HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

A14 Cambridge to Huntingdon improvement scheme

Environmental Statement

Appendices

Appendix 14.3: Noise and vibration significance criteria

Date: December 2014

6.3

This page is intentionally left blank.

Executive summary

This appendix sets out the noise and vibration significance criteria adopted for the assessment of the scheme. Justification for the criteria is provided with regard to Government noise policy, the *Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, HD213/11 – Revision 1 Noise and Vibration* (Highways Agency et al., 2011), standards, guidance and best practice from other major infrastructure projects.

1 Introduction

1.1.1 The noise and vibration assessment has been undertaken according to the *Infrastructure Planning (Environmental Impact Assessment) Regulations 2009* and the requirements of the *Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, HD213/11 – Revision 1 Noise and Vibration* (*DMRB, HD213/11*) (Highways Agency et al., 2011), which is applicable to assessments of trunk road and motorway projects in England.

1.1.2 The noise and vibration assessment also takes account of Government planning and noise policy as defined in:

- the *Noise Policy Statement for England (NPSE)* (Department for Environment, Food and Rural Affairs (Defra), 2010);
- *Planning Practice Guidance – Noise* (PPG-Noise) (Department for Communities and Local Government (Department for Communities and Local Government (DCLG), 2014); the *draft National Policy Statement for National Networks* (Department for Transport, 2013); and;
- *National Planning Policy Framework (NPPF)* (DCLG, 2012).

1.1.3 The term 'sound' describes the acoustic conditions which people experience as a part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of community areas would be likely to be modified by the scheme. Noise is defined as unwanted sound and hence adverse effects are termed noise effects and mitigation refers to noise mitigation e.g. 'noise' barriers. For simplicity, the term 'noise' is used throughout this ES as a descriptor.

1.1.4 The assessment of noise and vibration considers the likely significant effects arising from the construction and operation of the scheme on:

- people, primarily where they live ('residential receptors'), including:
  - on an individual dwelling basis; and
  - on a community basis, including any shared community open areas[1].
- community facilities such as schools, hospitals, places of worship; commercial properties, such as offices and hotels (collectively described as 'non-residential receptors'); and
- 'quiet areas.'[2]

[1] 'Shared community open areas' are those that the *Planning Practice Guidance* – Noise (Department for Communities and Local Government, 2014) identifies may partially offset a noise effect experienced by residents at their dwellings and are either a) relatively quiet nearby external amenity spaces for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet external publicly accessible amenity space that is nearby e.g. park or local green space.

2 'quiet areas' are defined as either Quiet Areas as identified under the Environmental Noise Regulations 2007 [as amended] or are resources which are prized for providing tranquillity as noted in the NPPF and are therefore designated as such under the relevant Local Plan or are designated under Local Plans or Neighbourhood Development Plans as Local Green Spaces.

1.1.5 In this assessment, significant noise or vibration effects may be:

- adverse from an increase in noise levels or beneficial from a decrease in noise levels caused by the scheme;
- temporary from construction or permanent from the operation of the scheme; or
- direct, resulting from the construction or operation of the scheme, and/or indirect, e.g. resulting from changes in traffic patterns on existing roads that result from the construction or operation of the scheme.

1.1.6 It is important to differentiate between impacts and effects. Based on the guidance in the *draft National Policy Statement for National Networks* (Department for Transport, 2013) *DMRB 205/08* (Highways Agency et al., 2008) and *DMRB HD213/11* (Highways Agency et al., 2011) the following definitions are adopted for this assessment:

- Impact - the introduction of a new noise or vibration into an existing environment.
- Effect - the noise effect on the receptor/community subject to an impact. The noise effect is therefore linked to the level of the impact, the sensitivity of the receptor and other key matters such as the existing acoustic environment.

1.1.7 Therefore it follows that:

- an impact is a change in the environment;
- an effect is what results from an impact on a receptor and is dependent on the receptor and its sensitivity; and
- as an impact increases in level, so the effect increases either in terms of magnitude (e.g. noise change) or in terms of the number of receptors adversely affected (or both), to a point where either the level of exposure or the number of receptors exposed reach a point where the assessment needs to report the outcome as a likely significant effect consistent with the EIA Regulations.

1.2 Background to government noise policy

1.2.1 The *draft National Policy Statement for National Networks* (Department for Transport, 2013) sets out the Government's vision and approach to development of nationally significant infrastructure projects on the road and rail networks in England. It sets out the policy against which the Secretary of State for Transport will make decisions on applications for nationally significant infrastructure projects on the road and rail networks. The *draft National Policy Statement for National Networks* (Department for Transport, 2013) specifically notes that:

> *"the Secretary of State should not grant development consent unless satisfied that the proposals meet the following aims:*
>
> - *Avoid significant adverse impacts on health and quality of life from noise as a result of the new development.*

- *Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development.*
- *Where possible, contribute to improvements to health and quality of life through the effective management and control of noise"*.

1.2.2 It is important to note that this scheme will improve the noise environment in many locations by reducing traffic noise along a number of existing roads, particularly sections of the existing A14 through Huntingdon, and also by providing noise mitigation at Important Areas on the upgraded sections of A1, A14 and Cambridge ring road within the scheme. This responds directly to the third aim of Government noise policy.

1.2.3 The wording of the *draft National Policy Statement for National Networks* (Department for Transport, 2013) has been queried as part of the government consultation process on the document. A change in wording has been suggested to note that the Secretary of State should not grant development consent unless:

> *"…satisfied that the proposals will meet, as far as is sustainable, the following aims:..."*

1.2.4 The proposed amendment is the addition of 'as far as is sustainable'. It would bring the *draft National Policy Statement for National Networks* (Department for Transport, 2013) in line with other government national planning documents, and specifically Government's noise policy as set out in the *NPSE* (Defra, 2010) *and PPG-Noise* (DCLG, 2014), that the draft NPS advises should be given weight.

1.2.5 *Chapter 14 of the environmental statement (ES)* summarises the quantitative and qualitative criteria that have been used to assess the scheme's likely significant noise and vibration effects consistently along the route. The criteria are described in more detail in this appendix. The criteria adopted are consistent with good practice; *National Planning Policy Framework* (Department for Communities and Local Government (DCLG), 2012); *NPSE* (Defra, 2010); *Planning Practice Guidance – Noise* (DCLG, 2014); *and relevant* standards and guidance; and respond to local environmental conditions.

1.2.6 The Government's noise policy, *NPSE* (Defra, 2010), uses the key phrases "*significant adverse*" and "*adverse*". In clarifying what these mean the policy notes that:

> *"….there are two established concepts from toxicology that are currently being applied to noise effects, for example, by the WHO."*

These concepts are:

- NOEL – no observed effect level.

  This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

- LOAEL – lowest observed adverse effect level.

  This is the level above which adverse effects on health and quality of life can be detected.

1.2.7 The policy extends these concepts to include:

- SOAEL – significant observed adverse effect level.

  This is the level above which significant adverse effects on health and quality of life occur.

