Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

Environmental Statement

Volume 2

Chapter 17: Noise and Vibration

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Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

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17. Noise and Vibration

17.1 Introduction

1) This chapter presents an assessment of the likely significant effects of the Proposed Bowland Section on noise and vibration.

2) The report begins by reviewing the legislation and planning policies relevant to noise and vibration. The assessment area and methodology for the assessment are then outlined. The nature, value and sensitivity of the existing baseline environment are then identified before an assessment is made of the potential effects of the Proposed Bowland Section on noise and vibration. The design includes embedded mitigation as part of the design to avoid, reduce or offset potential noise and vibration effects, and the Construction Code of Practice (CCoP) includes good practice measures to be implemented during construction. Embedded mitigation and good practice measures were included in the assessment, along with additional essential mitigation measures that were identified.

3) This chapter is supported by the following technical appendices and figures:

- Appendix 17.1: Legislation, Policy & Guidance Summary
- Appendix 17.2: Construction Assessment Approach & Scenarios
- Appendix 17.3: Baseline Sound Levels Review Report
- Appendix 17.4: Construction Vibration and Blasting
- Figure 17.1: Baseline Sound Level Monitoring Locations

17.2 Scoping and Consultations

17.2.1 Scoping

4) A noise and vibration chapter was included within the EIA Scoping Report, which was submitted to the relevant planning authorities in October 2019. An Addendum to the EIA Scoping Report was submitted in February 2021 due to design changes and refinements. The Addendum included reference to updated guidance contained in the Design Manual for Roads and Bridges (DMRB) LA 111 – noise and vibration[1] and the approach to baseline data gathering during the COVID-19 pandemic.

5) No comments regarding the noise and vibration chapter were received from Lancaster City Council or Ribble Valley Borough Council on the EIA Scoping Report.

17.2.2 Consultation

6) During the course of this assessment, consultation has taken place with Lancaster City Council and Ribble Valley Borough Council. The following additional consultation took place between October 2019 and August 2020:

- October 2019 – the approach to baseline sound-level monitoring and the proposed measurement locations were shared with Lancaster City Council and Ribble Valley Borough Council
- February 2020 – a modification to the assessment approach presented in the EIA Scoping Report, due to emerging guidance, was presented to Lancaster City Council and Ribble Valley Borough Council
- August 2020 – the Environmental Health Officer for Lancaster City Council responded with a number of questions. These were answered in two emails, which included a link to the scoping report, a link to the modified assessment approach and details of the baseline monitoring undertaken in the Lancaster City Council area.

[1] Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2020) *Sustainability & Environment Appraisal LA 111 noise and vibration*. Revision 2.

17.3 Key Legislation and Guidance

7) Table 17.1 presents the legislation and policy relevant to the assessment of noise and vibration.

Table 17.1: Noise and Vibration – Key Legislation and Policy

Applicable Legislation / Policy	Description
Environmental Protection Act 1990 Part III[2]	Part III defines statutory nuisance and provides the principal controls over it for local authorities. Under the Act, local authorities have a duty to inspect their areas to detect nuisances, and when satisfied that a statutory nuisance exists or is likely to occur or recur, to serve an abatement notice on the responsible party. They also have a duty to investigate any complaint made by a person living within their area. Though businesses have a defence of '*best practicable means*', failure to comply with a valid notice is a criminal offence.
Control of Pollution Act 1974[3]	This Act contains powers for local authorities to deal with noise and vibration from construction and demolition sites.
National Planning Policy Framework (NPPF) 2019[4]	This sets out the government's planning policies for England and how these are expected to be applied. For what constitutes a significant adverse impact, the NPPF refers to the *Noise Policy Statement for England*.
Noise Policy Statement for England 2010[5]	This provides explanation of the term *'significant adverse impact*' from the NPPF. The document also defines the meanings of the terms No Observed Effect Level (NOEL), Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL).
Planning Practice Guidance – Noise[6]	This provides additional guidance to the NPPF and sets out how planning can manage potential noise impacts in new development. It advises that planning authorities should take account of the acoustic environment and in doing so consider: ▪ Whether or not a significant adverse effect is occurring or likely to occur ▪ Whether or not an adverse effect is occurring or likely to occur ▪ Whether or not a good standard of amenity can be achieved. Planning Practice Guidance – Noise states that these potential effects should be evaluated by comparison with the SOAEL and the LOAEL for the given situation.

8) Table 17.2 presents guidance relevant to the assessment of noise and vibration.

Table 17.2: Noise and Vibration –Key Guidance

Applicable Guidance	Description
British Standards	
BS 5228-1:2009+ A1:2014 *Code of practice for noise and vibration control on construction and open sites. Noise*[7]	This code of practice provides guidance on the assessment and control of noise on construction sites, along with guidance on acceptable noise levels.

[2] Environmental Protection Act 1990 Part III. London: The Stationery Office.
[3] Control of Pollution Act 1974. London: The Stationery Office.
[4] Ministry of Housing, Communities and Local Government (MHCLG) (June 2019) National Planning Policy Framework (NPPF). London: MHCLG.
[5] Department for Environment, Food and Rural Affairs (DEFRA) (March 2010) *Noise Policy Statement for England*. London: DEFRA.
[6] Ministry of Housing, Communities and Local Government (MHCLG) (22 July 2019) Planning Practice Guidance – Noise. London: MHCLG.
[7] British Standards Institution (BSI) (2014) BS5228-1:2009+A1:*2014 Code of practice for noise and vibration control on construction and open sites. Noise*. London: BSI.

Applicable Guidance	Description
BS 5228-2:2009+ A1:2014 *Code of practice for noise and vibration control on construction and open sites. Vibration*[8]	This code of practice provides guidance on the assessment and control of vibration on construction sites, along with guidance on acceptable vibration levels.
BS 6472:2008 *Guide to evaluation of human exposure to vibration in buildings*[9]	Sets out guidelines for assessing blast-induced and non-blast-induced vibrations in two separate parts.
BS 7445:2003 *Description and measurement of environmental noise*[10]	Contains guidance of relevance to the description and measurement of environmental noise.
BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*[11]	Includes guideline values for noise levels within domestic homes and other building uses.
Other guidance documents	
Acoustic design of schools: performance standards. Building Bulletin 93[12]	These standards define suitable indoor ambient noise levels for a number of different educational activities and environments.
Acoustics of Schools: a design guide[13]	Accompanies *Building bulletin 93* and provides professional guidance and recommendations on achieving suitable indoor and external ambient noise levels.
Calculation of Road Traffic Noise[14]	The Calculation of Road Traffic Noise document presents a methodology for the prediction of road traffic noise from road traffic flow and other data.
Sustainability & Environment Appraisal LA 111 Noise and Vibration. Revision 2[15]	Contains advice on the assessment of noise and vibration from road traffic, particularly that from new / altered roads.
Guidelines for Community Noise[16]	This guidance provides guideline noise levels for community noise in specific environments, e.g. outdoor living areas and outside bedrooms.
Night Noise Guidelines for Europe[17]	Reviews health effects associated with exposure to night-time noise and recommends noise guideline values.
Guidelines for Environmental Noise Impact Assessment[18]	These guidelines set out key principles and advice on noise impact assessments, but acknowledge that impact assessment methodologies should be specific to each project.

