute terms. The proposed acoustic barrier will introduce a perceptible noise reduction for many properties.
Harlow Green (north of Allerdene Bridge)	Negligible to minor decreases	Not significant	In the long term, decreases will remain similar to those identified for the short term, but the associated impact magnitude is tempered to be negligible. The resulting effect remains 'not significant'. The assessment has also accounted the high sensitivity of the receptors, and the resulting noise level in absolute terms.
Trafford Road Banesley Lane	No impact to negligible increases	Not significant	In the long term, increases will remain negligible. The resulting effect remains 'not significant'. The assessment has also accounted for the high sensitivity of the receptors, and the resulting noise level in absolute terms. Identified effects are as a result of natural traffic growth and are forecast to occur both with and without the Scheme.
Saltwell Road South Hertford Chowdene Bank Harlow Green Lane (southern end only close to Durham Road) The link between Durham Road and Hertford Lamesley Road (between Haggs Lane and Moor Mill Lane)	No impact to negligible decreases	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting noise level in absolute terms. Account has also been taken that these routes would be subject to small noise level increases or neutral changes without the Scheme.

Receptor/receptor group/groups	Magnitude of impact	Significance of effect	Justification for significance of effect
Longacre Wood	Negligible to minor increases	Not significant	In the long term, increases will remain similar to those identified for the short term, but the associated impact magnitude is tempered to be negligible. Account has been taken that this receptor is subject to only short-term temporary occupation (e.g. dog walkers), not permanent residence. The resulting effect is 'not significant'.
Bowes Incline (north of junction 65 (Birtley) – NIA 6633)	Negligible to Minor decreases	Not Significant	The hotel and residential receptors are of high sensitivity (less so the tennis court) and are within an NIA meaning that the existing levels are high. The minor changes at the hotel and residences fall within the lower part of the range for the short term and are reduced to be negligible in the long term. The identified reduction is therefore considered not significant.
Northside and The Brambles (NW of junction 65 (Birtley) – NIA 6633)	Negligible to minor decreases	Not significant	Whilst the receptors are of high sensitivity and are within an NIA meaning that the existing levels are high, the minor changes fall within the lower part of the range for the short term and the impact magnitude is tempered to be negligible in the long term. The identified reduction is therefore considered to be not significant.
Northside (SW of junction 65 (Birtley) – NIA 6633)	No change	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting noise level in absolute terms.
Other NIAs within the calculation area and 1km boundary	Negligible increases to negligible decreases	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting noise level in absolute terms.

Receptor/receptor group/groups	Magnitude of impact	Significance of effect	Justification for significance of effect
Remaining calculation and 1km boundary area	Negligible to minor decreases	Not significant	In the long term, decreases will remain similar to those identified for the short term, but the associated impact magnitude is tempered to be negligible. The assessment has also accounted for the high sensitivity of the receptors, and the resulting noise level in absolute terms.
NIAs within the wider area 50m buffers	No change to moderate decreases	Significant (beneficial)	Where no change is identified in the short term, Minor reductions are predicted to arise in the long term. The receptors are high sensitivity and are located within NIAs so are therefore subject to existing high levels. Where Moderate decreases are identified, these apply in the short term. The identified reductions are therefore considered significant.

- 11.10.53. Overall, it can be concluded that a net benefit would arise from the introduction the Scheme.
- 11.10.54. The areas with significant benefits include dwellings in North Dene and Crathie (NIA 2451), which would be screened by the proposed Birtley acoustic barrier (large noise level reductions are afforded).

Noise Nuisance Assessment

- 11.10.55. An assessment of the change in noise nuisance has also been undertaken in accordance with the requirements of DMRB HD 213/11 (Ref. 11.1). This is summarised in **Appendix 11.16** of this ES (**Application Document Reference TR010031/APP/6.3**). As expected, the results of the assessment of change in noise nuisance are aligned with the dwelling noise level changes as categorised within **Table 11-27**. The vast majority of dwellings fall within the no change and the lowest two nuisance change bands (0%, <10% and 10-20% increase or decrease), but with some properties subject to a decrease in nuisance within the higher 20-30% decrease band.