1.2.8 These terms are also adopted in *Planning Practice Guidance - Noise* (DCLG, 2014) which also adds a fourth term, Unacceptable Adverse Effect Level (UAEL). The level of effect is higher than a significant adverse effect on health and quality of life and unacceptable adverse effects are to be prevented. In PPG-Noise, prevention is not in the context of Government policy on sustainable development. PPG-Noise links the four effect levels, in increasing severity, as a hierarchy:

- effect;
- adverse effect;
- significant adverse effect; and
- unacceptable adverse effect.

1.2.9 It The hierarchy of effects noted above is based on the premise that once noise or vibration becomes perceptible, the effect on people and other receptors increases as the level increases. *Planning Practice Guidance – Noise* (DCLG, 2014) presents example outcomes to help characterise these effects using non-technical language. In general terms, an observed adverse effect is characterised as a perceived change in quality of life for occupants of a building or a perceived change in the acoustic character of an area whereas a significant observed adverse effect disrupts activities.

1.2.10 The *NPSE* (Defra, 2010) notes that triggers should be defined for the onset of adverse effects (LOAELs) and significant adverse effects (SOAELs) in terms of the overall levels of exposure. It also notes that these adverse effect levels should reflect the nature of the noise source, the sensitivity of the receptor and local context. Therefore it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, SOAELs are likely to be different for different noise sources, for different types of receptor and at different times of the day and night. It is for a project to identify the relevant SOAEL values, taking account of the different sources of exposure and different receptors.

1.2.11 Similarly under PPG-Noise thresholds for unacceptable adverse effects on health and quality of life (UAELs) should be defined.

1.2.12 Adverse effect thresholds[3], in line with government noise policy, are defined for the scheme in this appendix as part of the methodology adopted to identify likely significant effects in EIA terms from noise and vibration. The overall assessment approach is based on best practice and also reflects previous projects. Significance criteria are presented in the next chapters of this appendix for:

- residential receptors;
- non-residential receptors; and
- quiet areas.

1.3 Local noise policy

1.3.1 The following summarises local policies with respect to the noise and vibration.

Huntingdon Draft Local Plan to 2036

1.3.2 *Policy LP15, Ensuring a High Standard of Amenity* states that "a proposal will be supported where a high standard of amenity is provided for existing and future users and residents of both the surroundings and the proposed development." As part of the proposal there is an expectation that "predicted internal and external levels, timing, duration and character of noise" are addressed.

1.3.3 Committed developments have been considered in the assessment and the scheme would respond to the points raised through careful design, construction and operation as described in *Chapter 14* and other Chapters of the *ES* including the *Code of construction practice (Appendix 20.2)*.

South Cambridgeshire District Council Development Control Policies (adopted 2007)

1.3.4 *Policy DP/1 Sustainable Development* recognises *"the principles of sustainable development are fundamental to international obligations and to national, regional and strategic planning policy."* Furthermore, South Cambridgeshire District Council acknowledges that the "same principles underpin the strategy, and all policies and proposals of the South Cambridgeshire Local Development Framework."

1.3.5 *Policy DP/3 Development Criteria* states that "*planning permission will not be granted where the proposed development would have an unacceptable adverse impact …from undue environmental disturbance such as noise*".

1.3.6 *Policy NE/15 Noise Pollution* states that *"planning permission will not be granted for development that has an unacceptable adverse impact on the indoor and outdoor acoustic environment" or "an unacceptable impact on countryside areas of tranquillity".* The policy also states that South Cambridgeshire District Council would seek to ensure that noise from proposed *"transport use does not cause any significant increase in the background noise level at nearby existing noise sensitive property which includes dwellings, hospitals, residential institutions, nursing homes, hotels, guesthouses, and schools and other educational establishments*"

[3] LOAELs, SOAELs and UAELs

1.3.7 *Policy TR/3 Mitigating Travel Impact* states that: *"new developments will be required to mitigate their travel impact including environmental impact, such as noise, pollution and impact on amenity and health. This may mean ensuring adequate provision is made of integrated and improved transport infrastructure or appropriate mitigation measures".*

1.3.8 The scheme policy, assessment and mitigation measures proposed in *Chapter 14* and other Chapters of the *ES* including the *Code of construction practice (Appendix 20.2)* accords with these local policies by identifying and mitigating significant effects as far as is sustainable in national government policy terms.

South Cambridgeshire District Council, The South Cambridgeshire Local Plan 2011-2031: Proposed Submission

1.3.9 *Policy CC/6 Construction Methods* recognises that for "development which by its nature or extent is likely to have some adverse impact on the local environment and amenity during construction and/or generate construction waste", constructors "must" be "considerate to neighbouring occupiers by restricting the hours of noisy operations and by locating storage compounds and using plant or machinery to avoid noise…adverse impacts".

1.3.10 *Policy SC/11 Noise Pollution* states that *"planning permission will not be granted for development which has an unacceptable adverse impact on the indoor and outdoor acoustic environment" or "an unacceptable impact on countryside areas of tranquillity"*. The policy also states that South Cambridgeshire District Council would seek to ensure that noise from proposed *"transport use does not cause any significant increase in the background noise level at nearby existing noise sensitive property which includes dwellings, hospitals, residential institutions, nursing homes, hotels, guesthouses, and schools and other educational establishments."*

1.3.11 *Policy HQ/1 Design Principles* states that:

> *"all new development must be of high quality design, with a clear vision as to the positive contribution the development will make to its local and wider context. As appropriate to the scale and nature of the development, proposals must…protect the health and amenity of occupiers and surrounding uses from development that is overlooking, overbearing or results in a loss of daylight which avoids unacceptable impacts such as noise…".*

1.3.12 *Policy SS/1 Orchard Park*. This is a committed development which requires the developer of the site to submit *"as part of any planning permission a noise assessment to demonstrate that the proposed development takes account of, and mitigates as necessary and appropriate, any impacts of noise on achieving a satisfactory external and internal residential noise environment."*

1.3.13 The policy also states that:

> *"the presence of the A14 has a heavy influence on the site and the original strategy envisaged that commercial uses on the northern edge of the site would act as noise attenuation for the A14. Any development proposal for residential development adjacent to the A14 would need to demonstrate that necessary mitigation measures have been included to ensure that traffic noise and vehicle emissions are reduced to acceptable levels. This includes creating a satisfactory internal and external residential noise environment through careful acoustic design and layout of any residential buildings (such as single aspect, limited height, sealed non opening windows on the façade facing A14, passive and or forced mechanical acoustically treated ventilation, no external private amenity spaces such as balconies / gardens on any façade with direct line of sight to road noise source)."*

1.3.14 *Policy SS/2 Land Between Huntingdon Road and Histon Road*. This is a committed development which requires the developer of the site to submit noise assessments:

> *"as part of any planning application. If necessary, development will be subject to measures, which may include planning conditions and / or planning obligations, a landscaped buffer, and layout and design measures, to mitigate the effects of…noise caused by traffic using the A14 north of the site and Histon Road east of the site. Noise attenuation fencing will not be permitted….Land within the AQMA [Air Quality Management Area] can be used to provide noise bunds".*

1.3.15 The scheme policy, assessment and mitigation measures proposed in *Chapter 14,* the appendices to Chapter 14, and other Chapters of the *ES* including the *Code of construction practice (Appendix 20.2)* accords with these local policies and acknowledges the committed developments.