9) National and Local Planning Policies are presented in Chapter 5: Planning Policy and Context.

10) Appendix 17.1 presents further detail on legislation and guidance summarised in Tables 17.1 and 17.2 that is considered to be of most relevance to this chapter.

[8] British Standards Institution (BSI) (2014) BS5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Vibration*. London: BSI.
[9] British Standards Institution (BSI) (2008) BS6472:2008 *Guide to evaluation of human exposure to vibration in buildings*. London: BSI.
[10] British Standards Institution (BSI) (2003) BS7445:2003 *Description and measurement of environmental noise*. London: BSI.
[11] British Standards Institution (BSI) (2014) BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*. London: BSI.
[12] Department for Education and Education Funding Agency (2015) *Acoustic design of schools: performance standards. Building bulletin 93*. London: The Stationery Office.
[13] Institute of Acoustics and the Association of Noise Consultants (2014) *Acoustics of Schools: a design guide*. St Albans.
[14] Department for Transport and the Welsh Office (1988) Calculation of Road Traffic Noise. Cardiff: National Assembly for Wales.
[15] Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2020) *LA 111 noise and vibration. op. cit.*
[16] Berglund, B., Lindvall, T. and Schwela, D.H. (on behalf World Health Organization) (1999) Guidelines for Community Noise. World Health Organization Regional Publications, European Series.
[17] World Health Organization (2009) *Night Noise Guidelines for Europe*.
[18] Institute of Environmental Management and Assessment (2014) *Guidelines for Environmental Noise Impact Assessment*.

17.4 Assessment Methodology and Assessment Criteria

17.4.1 Assessment Methodology

11) Potential significant adverse noise and vibration effects arising during the operation of the Proposed Bowland Section were originally screened out within the noise and vibration chapter of the EIA Scoping Report. The assessment methodology and criteria presented within this section considers noise and vibration effects arising during construction.

12) The assessment of potential Groundborne Noise and Vibration (GBNV) impacts along the Proposed Bowland Section cannot currently be undertaken due to unavailability of ground investigation information. Therefore, the assessment of GBNV effects along the Proposed Bowland Section is not included in this chapter; however, the outstanding GBNV assessment will be reported under a separate cover in due course.

13) Reference has been made to national and local policy documents, relevant British Standards, national guidance and other relevant information in determining the assessment methodology and criteria to be used.

14) During construction of the Proposed Bowland Section, and in addition to the operational road traffic impacts discussed above, there would be the potential for temporary significant noise and vibration effects at nearby sensitive properties in the vicinity of the launch and reception compounds along the route of the Proposed Bowland Section during tunnelling, the movement of construction traffic on local roads and construction works proposed on the existing highways. The potential scale of adverse effects would be dependent upon the type of works undertaken, the proximity to nearby sensitive properties, the duration of the works and their timing.

15) The assessment, including noise and vibration predictions, were undertaken in accordance with the key assessment methodology below:

- BS 5228-1: 2009+A1: 2014, Part 1 – Noise
- BS 5228-2: 2009+A1: 2014, Part 2 – Vibration
- DMRB LA 111 Noise and Vibration, 2020 (Rev. 2).

16) Appendix 17.2 presents the construction scenarios considered in the assessment, including a list of plant and equipment assumed to be operating during various phases of construction along with descriptions of the construction activities.

17.4.2 Assessment Criteria

17) Sensitivity and magnitude criteria are set out in Table 17.3 to Table 17.9. Table 17.10 within Section 17.4.3 then sets out how these values are used to determine significance of effect.

Sensitivity

18) Sensitivity is determined by a properties / community assets level of designation or protection, its susceptibility to (or ability to) accommodate change, and the timescale of the change.

19) The noise and vibration assessment has considered the following sensitive receptors in the vicinity of the Proposed Programme of Works and associated transportation routes:

- Human receptors – when present at residential properties, schools, hospitals, places of worship, recreational areas, public rights of way or other noise-sensitive locations
- Infrastructure receptors – buildings, both contemporary and historic (e.g. listed buildings) and statutory or other underground services
- Designated areas – for example Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs).

20) Table 17.3 provides the outline in determining the sensitivity of a receptor for noise and vibration.

Table 17.3: Noise and Vibration Sensitivity Criteria

Sensitivity	Criteria
Negligible	Industrial installations.
Low	Farms (excluding dwelling), retail and commercial premises, sports facilities.
Medium	Places of worship, cemeteries, open-air amenities used for recreation and offices.
High	Residential properties, hotels, hospitals and residential healthcare facilities, schools and TV / music recording studios / recital rooms. All properties and community assets discussed in the assessment are considered to be of High sensitivity, unless otherwise stated.
Very High	Internationally designated areas such as World Heritage Sites, special cases for noise or vibration sensitivity. Particular vibration sensitivity for receptors making use of highly vibration-sensitive equipment, e.g. microscopy, nanotechnology laboratories.

21) An initial review of potential noise and vibration-sensitive receptors did not identify any highly vibration-sensitive receptors, such as vibration-sensitive research and manufacturing premises, hospitals and universities with vibration-sensitive equipment / operations. However, should such receptors be identified then an assessment would be undertaken based on information currently available (from the operator and building owner where possible) for the relevant equipment and / or process.

Magnitude of Impact

22) The impact magnitude criteria that have been adopted for noise and vibration are presented in Tables 17.4 to 17.9.

23) LOAEL and SOAEL values, as described within the *Noise Policy Statement for England* 2010, are presented.