Noise Insulation Regulations Assessment

- 11.10.56. An initial assessment of the number of properties that might qualify for noise insulation measures (or a grant in respect thereof) under the NIR (Ref. 11.7), has also been undertaken. In order to qualify, all of the following criteria must be met:

- a.** Level - The highest total traffic noise level expected within the first fifteen years use of the road (the 'Relevant Noise Level') must be not less than the Specified Level of 68dB(A) $L_{A10,18h}$. Predicted noise levels of 67.5dB $L_{A10,18h}$ and above are rounded up to 68dB $L_{A10,18h}$;
- b.** Increase - The Relevant Noise Level in the design year, or within any other year between the year before the highway construction works commenced and the design year, must be at least 1dB(A) greater than that immediately before construction commenced (the 'Prevailing Noise Level');
- c.** Contribution - Noise from traffic on the road for which the Regulations apply must contribute at least 1.0dB $L_{A10,18h}$ to the Relevant Noise Level; and
- d.** Locality - The property under consideration must be within 300m of the Scheme.

11.10.57. On the basis of this initial assessment, no properties are considered likely to qualify under the NIR (Ref. 11.7).

Road Traffic Induced Airborne Vibration

11.10.58. Including for the design measures detailed in paragraphs 11.9.1 to 11.9.3, Table 11-29 presents the number of dwellings within the airborne vibration Study Area, categorised according to the NOEL, LOAEL and SOAEL. Presented in brackets are the change in numbers from the equivalent data for DM 2023 as taken from Table 11-15. Table 11-30 presents the equivalent data for the DS 2038 scenario.

Table 11-29 - DS 2023 – Airborne vibration - number of receptors in each effect level, and change compared to DM 2023

Effect level	Daytime (18 hours, 06:00 to 00:00)
	Number of dwellings
NOEL	12 (+7)
LOAEL to SOAEL	277 (+55)
>SOAEL	35 (-62)

Table 11-30 - DS 2038 – Airborne vibration - number of receptors in each effect level, and change compared to DM 2023

Effect level	Daytime (18 hours, 06:00 to 00:00)
	Number of dwellings
NOEL	5 (0)
LOAEL to SOAEL	273 (+51)
>SOAEL	46 (-51)

- 11.10.59. It can be seen that with the Scheme, as for noise, there is a general shift in the number of receptors towards lower effect levels, i.e. the numbers of receptors within the NOEL and between the LOAEL and SOAEL generally increase, whilst the number of receptors within the SOAEL decrease. This demonstrates a clear beneficial effect as a result of the Scheme with a net decrease in airborne vibration.
- 11.10.60. Consideration has also been given to the change in noise levels that will arise at individual receptors within the airborne vibration Study Area, with the Scheme, in both the short-term (DM 2023 vs DS 2023) and the long-term (DM 2023 vs DS 2038).
- 11.10.61. **Table 11-31** presents the numbers of dwellings within the airborne vibration Study Area subject to different noise level changes in the short-term (indicative of the change in airborne vibration). **Table 11-32** presents the equivalent data for the long-term and also includes, in brackets, the change in receptor numbers compared to the scenario without the Scheme as taken from **Table 11-19**.

Table 11-31 - Airborne vibration - DM 2023 vs DS 2023 - short-term road traffic noise changes with the Scheme

Change in noise level		Daytime (18-hour 06:00 – 00:00)
		Number of dwellings
Increase in noise level, L _{A10,18h} daytime (Adverse)	0.1 to 0.9	84
	1.0 to 2.9	0
	3.0 to 4.9	0
	5.0+	0
No Change	0	3
Decrease in noise level, L _{A10,18h} daytime (Beneficial)	0.1 to 0.9	24
	1.0 to 2.9	181
	3.0 to 4.9	4
	5.0+	28