Cambridge City Council, Cambridge Local Plan 2014: Proposed Submission

1.3.16 *Policy 1 The presumption in favour of sustainable development* states that:

> *"when considering development proposals, the council will take a positive approach that reflects the presumption in favour of sustainable development contained within the National Planning Policy Framework (NPPF). It will always work proactively with applicants to jointly find solutions, so that proposals can be approved wherever possible, and to secure development that improves the economic success and quality of life and place in Cambridge."*

1.3.17 *Policy 35 Protection of human health from noise and vibration* states that:

> *"development will be permitted where it is demonstrated that it will not lead to significant adverse effects, including cumulative effects, on health and amenity from noise and vibration: or that significant adverse effects can be minimised through appropriate reduction and/or mitigation measures (prevention through design is preferable to mitigation)."*

1.3.18 *Policy 35* also has supporting text which states:

> *"Noise not only causes annoyance but it can also cause serious disturbance such as the loss of sleep. Research by the World Health Organisation (WHO) has also shown noise to cause measurable health affects. Some aspects of noise are covered by other legal controls, such as nuisance law. These controls cannot meet the aim of the planning system, which is the protection of amenity, and the test of 'statutory nuisance' sets a much higher standard than that of 'unacceptable harm'. Neither do they include the impact on from transport-related noise on a development. Therefore noise is a material planning consideration. However, it is not the role of the local plan to prevent all forms of development that may result in some measure of noise, but rather to control development that may have significant adverse effects. The plan does not seek to duplicate the statutory nuisance and noise controls provided by other legislation."*

1.3.19 The scheme policy, assessment and mitigation measures proposed in *Chapter 14*, the appendices to Chapter 14, and other Chapters of the *ES* including the *Code of construction practice (Appendix 20.2)* accords with these local policies by identifying and seeking to mitigate significant effects within the context of national governmental sustainability policy.

Cambridge City Council and South Cambridgeshire District Council, North West Cambridge Area Action Plan, Local Development Framework (October 2009)

1.3.20 *Policy NW2: Development Principles* states that north west Cambridge will be planned and developed "to avoid the necessity for noise…mitigation measures that would detract from the landscape setting of Cambridge." "Development proposals should as appropriate to their nature, location, scale and economic viability to protect and enhance the geodiversity and biodiversity of the site." In addition, *"provide a high quality landscape framework for the development and its immediate setting."*

1.3.1 *Policy NW2* also states that *"planning permission will not be granted where the proposed development or associated mitigation measures would have an unacceptable adverse impact"* on various aspects including residential amenity, on the quality of the urban edge, on biodiversity, historic landscape and geological interest. The policy continues *"planning permission will not be granted where a development would be exposed to levels of noise, vibration…pollution that are unacceptable in relation to the nature of that development."*

1.3.2 Furthermore, it is important that the design of the development fully takes into account the impact of noise pollution arising from A14, in relation to the amenity and health of residents, workers and school children, the amenity and use of open spaces and impact upon the setting of Cambridge. Specific studies should be undertaken to address these concerns. Masterplanning and the detailed planning application process will need to determine the appropriate disposition of uses, location and design of buildings and mitigation measures.

1.3.3 The scheme policy, assessment and mitigation measures proposed in *Chapter 14*, the appendices to Chapter 14, and other Chapters of the *ES* including the *Code of construction practice (Appendix 20.2)* accords with these local policies by identifying significant effects of noise and defining mitigation compatible with national government policy on sustainability.

2 Residential receptors

2.1.1 In this assessment the term residential is applied to permanent dwellings (i.e. houses, apartments etc.). Hotels, hospitals and other buildings where people sleep but are not 'permanent' residents are, along with buildings having other specific noise and vibration sensitive resources, considered as non-residential receptors.

2.1.2 Under Government noise policy and practice guidance, it becomes clear that defining SOAELs for the noise sources under consideration in this assessment is a key step. Any receptor forecast to experience an overall exposure from the scheme that exceeds the relevant SOAELs is identified as being subject to significant adverse impact on health and quality of life (under Government noise policy) and hence identified as a likely significant adverse effect in this assessment. As these significant effects generally relate to disruption of activities indoors, offsite mitigation (e.g. noise insulation) can be used to avoid the significant effect, provided mitigation within the scheme (e.g. noise barriers) has first been maximised as far as is sustainable.

2.1.3 Where outdoor space associated with the a dwelling is also significantly effected then, as set out in PPG-Noise this can be "*offset if the residents of those dwellings have access to:*

- *a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling, and/or;*
- *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or;*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;*
- *a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)."*

2.1.4 Where the noise level from the scheme is between LOAEL and SOAEL, *NPSE* (Defra, 2010) states:

> *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."*

2.1.5 The EIA process requires that likely significant effects are identified along with the envisaged mitigation to avoid or reduce adverse significant effects. The *ES* therefore has to define significance criteria that enable impacts that are 'adverse impacts' in Government policy terms to be identified, where necessary, as likely significant effects in the *ES*. This aligns the triggering of mitigation under both the EIA process and government noise policy.

2.1.6 Where the effects are adverse in policy terms (i.e. not significant) then other factors such as the number of dwellings affected can result in the effects being reported as likely significant effects in the *ES*. The approach adopted is set out in greater detail later in this appendix. This approach has precedent in the assessment of other major infrastructure schemes such as High Speed One (HS1), High Speed Two (HS2) and the Forth Replacement Crossing.

2.1.7 The assessment of adverse effects has been undertaken at assessment locations that are representative of groups of residential receptors and any open space that they share[4] defined, wherever practicable, at the receptor in the group which is closest to the scheme (i.e. worst affected).

2.1.8 The following sections of this appendix provide more detail on significance criteria used in the scheme's noise and/or vibration impact assessment.

2.1.9 For residential receptors the significance criteria are:

- the magnitude of the impact and effect identified (based on overall noise level and noise change). In line with planning practice guidance, the types of noise or vibration effect on occupants is assessed using the criteria defined in this appendix as:
    - beneficial effect (code 'BA');
    - generally no adverse effect (code 'NA');
    - adverse effect (code 'A');
    - significant adverse effect (code 'S'); and
    - unacceptable adverse effect (code 'U').
- the number and grouping of adversely affected dwellings and shared open areas;
- the level and character of the existing noise environment;
- any unique features of the source or receiving environment in the local area;
- combined exposure to noise and vibration;
- duration of impact and effect (for construction); and
- the effectiveness of mitigation measures that could avoid or reduce the adverse effects.