24) The *Noise Policy Statement for England* 2010 describes a LOAEL as the level above which adverse effects on health and quality of life can be detected, while a SOAEL is the level above which significant adverse effects on health and quality of life occur. The *Noise Policy Statement for England* 2010 also defines the NOEL, which is the level below which no effect can be detected.

25) Magnitude of change categories (from negligible to major) have been used to inform the assessment of significance of effects for airborne noise and for human response to groundborne vibration (excluding tunnelling works). A slightly different approach is followed for assessment of GBNV impacts arising during tunnelling works, and for building response to groundborne vibration, as absolute thresholds are used for magnitude (i.e. the magnitude is either significant or not significant). These approaches are set out in the following paragraphs.

Airborne Noise

26) Noise impact thresholds for construction activities at residential properties are presented in Table 17.4, and have been classified using the assessment approach set out in Annex E.3 of BS 5228-1[19]. These thresholds relate to the site noise level, which is the noise from construction activities alone.

27) In relation to construction noise, day is 07:00 to 19:00, evening is 19:00 to 23:00 and night is 23:00 to 07:00.

[19] British Standards Institution (BSI) (2014) British Standard 5228 part 1: BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites, Part 1: Noise*. London: BSI.

Table 17.4: Construction Noise LOAEL and SOAEL Values at Residential Properties

Construction Airborne Noise Effect Level	Threshold Value ($L_{Aeq,T}$) 1 m in Front of the Relevant Façade	Source
LOAEL	Exceeds existing $L_{Aeq,T}$ sound level for day, evening or night	LOAEL is set at a level where construction noise becomes the dominant source, following the approach promoted within DMRB LA 111.[20]
SOAEL	Threshold level determined as per BS 5228-1:2009+A1:2014 Section E3 and Table E.1	Based on BS 5228-1 and follows approach promoted within DMRB LA 111.

28) The impact criteria for non-residential receptors is outlined in Table 17.5.

Table 17.5: Construction Noise Impact Criteria for Non-Residential Properties and Community Assets

Building Type	Impact Criteria		Sources
	Day 07:00 - 23:00	Night 23:00 - 07:00	
Schools and colleges(1)	50 dB(2) $L_{Aeq,T}$ or a change of >3 dB	-	BS 8233,[21] EFA Acoustics Performance Standards,[22] HTM 08-01,[23] WHO Guidelines,[24] Acoustics of Schools[25]
Outdoor teaching spaces	55 dB $L_{Aeq,T}$, with at least one area suitable for outdoor teaching where noise levels are below 50 dB $L_{Aeq,T}$(3)	-	
Hospitals(1)	50 dB(2) $L_{Aeq,T}$ or a change of >3 dB	45 dB(4) $L_{Aeq,T}$ or a change of >3 dB	
Hotels, care homes, nursing homes, places of worship and community facilities	As per the approach adopted for residential properties in Table 17.4(5)		BS 5228-1
Public open spaces	Total noise exceeds existing ambient ($L_{Aeq,T}$) by 5 dB or more(6)	-	BS 5228-1

Notes:

Note 1: Assessment criteria presented within HS2 London – West Midlands Environmental Statement, Volume 5 Technical Appendices, SV-001-000.

Note 2: Based on an internal level of 35 dB $L_{Aeq,T}$ consistent with Education Funding Agency (EFA) and BS 8233. Equivalent external level assuming 15 dB reduction for a partially open window.

Note 3: Based on the $L_{Aeq,30min}$ noise criteria presented in the IOA / ANC Acoustics of Schools design guide.

Note 4: Based on an internal level of 30 dB $L_{Aeq,T}$ consistent with BS 8233, WHO guidelines. Equivalent external level assuming 15 dB reduction for a partially open window.

Note 5: BS 5228-1 states that the evaluation criteria are generally applicable to residential properties, hotels and hostels, buildings in religious use, schools and health or community facilities.

Note 6: BS 5228-1 advises that for public open space, the impact might be deemed to cause significant effects if the total noise exceeds the ambient noise ($L_{Aeq,T}$) by 5 dB or more for a period of one month or more. However, the extent of the area impacted relative to the total available area also needs to be taken into account in determining whether the impact causes a significant effect.

[20] Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2020) *LA 111 Noise and Vibration*. *op. cit.*
[21] BS8233 (1999) *Sound Insulation and Noise Reduction for Buildings. Code of Practice*. London: BSI.
[22] Education Funding Agency (2012) *Acoustics Performance Standards for the Priority Schools Building Programme*. Department for Education: The Stationery Office.
[23] Department of Health (2013) Specialist services, Health Technical Memorandum 08-01: Acoustics. Department of Health: Richmond.
[24] World Health Organization (1999) *Guidelines for Community Noise*. WHO: Geneva.
[25] IOA/ANC (2015) *Acoustics of Schools: a design guide*. The Institute of Acoustics and the Association of Noise Consultants.

29) The magnitude of airborne noise change due to construction has been defined using the criteria presented in Table 17.6, which has been reproduced from DMRB LA 111. The impact criteria in Table 17.5 represent the SOAEL values and are used in determining moderate and major magnitude of change impacts as per Table 17.6. LOAEL values are not presented in Table 17.5 and, as such, predicted construction noise levels below the SOAEL values are considered to be of minor / negligible impact.

Table 17.6: Magnitude of Impact and Construction Noise Descriptions

Magnitude of Change	Criteria
Major	Above or equal to SOAEL+5 dB
Moderate	Above or equal to SOAEL and below SOAEL+5 dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Groundborne Vibration – Human Response

30) The effect of building vibration on people inside buildings may be assessed using the Vibration Dose Value (VDV) index, as described in BS 6472-1[26]. However, an alternative approach is often initially taken to establish if there is potential for perceptible effects from construction activities, and this is possible with the peak particle velocity (PPV) index. This approach is described by BS 5228-227, which states in paragraph B.2:

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

31) Further, BS 5228-2 states (paragraph B.2) that:

'Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote anxiety lest some structural mishap might occur.'

32) Based on this, the LOAEL has been set at 0.3 mm/s and the SOAEL at 1.0 mm/s. A table of guidance levels is provided in BS 5228-2, and is reproduced in Table 17.7.

Table 17.7: Vibration Impact Criteria (Human Response)

Magnitude of Change	Vibration Level, PPV (mm/s)	Effect
Major	≥10	10 mm/s: vibration is likely to be intolerable for any more than a very brief exposure to this level.
Moderate	1.0 to 9.9	1.0 mm/s: it is likely that vibration of this level in residential environments would cause complaint, but can be tolerated if prior warning and explanation has been given to residents.