Table 11-32 - Airborne vibration – DM 2023 vs DS 2038 - long-term road traffic noise changes with the Scheme

Change in noise level		Daytime (18-hour 06:00 – 00:00)
		Number of dwellings
Increase in noise level,	0.1 to 2.9	94 (-189)

Change in noise level		Daytime (18-hour 06:00 – 00:00) Number of dwellings
L _{A10,18h} daytime (Adverse)	3.0 to 4.9	0 (0)
	5.0 to 9.9	0 (0)
	10.0	0 (0)
No Change	0	9 (-9)
Decrease in noise level, L _{A10,18h} daytime (Beneficial)	0.1 to 2.9	189 (+166)
	3.0 to 4.9	6 (+6)
	5.0 to 9.9	26 (+26)
	10.0+	0 (0)

11.10.62. Noise level increases are identified to be less than 3dB in all cases, whilst noise level decreases of more than 5dB are predicted to arise for some areas.

11.10.63. Overall, a net decrease (benefit) in airborne vibration levels is identified due to the Scheme with the main cluster of benefitting properties being those at North Dene and Crathie. These receptors will be acoustically screened by the proposed Birtley acoustic barrier. Smaller benefits arise over the wider area as a result of the introduction of a TSCS along the length of the Scheme.

Summary of Effects

11.10.64. Given that the airborne vibration assessment is based upon the predicted noise levels and noise level changes, **Figures 11.8-11.11** of this ES (**Application Document Reference TR010031/APP/6.2**) have been used to determine where the adverse and beneficial effects are predicted to arise within the airborne vibration Study Area. A summary effects is presented in **Table 11-33**.

Table 11-33 - Summary of road traffic airborne vibration effects

Receptor/receptor group/ groups	Magnitude of impact	Significance of effect	Justification for significance of effect
Lady Park (NIA 2498)	No impact to negligible increases	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting

Receptor/receptor group/ groups	Magnitude of impact	Significance of effect	Justification for significance of effect
			levels in absolute terms. Small level increases in the long-term on the south façades of these dwellings (facing away from the A1) are accounted for in the in 'Banesley Lane' row of this table.
North Dene and Crathie area (area screened by proposed Birtley barrier) (NIA 2451)	Moderate to major decreases	Significant	In the long term, decreases will remain similar to those identified for the short term, but the associated impact magnitude is tempered to be 'moderate' beneficial. Such decreases remain significant. The assessment has also accounted for the high sensitivity of the receptors, and the resulting level in absolute terms. The proposed acoustic barrier will introduce a perceptible reduction for many properties.
Banesley Lane	No impact to negligible increases	Not significant	In the long term, increases will remain negligible. The resulting effect remains 'not significant'. The assessment has also accounted for the high sensitivity of the receptors, and the resulting levels in absolute terms. Identified effects are as a result of natural traffic growth and are forecast to occur both with and without the Scheme.
Saltwell Road South Hertford Harlow Green Lane (southern end only close to Durham Road) The link between Durham Road and Hertford	No impact to negligible decreases	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting level in absolute terms. Account has also been taken that these routes would be subject to small level increases or neutral changes without the Scheme.

Receptor/receptor group/ groups	Magnitude of impact	Significance of effect	Justification for significance of effect
Lamesley Road (between Hags Lane and Moor Mill Lane)			
Longacre Wood	No impact	Not significant	There is no associated structure to be affected.
Northside and The Brambles (NW of junction 65 Birtley– NIA 6633)	Negligible to minor decreases	Not significant	Whilst the receptors are of high sensitivity and are within an NIA meaning that the existing levels are high, the minor changes fall within the lower part of the range for the short term and the impact magnitude is tempered to be negligible in the long term. The identified reduction is therefore considered to be not significant.
Other NIAs within the calculation area and 1km boundary	Negligible increase to negligible decreases	Not significant	The same impact magnitude is also identified to arise in the long term. The assessment has also accounted for the high sensitivity of the receptors, and the resulting level in absolute terms.