[4] As defined in Planning Practice Guidance – Noise (DCLG, 2014)

2.2 Thresholds to determine the magnitude of impacts and effects

Construction noise (direct, temporary effects)

2.2.1 Direct, temporary effects of noise are associated with construction activities on the land likely to be acquired or used as defined by the DCO.

2.2.2 Impact thresholds for construction noise have been established by reference to the 'ABC method' described in Annex E of *BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – noise* (British Standards Institute, 2014). The ABC method defines the thresholds at building facades on the basis of existing noise levels as set out in *Table 2.1*.

2.2.3 Where the forecast construction noise exceeds the relevant threshold this is an indicator of a potential significant effect[5] i.e. where the level of impact is sufficient that it may lead to a likely significant effect once other aspects are considered.

2.2.4 For daytime, the widely used[6] threshold of 75dBL_{pAeq} (category C in *Table 2.1)* being exceeded for one month or more has been taken to be the SOAEL for construction noise. The threshold was originally set to avoid interference with normal speech indoors, with windows closed (reference the *Wilson Report*, 1963). Windows and their sound insulation properties have improved substantially since the *Wilson Report*; the 75dBL_{pAeq} SOAEL is therefore likely to be precautionary for modern properties.

[5] As noted in BS5228 Part 1

[6] Large infrastructure projects including HS1, Forth Replacement Crossing, Thames Tideway Tunnel and HS2.

Table 2.1: Thresholds of potential significant effects of construction noise at residential buildings (from *BS 5228-1:2009+A1:2014*)

Period	Threshold value in decibels, $dBL_{pAeq,T}$		
	Category A (LOAEL)*	Category B (LOAEL)*	Category C (SOAEL)
Day: T=12hr, Weekdays, 07.00-19.00, T=6hr, Saturday, 07.00-13.00	65	70	75
Evenings and weekends: T=1hr Weekdays 19.00–23.00, Saturdays 13.00–23.00, Sundays 07.00–23.00	55	60	65
Night: T=1hr Every day 23.00–07.00	45	50	55
Notes: All noise levels are defined outdoors at the façade of the receptor Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values; Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values; and Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values. * dependent on existing ambient noise levels			

2.2.5 The day-time SOAEL assumed for construction is, as is the norm, higher than the SOAEL for operational noise. This reflects that construction noise is temporary and that higher levels of noise generally only occur for part of the construction programme.

2.2.6 For night-time, the *Night Noise Guidelines for Europe* (World Health Organisation (WHO), 2009) introduced an interim target of $55dBL_{pAeq,8hr}$ measured outdoors as an annual average. Exceeding this noise threshold (category 'C' of the ABC impact criteria at night as shown in *Table 2.1),* for one month or longer has been adopted as the SOAEL for night-time construction noise. *The Night Noise Guidelines for Europe* (WHO, 2009) are based on evidence gathered for long term exposure to primarily road and aircraft noise. There is no evidence of short-term construction noise leading to significant health effects. The WHO's interim target of $55dBL_{pAeq}$ is therefore applied to construction on a precautionary basis.

2.2.7 For the evening, the SOAEL is set 10dB lower than the day-time SOAEL, consistent with the 'ABC criteria' (British Standards Institute, 2014) and the accepted criteria that date back to the *Advisory Leaflet 72 - Noise Control on Building Sites* (Department of the Environment, 1976).

2.2.8 Noise exposure between LOAEL and SOAEL is, in Government policy terms, an adverse observed effect but not a significant observed effect. Such adverse effects relate to people's response to changes in local acoustic character particularly outdoors and to a lesser extent indoors. Noise insulation cannot change outdoor noise levels, and hence minimising adverse effects is centred on maximising on-site mitigation in accordance with best practicable means and not by providing off-site mitigation. Adverse observed effects are identified in the ES for community areas where categories A or B from *Table 2.1* apply and the forecast construction noise exceeds the relevant category but is below category C. This provides a simplified method for considering adverse effects from noise increases caused by construction. Such observed adverse effects under policy may be reported as likely significant effects in the ES following the consideration of the other significance criteria set out in this appendix.

2.2.9 Section E.4 of *BS5228-1* (BSI, 2014) provides guidance on thresholds used to determine eligibility for noise insulation and temporary rehousing. For this assessment, a simplified form of the temporary re-housing thresholds set out in *BS5228-1* (BSI, 2014) has been adopted as Unacceptable Adverse Effect Levels (UAELs) as defined by PPG-Noise. These are set 10dB above the category C values set out in *Table 2.1* for the same time periods and days of the week as defined by *Table 2.1*. This approach has been adopted because *Planning Practice Guidance – Noise* (DCLG, 2014) states that exposure above a UAEL should be 'prevented'. When all other mitigation is exhausted then temporary rehousing is the only means to 'prevent' the exposure.

Construction noise (temporary, indirect effects)

2.2.10 Temporary indirect noise effects can arise at receptors along existing roads that are unchanged by the scheme but where the scheme causes changes in traffic flows.

2.2.11 Changes in traffic flows on the existing road have been used to calculate changes, at source, in noise levels ($L_{pA10,18hr}$ or $L_{pAeq,16hr}$). The magnitude of impact and effects associated with the change has been evaluated using *Table 2.4*. A minor impact (3dB or greater) is taken as an indicator of a potential significant effect unless the area being considered is currently exposed to high levels of sound (refer to *paragraph 2.2.2*), in which case a smaller impact (1dB or greater) has been taken as an indicator of potential significance. In this case the magnitude of impact and effect has been evaluated using *Table 2.5*

2.2.12 Likely significant indirect effects have been evaluated with respect to the impacts and also matters such as the number of receptors affected.

Construction vibration (direct, temporary effects)

2.2.13 *Table 2.2* defines the no observed adverse effect levels for groundborne vibration with regard to risk of building damage. These criteria are derived from *British Standard BS7385*, *Part 2 Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration* (BSI, 1993) and ensures there is no risk of the lowest damage category ('cosmetic') being exceeded, as defined in *BS ISO 4866:2010 Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures* (BSI, 2010).

Table 2.2: Vibration impact criteria for buildings (conservative criteria below which there is no risk of cosmetic damage)

Category of building	Peak particle velocity (PPV) at building foundation	
	Transient[7] vibration	Continuous[8] vibration
Potentially vulnerable buildings[9]	≥6 mm/s	≥3 mm/s
Structurally sound buildings	≥12 mm/s	≥6 mm/s

2.2.14 Guidance on the impact of vibration on people in buildings is presented in *British Standard 6472-1 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting* (BSI, 2008). Part 1 of this standard assesses the impact of vibration using the vibration dose value (VDV). This indicator takes into account how people respond to vibration in terms of frequency content, vibration magnitude and the number and duration of vibration events during an assessment period. For dwellings, vibration from construction is assessed using the criteria presented in *Table 2.3*.

2.2.15 The LOAEL values, corresponding to the threshold for a minor adverse impact in EIA terms, exceeded for a month or more are taken as the lower end of the range of values for which *BS6472-1* (BSI, 2008) indicates a 'low probability of adverse comment'. The SOAEL values are taken where a major adverse impact is indicated for more than a month, a level of exposure that is the lower value for 'adverse comment probable' in *BS6472-1*.