[26] British Standards Institution (BSI) (2008) British Standard 6472 part 1: BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings, Part 1: Vibration sources other than blasting*. London: BSI.
[27] British Standards Institution (BSI) (2014) British Standard 5228 part 2: BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites, Part 2: Vibration*. London: BSI.

Magnitude of Change	Vibration Level, PPV (mm/s)	Effect
Minor	0.3 to 0.9	0.3 mm/s: vibration might just be perceptible in residential environments.
Negligible	0.14 to 0.29	0.14 mm/s: vibration might just be perceptible on the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
	<0.14	Vibration is below levels of perception.

33) Human response in occupied non-residential receptors, such as hotels, hospital wards, education dormitories, offices, schools and places of worship have also been assessed using the criteria presented in Table 17.7.

Vibration – Buildings

34) Table 17.8 defines the impact criteria for groundborne vibration with regard to risk of building damage, below which there is no risk of cosmetic damage. The values for structurally sound buildings are taken from BS 7385-2, which states that the probability of damage tends towards zero at 12.5 mm/s PPV, which can be halved for a conservative level of continuous vibration. These values have been rounded down to the integer for a structurally sound building. If a building is structurally unsound, then these values may be reduced; a reduction of 50 % has been applied in Table 17.8. It should be noted that BS 7385-2[28] states (para 7.5.2), *'A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.'* The background and evidence for these criteria is set out in the report 'Impacts of Tunnelling in the UK.'[29] The values in Table 17.8 represent the threshold for significant effects; where vibration levels are predicted to be below the threshold they are not considered to result in a significant effect.

Table 17.8: Vibration Impact Criteria for Buildings

Category of Building	Peak Particle Velocity, PPV mm/s – at Building Foundation	
	Transient[(a)] Vibration	Continuous[(b)] Vibration
Potentially vulnerable buildings[(c)]	6	3
Structurally sound buildings	12	6
Notes: [a]: Transient vibration relative to building response such as impulsive vibration from percussive piling. [b]: Continuous vibration relative to building response such as vibrating rollers. [c]: BS 7385 highlights that the criteria for aged buildings may need to be lower if the buildings are structurally unsound. The standard also notes that criteria should not be set lower simply because a building is important or historic (listed). Properties shall be considered structurally sound, unless stated otherwise.		

Construction Traffic

35) A classification for the magnitude of changes in road traffic noise is provided in DMRB LA 111.[30] For construction road traffic noise, the classification of magnitude of change is reproduced from DMRB LA 111 in Table 17.9.

[28] British Standards Institution (BSI) (2008) British Standard 6472 part 1: BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings, Part 1: Vibration sources other than blasting*. London: BSI.
[29] High Speed Two Ltd for Department for Transport *Impacts of Tunnels in the UK* (2013).
[30] Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2020) *LA 111 Noise and Vibration*. *op. cit.*

Table 17.9: Magnitude of Impact at Properties (Short-term)

Magnitude of Change	Increase in Basic Noise Level of Closest Public Road Used for Construction Traffic (dB)
Major	≥5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9
Negligible	<1.0

36) The assessment also adopts absolute noise thresholds (LOAEL and SOAEL), as per the approach outlined for airborne noise from construction activities within Table 17.4.

37) DMRB LA 111 states the following regarding vibration from road traffic noise, which is therefore not included within the scope of this assessment:

'Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effect.'

17.4.3 Significance of Effect

38) The significance of effect for airborne noise and for human response to groundborne vibration (excluding tunnelling works) has been determined from the combination of the sensitivity of the property or community asset (Table 17.10) and the magnitude of impact (change). This approach is illustrated in Table 17.10, with moderate or above considered to be significant, subject to duration.

Table 17.10: Significance of Effects

		Magnitude			
		Negligible	Minor	Moderate	Major
Sensitivity	Low	Negligible	Negligible	Slight	Moderate
	Medium	Negligible	Slight	Moderate	Moderate
	High	Slight	Slight	Moderate	Major
	Very High	Slight	Moderate	Major	Major

39) For GBNV impacts arising during tunnelling works, and for building response to groundborne vibration, magnitude thresholds are used to determine significance.

40) For all aspects of construction noise and vibration, a significant effect was identified where it is determined that the impact would occur for a duration exceeding either:

- 10 or more days or nights in any 15 consecutive days or nights
- A total number of days exceeding 40 in any six consecutive months.

41) BS 5228-1 states the following with regard to public open spaces:

'For public open space, the impact might be deemed to cause significant effects if the total noise exceeds the ambient noise ($L_{Aeq,T}$) by 5 dB or more for a period of one month or more. However, the extent of the area impacted relative to the total available area also needs to be taken into account in determining whether the impact causes a significant effect.'

42) For the purposes of this assessment it is generally assumed that all works would occur for a duration of at least that presented above. Regarding more transient works, such as piling, additional discussion may be provided as necessary.

17.4.4 Embedded Mitigation and Good Practice

43) Embedded mitigation is inherent to the design, while good practice measures are standard industry methods and approaches used to manage commonly occurring environmental effects. The assessments presented in Section 17.6 of this chapter are made taking into account embedded mitigation and the implementation of good practice measures (where these can be quantified), along with topic-specific essential mitigation (generally for effects likely to be significant in the context of the EIA Regulations).

Embedded Mitigation

44) Chapter 3: Design Evolution and Development Description explains the evolution of the design with input from the environmental team, including mitigation workshops and the use of GIS-based constraints data. Embedded mitigation of particular relevant to noise and vibration is set out in detail in Appendix 17.2 (plant list tables).

- Pumps: partial or full enclosure of many pumps when located in close proximity to sensitive properties of community assets
- Hand tools: pneumatic hand tools would be fitted with exhaust silencers.

Good Practice Measures

45) Good practice measures are contained in Appendix 3.2 Construction Code of Practice (CCoP).

46) The CCoP presents a suite of mitigation measures that would be adopted during construction. Where the level of noise reduction can be quantified, these measures have been included in the noise prediction modelling that has been undertaken, while others can be considered examples of adopting Best Practicable Means for mitigating noise emissions. Best practicable means would be adopted by the contractor during construction and would further mitigate noise and vibration emissions. Some examples include the use of low vibration or non-vibratory compaction techniques when in close proximity to sensitive properties, fitting silencers to pneumatic tools and exhausts, and the use of sound-reducing enclosures and barriers.