Airborne Vibration Nuisance Assessment

11.10.65. An assessment of the change in airborne vibration nuisance has also been undertaken in accordance with the requirements of DMRB HD 213/11 (**Ref. 11.1**). This is summarised in **Appendix 11.17** of this ES (**Application Document Reference TR010031/APP/6.3**). As expected, the results of the assessment of change in airborne vibration nuisance are aligned with the dwelling noise level changes as categorised within **Table 11-32**. The vast majority of dwellings fall within the no change and the lowest two nuisance change bands (0%, <10% and 10-20% increase or decrease), but with some properties subject to a decrease in nuisance within the higher 20-30% decrease band.

11.11. MONITORING

11.11.1. It is a committed mitigation measure that construction noise monitoring would be undertaken during out-of-hours (evening and night-time) construction works associated with the delivery of the new Allerdene Bridge. This would include during both the removal of the existing Allerdene Bridge and the construction of the new Allerdene Bridge.

- 11.11.2. Construction vibration monitoring would also be undertaken where driven piling works are required, or where vibratory rollers are to be used in the immediate vicinity of sensitive receptors.
- 11.11.3. These surveys would include for an active feedback loop to the construction contractor so that the noise and vibration levels being generated in practice (and their associated effects) can be monitored, minimised and checked against the assessment criteria.
- 11.11.4. The delivery of this monitoring will be secured by being a specific requirement of the CEMP.

Table 11-34 - Summary of effects – noise and vibration

Potential impact	Nature of impact permanent/ temporary	Significance of potential impact	Proposed mitigation and delivery mechanism	Proposed enhancements	Significance of residual effect	Monitoring requirements
Noise and Vibration						
Construction Phase						
Construction noise	Temporary	Daytime works - not significant Night-time Works – Significant at Willowbeds Farm, Lamesley Vicarage and Cottages and dwellings on Salcombe Gardens	Adoption of BPM (to be specified within CEMP).	N/A – not currently present	Daytime - Not Significant Night-time Works – Significant at Willowbeds Farm, Lamesley Vicarage and Cottages and dwellings on Salcombe Gardens	A construction noise monitoring programme would be undertaken for out-of-hours works associated with the removal of the existing Allerdene Bridge and the construction of the new Allerdene Bridge.
Construction vibration	Temporary	Not Significant	Adoption of BPM including kept section of Bowes Railway retaining wall to be propped and supported	N/A – not currently present	Not Significant	A construction vibration monitoring programme will be undertaken where driven piling works are required, or where vibratory rollers

Potential impact	Nature of impact permanent/ temporary	Significance of potential impact	Proposed mitigation and delivery mechanism	Proposed enhancements	Significance of residual effect	Monitoring requirements
			during any necessary adjacent piling (to be specified within CEMP).			are to be used in the immediate vicinity of sensitive receptors.
Road traffic noise during diversions	Temporary	Not Significant	None required	N/A – not currently present	Not Significant	None required
Construction traffic noise	Temporary	Not Significant	None required	N/A – not currently present	Not Significant	None required
Operational Phase						
Road traffic noise	Permanent	Significant (Beneficial)	Proposed 3m acoustic barrier for NIA 2451 incorporated as part of Scheme design	Thin Surface Course System (low noise surface) incorporated for full length of A1 mainline including on and off slips. 1m high concrete central reserve.	Significant (Beneficial)	None required

Potential impact	Nature of impact permanent/ temporary	Significance of potential impact	Proposed mitigation and delivery mechanism	Proposed enhancements	Significance of residual effect	Monitoring requirements
Road traffic induced airborne vibration	Permanent	Significant (Beneficial)	Proposed 3m high acoustic barrier for NIA 2451 incorporated as part of Scheme design	Thin Surface Course System (low noise surface) incorporated for full length of A1 mainline including on and off slips. 1m high concrete central reserve.	Significant (Beneficial)	None required

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