[7] Transient vibration relative to building response such as impulsive vibration from percussive piling.

[8] Continuous vibration relative to building response such as vibrating rollers.

[9] BS7385-2 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). Where information about these structures is not currently known, the significance criteria for these receptors has been set at a lower level on a precautionary basis.

Table 2.3: Thresholds of likely effects of vibration for residential buildings (derived from *BS 6472-1:2008*)

Threshold (residential)	Impact classification	Vibration exposure[1)]	
		VDV daytime (07:00 – 23:00) ($m/s^{1.75}$)	VDV night time (23:00 – 07:00) ($m/s^{1.75}$)
LOAEL	Minor	0.2	0.1
-	Moderate	0.4	0.2
SOAEL	Major	0.8	0.4
1) Determined at the worst location on a normally loaded floor (usually the centre of the floor)			

Construction vibration (temporary, indirect effects)

2.2.16 Temporary indirect vibration effects are considered highly unlikely as described in (*DMRB, HD213/11*) (Highways Agency et al., 2011) and as such no impact criteria are required.

Operational noise (direct, permanent effects)

2.2.17 As described earlier, the operational noise impacts and effects are related to both the noise level (the 'end state' level) and the change in noise level caused by the scheme. In this assessment, noise levels are considered 'free-field' (i.e. away from reflecting surfaces).

2.2.18 With regard to overall noise levels due to the scheme and with the scheme in operation, the Government's noise policy provides the basis for evaluating the magnitude of the effect as discussed earlier in this appendix. In this assessment, residential receptors (dwellings) are forecast to experience a likely significant adverse noise effect from operation of the scheme if noise outside dwellings from the scheme only is:

- $68dBL_{pA10,18h}$ (equivalent to $63dBL_{pAeq,16h}$ free-field) or greater during the day; or
- $55dBL_{pAeq,8h}$ (i.e. 23:00-07:00) or greater during the night.

2.2.19 The rationale for this is as follows.

2.2.20 During the day-time the level of $68dBL_{pA10,18h}$ is considered a SOAEL (equivalent to $63dBL_{pAeq,16h}$ free-field). This is consistent with the daytime trigger level in the *Noise Insulation (Amendment) Regulations 1988*. Aligning the SOAEL with noise insulation trigger thresholds is consistent with the advice in *Planning Practice Guidance – Noise* (DCLG, 2014) that notes as an example of the consequence of noise exposure above the SOAEL is that people start

> *"avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise".*

2.2.21 This is relevant as the provision of noise insulation includes additional ventilation where necessary to enable windows to be kept closed. Therefore, the provision of noise insulation avoids the significant effect inside a dwelling that would otherwise occur. The difference in day-time SOAEL values for operation and construction is on the basis that operational noise is permanent.

2.2.22 The alignment of noise insulation, or other offsite mitigation, trigger values and SOAELs:

- enables significant observed adverse effects that would otherwise remain taking account of all sustainable mitigation onsite to be avoided (in line with the first aim of Government noise policy);
- is consistent with other major transport and infrastructure schemes such as HS2 Phase (that has been subject to published expert peer review) and Thames Tideway Tunnel (where the DCO decision letter notes compliance with the three aims of Government noise policy);
- is consistent with the framing of the earlier PPG24 (whilst PPG24 has been dis-applied there is no evidence from the Appraisals of Sustainability published alongside Government noise policy and NPS etc that Government intended any material tightening of noise policy or increase in mitigation provided in response to policy).

2.2.23 The *Night Noise Guidelines for Europe* (WHO, 2009) sets an interim target of 55dB$L_{pAeq,8hr}$ outdoors. This has been taken to be a SOAEL for night-time traffic noise.

2.2.24 In this assessment residential receptors (dwellings) are forecast to experience an adverse effect in policy terms where noise from the operation of the scheme outside dwellings is:

- 50dB$L_{pAeq,16h}$ or greater during the day; and
- 40dB$L_{pAeq,8h}$ or greater at night.

2.2.25 These are the LOAELs adopted for operational noise in this assessment.

2.2.26 For the day-time LOAEL:

- the *Guidelines for Community Noise* (WHO, 1999) identify that 50 to 55dBL_{pAeq} (outdoor noise level), represents: *"day-time levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed, respectively.";*
- the 1995 version of the WHO Guidelines for Community Noise, that provides further detail and supporting evidence for the final 1999 version, confirms that the 'majority' referred to in the 1999 Guidelines is 95% of the population;
- the superseded PPG24, 50dB$L_{pAeq0700-2300}$ for daytime falls into Noise Exposure Category 'A' (defined as <55dB). The description for NEC A is as follows "Noise need not be considered as a determining factor in granting planning permission"; and

- is consistent with other major transport and infrastructure schemes such as HS2 Phase (that has been subject to published expert peer review) and Thames Tideway Tunnel (where the DCO decision letter notes compliance with the three aims of Government noise policy).

2.2.27 In the *Night Noise Guidelines for Europe* (WHO, 2009), the night noise guideline of 40dB$L_{night,\ outside}$ is set explicitly as a lowest observable adverse effect level (LOAEL). This is an annual average level measured over the 8hr night-time period from 2300 to 0700.

2.2.28 The thresholds of 50dB$L_{pAeq,8hr}$ and 40dB$L_{pAeq,8hr}$ therefore represent the onset of the lowest observed community noise effects during the day (annoyance) and night (potential for some reported sleep disturbance) consistent with guidance such as the *Night Noise Guidelines for Europe,* (WHO, 2009), *Guidelines for Community Noise* (WHO, 1999) and *Planning Practice Guidance – Noise* (DCLG, 2014). No adverse effects are therefore generally likely below these absolute levels of sound exposure.

2.2.29 For this assessment an unacceptable adverse effect level (UAEL) has been set at 76dB$L_{pA10,18hr}$ (approximately 74dB$L_{pAeq,16hr}$) in line with *Planning Practice Guidance Noise* (DCLG, 2014). This is with reference to Defra's 2014 noise action plan for major roads (Defra, 2014), which links back to the methodology used in the first round of action plans that set this threshold as the basis for defining first priority locations. *Planning Practice Guidance Noise* (DCLG, 2014) identifies that exposures above the UAEL should be 'prevented' and that this is not in the context of sustainable development. Unacceptable levels ultimately should be defined inside a property in order to stop noise being 'very disruptive' as set out in PPG-Noise. Setting UAELs based on outdoor noise levels is likely to err on the side of caution.

2.2.30 Forecast operational sound levels from the scheme of between 50dBL_{pAeq} and 68dB$L_{pA10,18h}$ (equivalent to 63dB$L_{pAeq,16h}$ free-field), or 40dB$L_{pAeq,8h}$ and 55dB$L_{pAeq,8h}$ night-time (i.e. between the respective LOAELs and SOAELs) are adverse effects with regard to noise policy. They are not significant levels of exposure in policy terms. Any change in noise levels brought about as a consequence of the new noise from the scheme may be perceived by communities as a change in quality of life resulting from a perceived change out doors in the acoustic character of an area. When considered collectively for groups of dwellings and their shared community open areas, such effects may be considered significant in terms of the EIA because of the change in noise and the number of dwellings exposed to the change.