17.4.5 Assumptions and Limitations

47) The following limitation applies to baseline sound levels:

- Periods of adverse weather conditions and atypical noise events occurred during monitoring. These periods were excluded before average sound levels were calculated. Monitoring periods were extended, where necessary, to compensate for the data loss due to adverse weather events.

48) The following assumptions and limitation apply to construction noise predictions:

- Noise predictions are made using the best available information at the time of assessment. However, the plant list (presented in Appendix 17.2) and the construction strategy developed to support this assessment by the Early Contractor Involvement contractor may not reflect that adopted during construction. The assessment is considered to be based on a series of reasonable worst-case assumptions
- Technical assumptions that have been made in predicting construction noise levels through noise modelling are detailed in Appendix 17.2.

49) The following limitation applies to GBNV:

- As previously advised, an assessment of GBNV during tunnelling along the entire route of the Proposed Bowland Section cannot currently be undertaken. A GBNV assessment shall be completed when ground investigation details are available and will be reported in due course under a separate cover.

17.5 Baseline Conditions

50) The baseline sound climate along the route of the Proposed Bowland Section was determined through sound-level monitoring and review of online noise mapping. The baseline sound determination approach and sound levels are detailed in Appendix 17.3, which includes all baseline locations included along all sections of the Proposed Programme of Works. A summary of baseline conditions along the Proposed Bowland Section is provided below.

51) Prevailing baseline groundborne vibration levels at sensitive properties in the vicinity of the Proposed Bowland Section would be anticipated to be below the moderate impact assessment thresholds identified in this chapter (Table 17.8) and have not been measured as part of the baseline study.

17.5.1 Monitoring Locations

52) Table 17.11 presents the baseline sound-level monitoring locations and the baseline sound levels established at each location in the vicinity of the Proposed Bowland Section. Each location is considered representative of the baseline sound climate in the community area in which they are located. Figure 17.1 shows the positions of each baseline location.

Table 17.11: Baseline Locations and Summary

ID	Monitoring Location Address	Period	Sound Pressure Level (dB $L_{Aeq,1hr}$)			Comments / Observations
			Wd	Sat	Sun	
B08	Botton Hall Farm, Wray (Sound-level monitoring)	Day	46	46	42	This is a rural location 1.4 km west of Lowgill village. Natural sounds and some distant road traffic noise was observed during the survey.
		Eve	39	45	-	
		Night	39	39		
B09	Leyland Farm, Wray (Sound-level monitoring)	Day	43	41	*36*	This is a rural location 2.6 km north-west of Lowgill village. Farm activities and natural sounds were observed during the survey. * Baseline sound-level adjustments made for assessment: (i) weekend night to match weekday = 43 dBA.
		Eve	39	44	-	
		Night	43	48 43*		
B10	Fober Farm, Dunsop Road, Newton-in-Bowland (Sound-level monitoring)	Day	49	50 49*	52 49*	This is a rural location 1 km west of Newton-in-Bowland village. Farm activities, animal sounds (inc. dog barking) and distant road traffic noise were observed during the survey. * Baseline sound-level adjustments made for assessment: (i) weekend daytime sound level to match weekday = 49 dBA, (ii) weekend night to match weekday = 43 dBA.
		Eve	43	46	-	
		Night	43	50 43*		

Notes:
Weekday (Wd) (Mon to Fri); Day = 07:00 to 19:00; Eve (evening) = 19:00 to 23:00; Night = 23:00 to 07:00
Saturday; Day = 07:00 to 13:00; Eve (evening) = 13:00 to 23:00; Night = 23:00 to 07:00
Sunday; Day = 07:00 to 23:00; Night = 23:00 to 07:00
Sound-level monitoring – baseline measurements undertaken by Jacobs

17.6 Assessment of Potential Significant Effects

53) The following section describes the effects of the Proposed Bowland Section on noise and vibration during the construction phase.

54) The section is split into the following four subsections:

- Lower Houses Compound
- Newton-in-Bowland Compound
- Blasting
- Construction road traffic.

55) Figure 17.1 shows the locations of the assessment sample receptors included in the assessment of the Proposed Bowland Section.

56) Appendix 17.2 provides indicative construction activity durations, which identifies relatively short duration works such as the early enabling activity (approximately three to five months), and longer duration works such as the main tunnelling activity (over 12 months). The construction compounds that would be created for the Proposed Bowland Section, along with approximate duration of works and earliest commencement years, are listed below:

- Lower Houses Compound: anticipated four-year duration, with approximately 2.5 years of activity at the compound (estimated earliest commencement 2024)
- Newton-in-Bowland Compound: anticipated six-year duration, not including reinstatement, with approximately five and a half years of activity at the compound (estimated earliest commencement 2023).

17.6.1 Lower Houses Compound (Reception Shaft)

Airborne Noise

57) Noise arising from activities at the reception shaft compound have been predicted at three locations around the compound (representing residential properties). The highest noise levels and impacts during construction have been predicted at Lower House Farm, located 340 m north-east of the shaft, 300 m from the northern edge of the compound, 190 m from the connection works site and 75 m from the access road.

58) The noise levels predicted during construction at Lower House Farm, along with the existing sound levels at this location, are presented in Table 17.12.

Table 17.12: Predicted Construction Noise Levels at Residential Properties in the Vicinity of the Lower Houses Compound

Period		Existing $L_{Aeq,T}$ dB	SOAEL $L_{Aeq,T}$ dB	Predicted Construction Noise Level (dB $L_{Aeq,T}$)				
				Enabling Works*	General Surface Works	Connections (MLS)	Piling	Open Cut
S10: Lower House Farm, Wray (residential property, 340 m north-east of shaft and 300 m from compound)								
Wd	D	46	65	64 (62)	51	52	58	60
	E	39	55	-	41	49	-	-
	N	39	45	-	35	41	-	-
Sat	D	46	65	64 (62)	51	52	58	60
	E	45	55	-	42	49	-	-
	N	39	45	-	35	41	-	-
Sun	D	42	55	-	44	49	-	-
	N	39	45	-	35	41	-	-

Period		Existing $L_{Aeq,T}$ dB	SOAEL $L_{Aeq,T}$ dB	Predicted Construction Noise Level (dB $L_{Aeq,T}$)				
				Enabling Works*	General Surface Works	Connections (MLS)	Piling	Open Cut
S11: Leyland Farm (residential property, 820 m west of shaft and 760 m from compound)								
Wd	D	43	65	45 (44)	35	36	40	40
	E	39	55	-	30	31	-	-
	N	43	50	-	25	26	-	-
Sat	D	41	65	45 (44)	35	36	40	40
	E	44	55	-	30	32	-	-
	N	43	50	-	25	26	-	-
Sun	D	36	55	-	33	34	-	-
	N	43	50	-	25	26	-	-
S12: Botton Hall Farm (residential property, 490 m south-east of shaft and 445 m from compound)								
Wd	D	46	65	53 (52)	45	45	51	50
	E	39	55	-	37	40	-	-
	N	39	45	-	33	34	-	-
Sat	D	46	65	53 (52)	45	45	51	50
	E	45	55	-	38	40	-	-
	N	39	45	-	33	34	-	-
Sun	D	42	55	-	41	42	-	-
	N	39	45	-	33	34	-	-

Notes:

* Activity represents predicted noise impacts during both early site enabling works (inc. earth moving) and the site reinstatement works.

