17 Noise and Vibration

17.1 Introduction

17.1.1 This chapter presents a Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) of the potential noise and vibration impacts of the Proposed Scheme for Project 7 – Glen Garry to Dalwhinnie (Central Section) of the A9 Dualling Scheme. It considers the operational and construction impacts of the Proposed Scheme on existing noise sensitive receptors. The Proposed Scheme to be assessed in Project 7 is described in **Chapter 5**.

17.1.2 The objective of this EIA is to gain an appreciation of the noise and vibration climate resulting from leaving the existing A9 route alignment unchanged, or implementing the Proposed Scheme, referred to as the Do-Minimum and Do-Something scenarios respectively. Potential impacts of operational road traffic noise are considered based on outputs from the traffic model, which simulates traffic flows for the Do-Minimum and for the Do-Something scenarios.

17.1.3 The EIA of the potential noise and vibration impacts for noise and vibration sensitive receptors presented in this chapter follows the guidance for Detailed Assessment provided in the DMRB, Volume 11, Section 3, Part 7 '*Noise and Vibration'* (The Highways Agency et al, 2011, thereafter referred to as HD213/11).

17.1.4 An assessment of temporary noise and vibration impacts from the construction of the scheme has also been undertaken following the methodology provided by British Standard 5228:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites*' (BS5228) Parts 1 and 2 for noise and vibration respectively.

17.1.5 For the assessment of permanent noise and vibration impacts, the baseline year and future assessment years are considered. The baseline year is taken to be the first full year of operation of the road project, which is assumed to be 2026 and the future assessment year is fifteen years later (2041). For the assessment of temporary construction impact, construction was presumed to occur over a period of approximately 26 months, up to the scheme opening year of 2026.

17.1.6 Although every attempt has been made to ensure that this assessment is easily understood, the use of acoustic terms and quantities is unavoidable. As a consequence an 'Introduction to Noise' section is provided in **Appendix 17.1** (contained in **Volume 2**).

17.2 Approach and Methods

Scope and Guidance

The 'Environmental Noise (Scotland) Regulations' 2006

17.2.1 The '*Environmental Noise (Scotland) Regulations'* 2006 implements the obligations of the Scottish Government established within the Environmental Noise Directive (END).

17.2.2 The '*Transportation Noise Action Plan (Round 1)'* was first published in 2010 and the latest revision was published in September 2013. The purpose of this Action Plan is to describe how the Scottish Government proposes to deliver their obligations under the END in Scotland. The

full text of the Action Plan can be found at http://www.scottishnoisemapping.org. This website also provides a copy of the END and '*The Environmental Noise (Scotland) Regulations'* 2006.

17.2.3 In July 2014 the second round of noise maps and *Noise Action Plans* were published by the Scottish Government.

17.2.4 In addition to the '*Transportation Noise Action Plan'*, a document *'Guidance for possible measures to manage noise from road and rail'* has been published. This guidance is predominantly for those organisations involved in implementing the '*Noise Action Plan'* including the Local Authorities, Regional Transport Partnerships, The Scottish Government and Transport Scotland, and provides possible mitigation measures in managing noise from road and rail.

The 'Noise Insulation (Scotland) Regulations' 1975

17.2.5 In the case of noise from new or altered roads the '*Noise Insulation (Scotland) Regulations'* 1975 (NISR) provides certain mandatory and discretionary powers in relation to the provision of noise insulation to affected dwellings.

17.2.6 The methodology provided in '*The Memorandum on the Noise Insulation (Scotland) Regulations'* 1975 Regulations 3 and 6 should be used to establish eligibility of receptors. Under Regulation 3 of the NISR, noise from a new highway that conditionally exceeds 68dB $L_{A10,18h}$ requires a roads authority to make offers of insulation to eligible dwellings.

17.2.7 The qualifying criteria, which all must be met, are as follows.

- the properties are situated within 300m of the new or altered carriagewaythe properties lie within the triangular area at the terminal point of the new road, the apexes of which are 50m along the centreline of the existing road form the terminal point of the bases of which extend from points 300m on either side of the road to the nearest point on the carriageway, at right angles to the centreline of the carriagewaya straight line can be drawn from any point of the property to a point on the carriageway without passing another building
- the use of the road causes, or is expected to cause, noise at a level not less than 68dB(A)
- the property will experience noise levels exceeding the 'prevailing noise level' by at least 1.0dB(A)

17.2.8 Regulation 4 provides discretionary powers in relation to altered roads. Regulation 5 allows a roads authority to offer insulation where noise from the construction of a new road seriously affects the enjoyment of an eligible building.