2.2.31 *DMRB, HD213/11* (Highways Agency et al., 2011) provides a basis for evaluating the magnitude of the impact and effect caused by noise change both in the short-term and long-term. This assessment has focused on the long term change as this is the likely worst case considering traffic growth. This is also consistent with (*DMRB, HD213/11*) (Highways Agency et al., 2011) that notes:

"In terms of permanent impacts… In the long-term, a 3dB(A) change is considered perceptible. Such increases in noise should be mitigated if possible".

2.2.32 The focus on long-term effects also relates to the evidence that underpins *DMRB, HD213/11* (Highways Agency et al., 2011). This evidence shows that the reported sensitivity to small changes in noise levels (less than 3dB(A)) may be coloured by factors other than noise at the time a new road opens.

2.2.33 Where the overall noise level with the scheme in operation is between the lowest (LOAEL) and the significant observed adverse effect levels (SOAEL), the magnitude of the impact and effect caused can be indicated by the change in noise levels attributable to the scheme. The DMRB method for evaluating the magnitude of impact from such changes in the long term is shown in *Table 2.4*.

Table 2.4: Classification of magnitude of noise impact and effect on residential communities in the long-term under *DMRB*, where the level of overall exposure is between LOAEL and SOAEL

Noise change (dB(A)) – decrease or increase	Magnitude of impact in the long term
0	no change
0.1 – 2.9	negligible
3.0 – 4.9	minor
5.0 – 9.9	moderate
10.0 +	major

2.2.34 Where the overall exposure is greater than the relevant significant observed adverse effect level (SOAEL), then there is the increasing risk of likely health effects associated with long term (permanent) exposure. Further information is included in the *Appendix 18.1*.

2.2.35 A few areas in the scheme noise study area are already exposed to high levels of road traffic noise. It is therefore considered appropriate to give greater weight to noise change where the existing baseline noise level in excess of the SOAEL in the absence of the scheme. This is to reflect the consideration of likely health effects. In these situations the magnitude of the impact and effect caused by change in noise levels attributable to the scheme is shown in *Table 2.5.*

Table 2.5: Classification of magnitude of noise impact and effect on residential communities in the long-term under *DMRB*, where baseline noise level is greater than SOAEL

Noise change (dB(A)) – decrease or increase	Magnitude of impact in the long term
0	no change
0.1 – 0.9	negligible
1.0 – 2.9	minor
3.0 – 4.9	moderate
5.0 +	major

Operational noise (permanent, indirect effects)

2.2.36 Permanent indirect noise effects can arise at receptors along existing roads that are unchanged by the scheme but where the scheme causes permanent changes in traffic flows.

2.2.37 Changes in traffic flows on the existing road network have been used to calculate changes, at source, in noise levels ($L_{pA10,18hr}$ or $L_{pAeq,16hr}$). The magnitude of impact and effects associated with the change has been evaluated using *Table 2.4*. A minor impact (3dB or greater) is taken as an indicator of a potential significant effect unless the area being considered is currently exposed to high noise levels (refer to paragraph 2.2.2), in which case a small impact (1dB or greater) may be taken as an indicator of potential significance with the magnitude of impact and effect being evaluated using *Table 2.5*.

2.3 The level and character of the existing noise environment

2.3.1 The existing noise level is taken into account as part of the impact and effect criteria.

2.3.2 The baseline environment is described quantitatively and qualitatively in *Appendix 14.2*.

2.3.3 Any unusual character or feature of the existing noise environment that could influence the assessment of effects is described in *Appendices 14.4 to 14.6*.

2.4 The number and grouping of adversely affected dwellings and shared open areas

2.4.1 Any receptor forecast to experience an overall ‘end state’ exposure from the new/altered scheme roads that exceeds the relevant SOAEL should be identified as being subject, in EIA terms, to a likely significant adverse effect.

2.4.2 Noise levels from the scheme between LOAEL and SOAEL are not significant in terms of government noise policy. However, in terms of this assessment and in line with best practice, a likely significant effect (in EIA terms) identified on a community area is dependent on:

- the magnitude of the impact due to the change in noise levels (impact classification as defined in *Tables 2.4 and 2.5*);
- the number of dwellings experiencing the impact (generally the higher the impact magnitude the smaller the number of dwellings receiving the impact required to identify a likely significant effect in the *ES*, which at increasing absolute exposure converges to one dwelling when the SOAEL is reached as noted earlier);
- the grouping of the dwellings subject to an impact, generally being weighted to clusters of dwellings in close proximity that form a community or part of a community. This ensures that mitigation in the scheme provides a reasonable level of benefit compared to cost (see later in this section). This is consistent with government policy to minimise adverse effects (in policy terms) as far as sustainable and
- whether the private gardens or other open space (e.g. balconies) of affected dwellings is also affected by noise and if so whether the affected community has separate access to shared open space (as defined in *Planning Practice Guidance – Noise*) that is not affected by noise from the scheme.

2.5 Unique features of the source or receiving environment in the local area

2.5.1 By exception, effects may also be identified following consideration of any unique features of the noise impact from the scheme and/or the character of the existing environment. Any unique features are identified, in so far as are practicable, and described in the relevant *Appendix 14.4, 14.5 or 14.6* and *Chapter 14 of the ES*.

2.5.2 The assessment of any unique feature, including the consideration of secondary impact criteria, is presented in the relevant *Appendix 14.4, 14.5 or 14.6 and Chapter 14 of the ES*.

2.5.3 Unique features that could influence the assessment of effects from noise and vibration are, for example:

- Noise from the scheme with acoustics features e.g. construction activities such as impact driven piling generates impulsive noise;
- Existing features where, for example, the existing baseline environment in an area is subjectively very quiet (substantially less than 50dBL_{pAeq} day-time and/or 40dBL_{pAeq} night-time) and the existing environment is characterised by little or no appreciable man made sound sources. Such environments are rare in the national context and hence it is considered a unique feature. Specific assessment of any such environment calls on additional secondary criteria as required and as identified in the relevant technical *Appendix 14.4, 14.5 or 14.6 and Chapter 14 of the ES*. Effects identified for such an environment would be effects on the unique feature as a resource.
- The characteristics of any non-standard dwellings which may affect the internal noise levels. For standard dwellings, the assessment is based upon habitable rooms facing the noise source, which is a worst case assessment.
- Others features as described in the relevant technical *Appendix 14.4, 14.5 or 14.6 and Chapter 14 of the ES*.

2.6 Combined exposure to noise and vibration

2.6.1 Where significant effects from more than one source are identified at the same assessment location then an additional significant combined effect is reported.