The predicted construction noise levels, for enabling (and reinstatement) works, shown in brackets represent average noise levels during this works phase (i.e. with plant spreads across the main works area). The reasonable worst-case assessment scenario, where works are assumed to be undertaken in the vicinity of the property under consideration, are shown as the noise levels outside of brackets.

Wd = Weekday

General surface works = General surface activities at the compound, including the operation of the Water Treatment Plant and generators

MLS = Multi-Line Syphon

Botton Hall Farm and Lower House Farm existing sound-level data = B08

Leyland Farm existing sound-level data = B09

59) All residential properties are assessed to be of high sensitivity. The construction noise levels presented in Table 17.12 are not predicted to exceed the daytime, evening / weekend or night-time SOAEL levels but are likely to be above existing $L_{Aeq,T}$ sound levels. As such, the impact magnitudes are predicted to be negligible to minor and significant effects are not predicted.

Vibration – Piling and Vibratory Compaction

60) Piling and vibratory soil compaction may be undertaken at the reception shaft compound and both have the potential to cause vibration impacts at nearby properties. Appendix 17.4 presents the indicative predicted vibration levels during piling and soil compaction at distances of between 10 m and 100 m for both steady-state operations and during transient start-up and run-down.

Vibratory Compaction

61) Lower Houses Farm property is approximately 75 m from the proposed access road at its closest point. Should soil compaction be required to construct the access road then the following range in vibration levels may be expected:

- With a 50 % chance of exceedance and assuming a low vibration amplitude setting: 0.1 to 0.2 mm/s PPV for steady-state and transient conditions, respectively (0.4 to 0.6 mm/s PPV with a 5 % chance of exceedance)
- With a 5 % chance of exceedance and assuming a high vibration amplitude setting: 1.2 to 1.9 mm/s PPV for steady-state and transient conditions, respectively (0.3 to 0.7 mm/s PPV with a 50 % chance of exceedance).

62) Human impacts: the vibration levels presented above range from 0.1 mm/s PPV (when considering low vibration amplitude operating setting, steady-state operation and a 50 % chance of exceedance) to 1.9 mm/s PPV (when considering high vibration amplitude operating setting, transient operating modes and a precautionary 5 % chance of exceedance). As such, based on the prediction methods provided in BS 5228-2, potential moderate adverse impacts at high-sensitivity residential properties during vibratory compaction works are predicted. However, typical methods to control vibration impacts during compaction are included in the CCoP and would be adopted by the construction contractor. With the adoption of these measures, such as running start-up and run-down modes away from sensitive properties and adopting low vibration amplitude or non-vibratory techniques when working in close proximity to sensitive properties, it is anticipated that vibration impacts would be controlled and adverse impacts reduced to minor, and would not be predicted to result in significant effects.

63) Structural impacts: with vibration control measures implemented (as outlined in the CCoP) to mitigate human vibration impacts, including operating vibratory compactors on a low vibration amplitude setting and using non-vibratory techniques when working in close proximity to properties, damage to buildings is considered to be unlikely and significant effects are not predicted.

Piling

64) Lower Houses Farm is over 200 m from the Lower Houses Compound and approximately 190 m from the connections works. Should piling be undertaken then vibration levels at Lower Houses Farm are predicted to remain below 1.0 mm/s PPV and no significant vibration effects would be anticipated.

17.6.2 Newton-in-Bowland Compound (Drive Portal)

Airborne Noise

65) Noise arising from activities at the drive portal compound have been predicted at 14 locations around the compound (representing residential properties and a village hall, church and public house in Newton-in-Bowland). The highest noise levels and impacts during construction have been predicted at Fober Farm, located approximately 300 m south of the main construction portal compound.

66) The noise levels predicted during construction at Fober Farm and other properties in the vicinity of the compound, and the existing sound levels at this location, are presented in Table 17.13.

Table 17.13: Predicted Construction Noise Levels at Properties in the Vicinity of the Newton-in-Bowland Compound

Period		Existing $L_{Aeq,T}$ dB	SOAEL $L_{Aeq,T}$ dB	Predicted Construction Noise Level (dB $L_{Aeq,T}$)						
				Enabling Works*	General Surface Works	Adit Construction	Tunnelling	Connections (MLS)	Piling	Open Cut
S13: Fober Farm (residential property approximately 300 m south of portal compound and 160 m north-west of the welfare / car park compound)										
Wd	D	49	65	63 (63)	53	54	57	52	60	59
	E	43	55	-	45	46	45	47	-	-
	N	43	50	-	44	45	44	44	-	-
Sat	D	49	65	63 (63)	53	54	57	52	60	59
	E	46	55	-	45	46	46	47	-	-
	N	43	50	-	44	45	44	44	-	-
Sun	D	49	55	-	46	47	47	48	-	-
	N	43	50	-	44	45	44	44	-	-
S14: The Bungalow (residential property approximately 280 m west of portal)										
Wd	D	49	65	60 (57)	47	48	51	46	54	51
	E	43	55	-	40	40	40	40	-	-
	N	43	50	-	37	38	37	37	-	-
Sat	D	49	65	60 (57)	47	48	51	46	54	51
	E	46	55	-	40	40	40	41	-	-
	N	43	50	-	37	38	37	37	-	-
Sun	D	49	55	-	43	43	43	43	-	-
	N	43	50	-	37	38	37	37	-	-
S15: Wayside, Newton-in-Bowland (residential property approximately 660 m east of portal and ~310 m north of access road) *This property represents residential properties in Newton-in-Bowland and other community assets such as the village hall (which would be subject to the same assessment criteria)*										
Wd	D	49	65	56 (56)	44	45	49	43	54	48
	E	43	55	-	29	30	29	32	-	-
	N	43	50	-	27	28	27	28	-	-
Sat	D	49	65	56 (56)	44	45	49	43	54	48
	E	46	55	-	30	30	30	32	-	-
	N	43	50	-	27	28	27	28	-	-
Sun	D	49	55	-	32	32	32	33	-	-
	N	43	50	-	27	28	27	28	-	-

Period	Existing $L_{Aeq,T}$ dB	SOAEL $L_{Aeq,T}$ dB	Predicted Construction Noise Level (dB $L_{Aeq,T}$)						
			Enabling Works*	General Surface Works	Adit Construction	Tunnelling	Connections (MLS)	Piling	Open Cut

Notes:

* Activity represents predicted noise impacts during both early site enabling works (inc. earth moving) and the site reinstatement works.