17.2.9 In the situation where development leads to traffic growth on existing roads, there is no obligation within the NISR to offer noise insulation where noise levels are raised.

17.2.10 The NISR assessment presented has been based on the results obtained from the noise model which have been calculated following the Department of Transport and Welsh Office technical memorandum Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988). As the important elements of this methodology are similar to that offered in The Memorandum to Regulations 3 and 6 of the NISR, this assessment offers an approximate indication of those dwellings that are likely to be entitled to noise insulation measures. A detailed assessment following The Memorandum on the NISR (Regulations 3 and 6) should follow to establish eligibility when the detailed design is finalised, and prior to construction.

Methodologies

17.2.11 Each topic within the scope of this chapter has its own methodology as presented in Table 17-1.

Table 17-1: Assessment methodology for each noise and vibration topic

Topic	Methodology[1]
Construction noise	BS5228-1 Section E.3.2 Table E.1
Construction vibration	BS5228-2 (partially sourced from BS7385-2)
Operational traffic noise	DMRB HD 213/11
Operational airborne vibration	DMRB HD 213/11

Study Areas

17.2.12 The study area for temporary construction noise covers the area within approximately 350m from the scheme extents, and for temporary construction vibration the study area covers approximately 100m from any construction activities likely to result in vibration, as shown on **Drawing 17.1**, contained in **Volume 3**). Beyond a distance of 350m the accuracy of construction noise calculations is less certain due to atmospheric factors.

17.2.13 The study area for the operational road traffic noise assessment has been identified in accordance with the guidance provided in HD213/11, as described below and shown in **Drawing 17.2** (**Volume 3**).

17.2.14 The first step is to define the 'project boundary', which includes the start and end points of the physical works associated with the scheme. A surrounding 1 km zone is then defined from and around this project boundary.

17.2.15 The next step is to identify the 'affected routes' from the traffic data. An affected route is one where there is the possibility of a change of 1 dB(A) or more between the Do-Minimum and Do-Something scenarios in the short-term (Do-Minimum to Do-Something in the baseline year) or 3 dB(A) or more in the long-term (Do-Minimum in the baseline year to Do-Something in the future assessment year).

[1] Sources:

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

BS5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration, British Standards Institution.

Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 HD 213/11 Rev. 1 Noise and Vibration, Highways Agency et al., 2011.

17.2.16 A 600m boundary is then defined around all affected routes within the 1 km zone of the project boundary, and the project boundary itself between the start and end points. This is the 'study area' within which the detailed noise modelling exercise is undertaken.

17.2.17 The resulting area generally forms a cylindrical shape with rounded ends around the road. This area overlaps with similarly shaped study areas for A9 Dualling project located immediately north of Project 7. There is therefore the potential for double counting of any receptors that lie within the crossover areas. The study area has therefore been cut off by a perpendicular line at the boundary of Project 7 with the adjacent project to the north, to avoid any double counting. To the immediate south is an existing dualled section of the A9. The noise model includes road traffic noise sources and topography for an additional minimum distance of 600m from the edge of the study area so that potential impacts are not underestimated.

17.2.18 The operational road traffic noise study area is presented in **Drawing 17.2** (**Volume 3**). The drawing also indicates the noise sensitive receptors within the study area.

17.2.19 The HD213/11 methodology also requires an assessment of the impacts upon the wider road network for affected roads where there is a 1dB increase or decrease of noise in the baseline year and/ or a 3dB increase or decrease in the future year assessment year compared to the baseline year.

17.2.20 As the A9 dualling programme is currently being assessed as shorter sections on a project by project basis, the noise and vibration impacts on the wider road network are scoped out from the individual A9 dualling project assessments. A wider network assessment at the programme level will be undertaken using traffic data generated by the central traffic model, which will assess the wider network effects and combined effects of the A9 dualling programme. As such, an assessment of any wider study area impacts is not included within this Chapter.

17.2.21 The study area for the wider network assessment would be the area from the extent of the boundary of the detailed study areas considered for each individual A9 dualling project to the validated extent of the traffic model. It is noted that the wider network study area will need to include sections of the A9 that are currently dual carriageway, and will consider receptors so that they are not double counted in these areas.

17.2.22 For the assessment of operational airborne vibration, the study area is limited to dwellings within 40m of the scheme carriageway, in line with the advice in HD213/11.