2.6.2 The assessment tables in *Appendix 14.4* identify where a receptor is forecast to experience simultaneous adverse effects from construction vibration and noise. Additional weight is given to combined effects of simultaneous noise and vibration in the identification of significant effects. This is set out as required in the assessment sections of *Chapter 14 of the ES.*

2.7 Duration of impact and effect (for construction)

2.7.1 For construction, where an effect exceeds other significance criteria and is identified for a period exceeding one month[10] (i.e. the average monthly level exceeds the construction noise assessment category level) then the effect is considered to be a significant effect in this assessment. This is consistent with precedent from other recent large infrastructure schemes (e.g. HS2, Thames Tideway Tunnel, Forth Replacement Crossing and before those Channel Tunnel Rail Link) and is based on some of the guidance in *BS5228-1* (BSI, 2014).

[10] Measured by the monthly L_{pAeq} construction noise level exceeding the relevant assessment category in *Table 2.1*.

2.8 The effectiveness of mitigation measures that could avoid or reduce the adverse effects

2.8.1 In assessing significant effects, the effectiveness of the envisaged mitigation options is taken into account.

2.8.2 For the temporary works (construction), mitigation options are considered in respect of best practicable means as defined by the *Control of Pollution Act 1974.*

2.8.3 For the permanent works, mitigation options are considered in respect of the following criteria:

- benefit of noise reduction to stakeholders compared to cost, where:
    - The benefit has been evaluated by calculating the reduction in WebTAG 'willingness to pay' provided by the further mitigation. The WebTAG monetised noise impact values are 60 year costs (base year 2011).
    - In Important Areas, additional benefit from the noise reduction provided by a barrier has been allowed for where the baseline exposure to road traffic exceeds the relevant SOAEL. This accounts for the potential risk of health effects from chronic exposure that are not monetised in WebTAG 'willingness to pay'.
    - Cost has been estimated based upon indicative costs for noise fence barriers.
    - It has been assumed that the design life of a noise fence barrier is 40 years.
- engineering practicability;
- impacts on other environmental disciplines, including landscape and visual; and
- consultation and stakeholder engagement responses.

3 Non-residential receptors

3.1.1 In this assessment the term 'non-residential receptor' is applied to:

- hotels, hospitals and other buildings where people sleep but are not 'permanent' residents; and
- buildings having other specific noise and vibration sensitive resources, considered as non-residential receptors.

3.1.2 The significance criteria adopted in this noise and vibration assessment for non-residential receptors are:

- the receptor's generic use and sensitivity to noise or vibration i.e. dependant on the use of the receptor with for example, during the day time a school being more sensitive than an hotel;
- the receptor's specific use and sensitivity to noise or vibration e.g. the location and layout of a school and whether the most sensitive parts of the school are closest to and face the proposed scheme or are located further from the scheme and are on the opposite side of a building. Sensitivity to noise or vibration also refers to the sound insulation performance of the building and hence whether sensitive indoor activities are insulated from change in outdoor noise; and the existing noise and vibration levels inside the receptor;
- the duration of the impact and effect for construction; and
- unique features of the source.

3.1.3 The assessment considers the noise and vibration exposure at each receptor and the receptor's generic sensitivity. With regard to specific sensitivity the assessment is on a worst case basis, assuming that the receptor is the most sensitive it can be. For example, assuming that for a school the teaching spaces are at the closest point to the scheme, facing the route with windows partially open.

3.1.4 Where significant effects are forecast on this worst case basis, the Highways Agency will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so the Highways Agency would continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures. The outcome of these activities would be reflected in updates to the Code of Construction Practice (*Appendix 20.2*) and DCO requirements as necessary.

3.1.5 The assessment has been undertaken at assessment locations that are representative of each non-residential receptor defined, wherever practicable, at the building, part of the building or open space associated with the receptor and which is closest to the scheme. The following sub-sections consider in turn the application of the nine qualitative significance criteria set for non-residential receptors.

3.1.6 For non-residential receptors, including resources such as hospitals and hotels where people sleep, the types of likely effect on occupants and activities considered in the *ES* arising from noise or groundborne vibration and the codes used to identify them are:

- beneficial effect (code 'BA');
- generally no adverse effect (code 'NA');
- adverse effect (code 'A'); and
- significant adverse effect (code 'S').

3.1.7 The potential for effects on non-residential buildings themselves, in terms of any risk of cosmetic building damage arising from construction groundborne vibration is assessed (code 'B'). Under *Planning Practice Guidance – Noise* (DCLG, 2014), such an observed effect may be considered unacceptable. Accordingly *Planning Practice Guidance – Noise* advises that it should be prevented from occurring.

3.2 Generic use and sensitivity

Noise (temporary and permanent direct effects)

3.2.1 For non-residential receptors, impacts and likely significant effects arising from construction (temporary) or operation (permanent) of the scheme have been evaluated on a worst case basis using the relevant screening criterion defined in *Table 3.1.*

Noise (temporary and permanent indirect effects)

3.2.2 Temporary and permanent indirect noise effects can arise at receptors along existing roads that are unchanged by the scheme but where the scheme causes temporary or permanent changes in traffic flows.

3.2.3 Changes in traffic flows on the existing road network would be used to calculate changes, at source, in noise levels ($L_{pA10,18hr}$ or $L_{pAeq,16hr}$). The magnitude of impact and effects associated with the change has been evaluated using *Table 2.3*. A minor impact (3dB or greater) is taken as an indicator of a potential significant effect.

Table 3.1: Noise impact criteria at non-residential receptors (construction and operation)

Description	Impact (screening) criterion		Outcome	Reference
	Day 0700-2300	Night 2300-0700		
Places of meeting for religious worship; courts; cinemas; lecture theatres; museums; and small auditoria or halls	50 dB[1] $L_{pAeq,T}$ and a change >3 dB	--	Disturbance	BS8233; EFA Acoustics Performance Standards; HTM08-01; WHO Guidelines
Schools; colleges; hospitals*; hotels*; and libraries	50 dB[1] $L_{pAeq,T}$ and a change >3 dB	*45 dB[2] $L_{pAeq,T}$ and a change >3 dB	Disturbance and sleep disturbance*	
Offices	ABC[3] / 55 dB[4] $L_{pAeq,T}$ and a change >3 dB	--	Disturbance	BS8233; BCO guidance

Notes:

[1] Based on an internal level of 35dB$L_{pAeq,T}$ consistent with Education Funding Agency (EFA, 2012) and *BS8233* (BSI, 2014a). Equivalent external level assuming 15dB attenuation for a partially open window.

[2] Based on an internal level of 30dB$L_{pAeq,T}$ consistent with *BS8233* and WHO guidelines. Equivalent external level assuming 15dB attenuation for a partially open window.

[3] For construction assess using A and B categories from the *BS5228-1* ABC method, consistent with AL72 (DoE, 1976). Refer to *Chapter 14*.

[4] Based on an internal level of 40dB$L_{pAeq,T}$ consistent with *BS8233* and BCO (British Council for Offices, 2009) guidelines. Equivalent external level assuming 15dB attenuation for a partially open window.