The predicted construction noise levels, for enabling (and reinstatement) works, shown in brackets represent average noise levels during this works phase (i.e. with plant spreads across the main works area). The reasonable worst-case assessment scenario, where works are assumed to be undertaken in the vicinity of the property under consideration, are shown as the noise levels outside of brackets.

Wd = Weekday

General surface works = General surface activities at the compound, including the operation of the Water Treatment Plant and generators

MLS = Multi-Line Syphon

Fober Farm, The Bungalow and Wayside existing sound-level data = B10

67) All residential properties are assessed to be of high sensitivity. The construction noise levels presented in Table 17.13 are not predicted to exceed the daytime, evening / weekend or night-time SOAEL levels but are likely to be above existing $L_{Aeq,T}$ sound levels. As such, the impact magnitudes are predicted to be negligible to minor and significant effects are not predicted.

Vibration – Piling and Vibratory Compaction

68) Piling and vibratory soil compaction may be undertaken at the drive portal compound and both have the potential to cause vibration impacts at nearby properties. Appendix 17.4 presents the indicative predicted vibration levels during piling and soil compaction at distances of between 10 m and 100 m for both steady-state operations and during transient start-up and run-down.

Vibratory Compaction

69) Fober Farm property is approximately 120 m from the access road at its closest point. Should soil compaction be required to construct the access road then the following range in vibration levels may be expected:

- With a 50 % chance of exceedance and assuming a low vibration amplitude setting: 0.1 mm/s PPV for steady-state and transient conditions, respectively (0.2 to 0.3 mm/s PPV with a 5 % chance of exceedance)
- With a 5 % chance of exceedance and assuming a high vibration amplitude setting: 0.6 to 1.0 mm/s PPV for steady-state and transient conditions, respectively (0.2 to 0.4 mm/s PPV with a 50 % chance of exceedance).

70) The vibration levels presented above range from 0.1 mm/s PPV (when considering low vibration amplitude operating setting, steady-state operation and a 50 % chance of exceedance) to 1.0 mm/s PPV (when considering high vibration amplitude operating setting, transient operating modes and a precautionary 5 % chance of exceedance). As such, based on the prediction methods provided in BS 5228-2, potential moderate adverse impacts during vibratory compaction works are predicted. However, as discussed in paragraphs 62 and 63, with the use of methods to control vibration impacts presented in the CCoP, it is anticipated that impacts would be controlled and that there would be no significant adverse effects.

Piling

71) Fober Farm is located several hundred metres from the drive compound and approximately 230 m from the section of open-cut trenching works. Based on the predicted vibration levels presented in Appendix 17.4 no significant vibration effects during piling would be anticipated.

17.6.3 Blasting

72) It is likely blasting would be undertaken to excavate for the working platform at the Newton-in-Bowland compound. An assessment of potential vibration and air-overpressure impacts associated with blasting has not been possible at this time. However, Appendix 17.4 discusses how blasting would be considered at detailed design stage and how impacts can be mitigated through appropriate design (i.e. determining maximum instantaneous charges). Appendix 17.4 also includes noise and vibration limits that would be adopted, subject to discussion and agreement with the local planning authority.

17.6.4 Construction Traffic

73) The construction vehicle access for the Proposed Bowland Section is described below:

- Lower Houses Compound – construction vehicles would access via two routes. The first route (for abnormal loads) would be along the B6480 and local roads towards Wray (approximately 16 km west of the compound). The second route (for normal HGV loads) would be along Park House Lane, Furnessford Road and Long Lane (approximately 8 km north and east of the compound)
- Newton-in-Bowland Compound – construction access to the compound is via the A59 south of Clitheroe. Construction traffic would access the Clitheroe area from the south-west via the A59 and would exit onto the Pimlico Link Road (north-east of Clitheroe). Abnormal loads would then travel east toward Chatburn and then north-west to West Bradford and Waddington, while normal HGV loads would travel west from Pimlico Link Road towards Clitheroe and then north to Waddington. Once at Waddington, all traffic would travel north along Slaidburn Road before arriving at the compounds (approximately 15 km south of the compound.

74) The analysis of the traffic data from the spreadsheet traffic model exercise, as reported in Chapter 16: Transport Planning, has not identified any road links that are predicted to exceed the SOAEL and result in a moderate (or greater) magnitude of change, and as such no significant construction traffic impacts would be anticipated.

75) Combined construction traffic noise and noise arising from construction works at the compounds are not predicted to result in an exceedance of the SOAEL at sensitive properties in the vicinity of the compounds.

17.6.5 Summary

76) The summary of the potential noise and vibration impacts during construction are presented in Table 17.14 .

Table 17.14: Summary of Construction Effects

Environmental / Community Asset [1) 2)]	Type	Construction Activity	Period of day / week	Effect	Magnitude	Significance of Effect
Lower Houses Compound						
Lower House Farm, Leyland Farm, Botton Hall Farm	Residential properties	Enabling and reinstatement works. General surface works and connections. Piling and open-cut works.	Weekday and weekend day, evening and night	Airborne noise and vibration[3)] (human and structural response)	Negligible / Minor	Slight (Vibration structural response – Not significant)
Newton-in-Bowland Compound						
Fober Farm, The Bungalow, Wayside in Newton-in-Bowland village	Residential properties and community assets in Newton-in-Bowland village	Enabling and reinstatement works. General surface works and connections. Piling and open-cut works.	Weekday and weekend day, evening and night	Airborne noise and vibration[3)] (human and structural response)	Negligible / Minor	Slight (Vibration structural response – Not significant)

Notes:

Note 1) Environmental / community assets are noise and vibration assessment sample receptors and represent impacts and effects for one or multiple sensitive properties.