Vibration

3.2.4 *Chapter 14 of the ES* notes, with reference to *DMRB HS213/11* (Highways Agency et al., 2011) that the operation of the scheme is unlikely to give rise to groundborne vibration effects.

3.2.5 *Table 2.2* defines the no observed adverse effect levels for groundborne vibration with regard to risk of building damage arising from a smaller number of types of construction activity. The criteria are derived from *British Standard BS7385-2 Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration* (BSI, 1993).

3.2.6 With regard to disturbance of people or activities inside non-residential buildings *BS6472-1 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting* (BSI, 2008) provides impact and effect criteria. These are set out in *Table 3.2*.

Table 3.2: Groundborne vibration impact criteria for non-residential receptors

Category of building		Impact (screening) criterion		Reference	Effect
Code	Description	VDV daytime (07:00 – 23:00) ($m/s^{1.75}$)	VDV night time (23:00 – 07:00) ($m/s^{1.75}$)		
V1	Vibration sensitive research and manufacturing (e.g. computer chip manufacture); hospitals with vibration sensitive equipment / operations; universities with vibration sensitive research equipment / operations;	Risk assessment will be undertaken based on the information currently available for the relevant equipment / process, or where information provided by the building owner or equipment manufacturer[11].		ISO 14837-1	Adverse 'A'
V2	Hotels; hospital wards; and education dormitories.	0.2	0.1	BS6472-1	Adverse 'A'
V3	Offices; Schools; and Places of Worship.	0.4	n/a	BS6472-1	Adverse 'A'
V4	Workshops	0.8	n/a	BS6472-1	

3.3 Specific use and sensitivity

3.3.1 Likely significant effects are identified on a 'worst-case' basis using the screening criteria in *Tables 3.1 and 3.2*. With regard to specific sensitivity, the assessment is on a worst case basis, assuming that the receptor is the most sensitive it can be (for example, assuming that for a school the teaching spaces are at the closest point to the scheme, facing the route with windows partially open, and dual use buildings for example residences above an office will be assessed using the more onerous use; in this case the residence).

3.4 Duration of the impact and effect (construction)

3.4.1 Where a qualifying effect is identified for a period exceeding one month, then the effect is considered to be a significant effect.

3.5 Unique features of the source

3.5.1 The assessment of any unique feature, including the consideration of secondary impact criteria, is presented in the relevant technical *Appendix 14.4, 14.5 or 14.6 and Chapter 14 of the ES.*

[11] The assessment will be based on all information available to the project but it is accepted that it will not be possible to identify every potentially vibration sensitive process or item of equipment. The assessment methodology provides a basis for assessing and mitigating if necessary any vibration sensitive process or equipment at the time the project becomes aware of it.

3.5.2 Unique features of the scheme that could influence the assessment of effects from noise and vibration are, for example:

- noise from the scheme with acoustics features e.g. construction activities such as impact driven piling generates impulsive noise; and
- other features as described in the relevant technical *Appendix 14.4, 14.5 or 14.6 and Chapter 14 of the ES*.

4 Quiet areas

4.1.1 Quiet areas considered in the noise and vibration assessment comprise:

- areas designated under local plans as being prized for their tranquillity;
- areas designated under local plans or neighbourhood development plans as local green spaces; and
- areas identified as Quiet Areas through implementation of the *Environmental Noise (England) Regulations 2009*.

4.1.2 Tranquillity assessment is multi-disciplinary and has been led for this EIA by the landscape discipline.

4.1.3 The assessment of effects has been undertaken at assessment locations that are representative of each quiet area identified. The results are reported in the relevant noise and vibration assessment tables of *Chapter 14* of the *ES*; and in terms of the tranquillity the assessment is reported in *Chapter 10* of the *ES*.

4.1.4 The following considers qualitative significance criteria for quiet areas.

4.2 Criteria set out in the noise action plans in England for Quiet Areas

4.2.1 Local authorities are responsible for identifying Quiet Areas.

4.2.2 No Quiet Areas have been identified within the study area of the noise and vibration assessment as set out in *Chapter 14 of the ES*.

4.3 Tranquillity indicators

4.3.1 As advised in the *Planning Practice Guidance – Noise* (DCLG, 2014), there is no specific guidance regarding tranquillity. Generally however for an area to be protected for its tranquillity it is likely to be relatively undisturbed by noise from human sources that undermine the intrinsic character of the area. Such areas are likely to be valued for their tranquillity already and are likely to be regarded as important for other reasons, including their landscape. Consistent with this, the assessment of tranquillity is reported in *Chapter 10 of the ES*.

5 Bibliography

European Commission (2011). Environmental Impact Assessment Directive, 2011/92/EU, 2011.

European Commission (2014). Environmental Impact Assessment Directive, 2014/52/EU.

Environmental Noise (England) (Amendment) Regulations, (2009). Statutory Instrument 2009 No.1610.

Infrastructure Planning (Environmental Impact Assessment) Regulations, (2009). Statutory Instrument 2009 No.2263.

Noise Insulation Regulations (as amended 1988), 1975. Statutory Instrument 1975 No.1763.

The Environmental Noise (Identification of Noise Sources) (England) (Amendment) Regulations 2007. Statutory Instrument 2007 No. 2458.

The Planning Act (2008). Her Majesty's Stationary Office.

British Council for Offices (2009). Guide to Specification. The British Council for Offices.

British Standards Institute (1993). BS7385, Part 2 Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration.

British Standards Institute (2008). BS6472-1 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.

British Standards Institute (2010). BS ISO 4866:2010 Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures.

British Standards Institute (2014). BS5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Noise.

British Standards Institute (2014a). BS8233 Guidance on sound insulation and noise reduction for buildings.

Department for Communities and Local Government (2012). National Planning Policy Framework.

Department for Communities and Local Government (2014). Planning Practice Guidance – Noise. http://planningguidance.planningportal.gov.uk/blog/guidance/noise/noise-guidance/ .Accessed 11 November 2014.

Department for Environment, Food and Rural Affairs (2006). Noise Action Plan for Major Roads 2006.

Department for Environment, Food and Rural Affairs (2010). Noise Policy Statement for England (NPSE).

Department for Environment, Food and Rural Affairs (2014). Noise Action Plan for Major Roads 2014.

Department of Health (2013). Health Technical Memorandum 08-01: Acoustics. The Stationery Office Limited.

Department of the Environment (1976), Advisory Leaflet (AL) 72 (1976), Noise control on Building Sites, HMSO, first published 1968, Third edition 1976.

Department for Transport (2013). Draft National Policy Statement for National Networks.

Education Funding Agency (2012). Acoustics Performance Standards for the Priority Schools Building Programme. Department for Education. The Stationery Office Limited.

European Commission (2011). Environmental Impact Assessment Directive.

Highways Agency and Welsh Office (2011). Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, HD213/11 Revision 1, Noise and Vibration.

Ministry of Public Buildings and Works (1963). Wilson Report on Noise RC 2210/2 Part 2.

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

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