Note 2) All environmental / community assets are considered to be of high sensitivity.

Note 3) Vibration impacts have been predicted for vibratory ground compaction and vibratory piling works. These works are not anticipated to take place at night. The assessment of structural response to vibration has not considered magnitude of change impact categories; rather the assessment concluded potential significant effect only.

An assessment of vibration and air overpressure impacts during blasting has not been possible at this time. Details regarding the proposed assessment approach and noise and vibration limits to be adopted during detailed design are presented in Appendix 17.4.

17.7 Essential Mitigation

77) As explained in Section 17.4.4, the assessment of effects in Section 17.6 takes into account the application of embedded mitigation, good practice measures (where quantifiable) and essential mitigation. This section identifies additional topic-specific essential mitigation identified through the assessment process.

78) A noise and vibration monitoring, and control strategy would be agreed between the construction contractor, Lancaster City Council and Ribble Valley Borough Council before commencement of enabling works. The agreed strategy would be included within the Environmental Controls Plans.

79) Examples of specific control measures that have been incorporated into the assessment at the Proposed Bowland Section include (further details are presented in Appendix 17.2):

- Temporary barriers during the use of rock breakers and access road construction (inc. works in the vicinity of Fober Farm and Lower Houses Farm) (**Mitigation Item NV1**)
- Blasting of hard rock would only be undertaken where alternative methods are not reasonably practicable. Where blasting is required (e.g. the Newton-in-Bowland portal), and prior to the blasting being undertaken, an assessment would be carried out by the appointed contractor to determine the predicted vibration and air overpressure levels at the nearest sensitive receptors following the guidance contained in BS 6472-2[31]. The assessment approach, measurements and controls would be agreed with the local planning authority. Further details are available in Appendix 17.4 (**Mitigation Item NV2**).

17.8 Cumulative Effects

80) The following section provides an overview of the potential cumulative effects from different proposed developments and land allocations, in combination with the Proposed Bowland Section (i.e. inter-project cumulative assessment). Data on proposed third party developments and land allocations contained in development plan documents were obtained from various sources, including local planning authority websites, online searches, and consultations with planning officers. Proposed development data were then reviewed with a view to identifying schemes or land allocations whose nature, scale and scope could potentially give rise to significant environmental effects when considered in combination with the likely effects arising from the Proposed Bowland Section.

81) Intra-project cumulative impacts, i.e. two or more types of impact acting in combination on a given environmental receptor, property or community resource, are considered in Chapter 14: Communities and Health.

82) It is important to note that future growth on the local road network was taken into account in the traffic modelling described in Chapter 16: Transport Planning. For this reason, the potential cumulative effects of future traffic growth between the Proposed Bowland Section and other proposed developments are embedded into predicted road traffic-related impacts on highways capacity, air quality and noise.

83) The over-arching cumulative effects of the Proposed Programme of Works i.e. the five proposed replacement tunnel sections in combination, are considered in Chapter 19: Cumulative Effects. In addition, Chapter 19 examines the cumulative effects associated with the outcomes from Volume 2 (delivery and operation of the main construction compounds, tunnel, and construction traffic routes), Volume 5 (proposed off-site highways works and satellite compounds), and Volume 6 (Proposed Ribble Crossing).

84) Based on professional judgement, it was concluded that there are no proposed third party developments or land allocations in local development plan documents which could potentially give rise to likely significant cumulative effects. No cumulative assessment was therefore undertaken in connection with noise and vibration.

[31] British Standard 6472-2: 2008 - Guide to evaluation of human exposure to vibration in buildings; Part 2 Blast-induced vibration

17.8.1 Highways Works

85) This chapter assesses the likely significant effects associated with enabling works and construction activities at the main construction compounds. It is also worth noting that likely significant effects have been identified for the proposed off-site highways works and the Proposed Ribble Crossing.

86) Potential significant noise effects are predicted during the following off-site highway works:

- Road widening at Cedar House School, TR3/RW08
- Road widening at Toll House, TR3/RW07
- Road widening at Wennington, B6480, TR3/RW06
- Road widening at Bridge Barn, LA2, TR3/RW05
- Road widening at Lunesdale Court, LA2, TR3/RW02
- Road widening at Lane House, LA2, TR3/RW20
- Alternative parking at Bridge House Farm.

17.8.2 Ribble Crossing

87) There is the potential for the following significant adverse effects at the Waddington and West Bradford C of E primary school as a result of works associated with the Ribble crossing.

- Enabling works: compound and laydown area set up (moderate)
- Construction phase: earthworks along the proposed route (major)
- Construction phase: drainage works along the proposed route (moderate)
- Decommissioning works: earthworks and road reinstatement (major).

88) There is the potential for moderate significant vibration effects in human response at Horrocks Farm as a result of bridge foundation piling works.

89) The potential significant effects associated with the off-site highway works and Ribble crossing would not take place in the vicinity of the Bowland construction compounds and as such additional cumulative effects are not anticipated.

17.9 Conclusion

90) This chapter of the Environmental Statement considered the potential noise and vibration impacts associated with construction along the route of the Proposed Bowland Section. This assessment has considered the impacts on residential properties during construction works at the temporary drive and reception compounds and construction traffic movements on the existing highway.

91) Existing levels of background noise were established with noise measurement surveys. The assessment areas are rural, with noise contributions from local activities, natural sounds and distant road traffic noise.

92) The assessment has identified that potential significant noise and vibration effects would be unlikely to occur during construction works at the Lower Houses and Newton-in-Bowland compounds.

93) Blasting is likely to be required at the Newton-in-Bowland Compound. An assessment of likely impacts would be made by the specialist contractor and used to design a suitable blasting strategy prior to works commencing. With adherence to the appropriate limits for blasting then no significant adverse impacts would be anticipated.

94) It is not anticipated that construction road traffic would result in significant effects during the construction phase of the Proposed Bowland Section.

95) No proposed developments or works have been identified in the vicinity of the Proposed Bowland Section, and as such no cumulative effects have been identified.

96) The CCoP includes construction mitigation measures for the management of construction airborne noise and vibration.

17.10 Glossary and Key Terms

97) Key phrases and terms used within this technical chapter relating to Noise and Vibration are defined within Appendix 1.2: Glossary and Key Terms.