Baseline Conditions

17.2.23 Given that the study area presents a relatively long section of road running through a mix of sparsely populated areas and also close to groups of residential dwellings, there is a need to understand the variability in the noise levels along the Proposed Scheme, both close to the road alignment and within the residential areas or at isolated properties.

17.2.24 A mix of long-term unattended and 3-hour daytime attended measurements were undertaken, and full details are presented in the Baseline Noise Survey report for the Central Section, which is reproduced in **Appendix 17.2** (**Volume 2**).

17.2.25 The long-term measurements provide an understanding of how the noise level varies over a 24-hour period, whilst the 3-hour measurements provide additional surety in relation to the daytime noise levels. The noise measurements were undertaken between the 17 and 19 September 2014 at three locations representative of the nearest noise sensitive receptors. These are described in the sections below, and the locations presented in **Drawing 17.1** (**Volume 3**). A full set of survey

information, including details of equipment used, photographs and observations, is provided in the full Baseline Noise Survey report which is reproduced in **Appendix 17.2** (**Volume 2**).

Construction Noise

17.2.26 Predictions of the construction noise impacts from the proposed works were undertaken for receptors up to approximately 350m from the earthworks boundary as shown on **Drawing 17.1** (**Volume 3**). The calculation methods contained within BS5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites - Part 1: Noise*' were used.

Construction Vibration

17.2.27 Construction vibration impacts from the proposed works were considered for receptors up to 20m from general vibration generating activities such as compaction and up to 100m from potential piling locations, as shown on **Drawing 17.1** (**Volume 3**). The calculation methods contained within BS5228-2:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration*' were used.

Operational Road Traffic Noise

17.2.28 In the United Kingdom (UK), road traffic noise is normally assessed using $L_{A10,18h}$ index, defined as the arithmetic mean of the dB(A) noise levels exceeded for 10% of the time in each of the eighteen, one-hour periods between 0600-2400 hours on a typical weekday. This takes account of the diurnal variation in traffic noise.

17.2.29 Annual average weekday traffic (AAWT) flows, speeds and percentage of Heavy Duty Vehicles (HDV) is used to allow for seasonal variations. AAWT is the maximum traffic flow expected between 0600 and 2400 hours on a normal week day, averaged over a year.

17.2.30 The procedure for predicting the noise level from a road is described in CRTN, which also applies in Scotland.

17.2.31 The prediction method takes into account factors such as the traffic flow, composition and speed, the alignment and distance of the road relative to receiving property, the road surface type, the nature of the intervening ground cover between the road and reflections from building façades to calculate the $L_{A10,18h}$ dB noise level.

17.2.32 The Detailed Assessment methodology from HD213/11 was used to undertake assessment of the noise and vibration impacts associated with the Proposed Scheme. The main steps undertaken in this assessment are summarised below:

- Identify the study area
- Undertake noise calculations for all dwellings and other sensitive receptors (examples include schools, community facilities, designated areas (e.g. National Park, Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), SM (Scheduled Monument) and pubic rights of way) identified within the study area. Calculations were undertaken in accordance with the procedures given in CRTN and those relevant additional procedures identified within HD213/11
- The noise levels calculated were façade levels, unless the receptor is an open space where free-field levels were calculated. All road traffic noise levels were calculated as $L_{A10, 18h}$ dB

at a default height of 1.5m above ground level. For dwellings with first floor rooms, the noise level was calculated at 4m above ground to represent a first floor bedroom window

- Complete assessment tables showing the changes in noise levels over the short-term and long-term, comparing the Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year and also future assessment year
- Assessment of the potential night-time noise impacts over the long-term comparing the Do-Minimum scenario in the baseline year against the Do-Minimum and also the Do-Something scenario in the future assessment year
- Assessment of noise nuisance over the long term, including a comparison of the Do-Minimum scenario in the baseline year against the Do-Minimum and also the Do-Something scenario in the future assessment year
- Where a building is predicted to experience different changes on different façades, the least beneficial change in noise level is reported
- Maps are provided that show the study area and the dwellings and other sensitive receptors that are included in the assessment (**Drawings 17.1 and 17.2**, **Volume 3**). Maps are also provided indicating the noise change for the three scenarios assessed (see **Drawings 17.3 to 17.5**, **Volume 3**)
- A list of predicted noise levels for all sensitive receptors in the study area is provided
- Evaluation of any cumulative noise and vibration impacts
- Assessment of possible airborne and ground borne vibration impacts

17.2.33 The detailed calculations of road traffic noise undertaken for this assessment have been conducted using a computer based prediction programme called IMMI (produced by Wölfel Meßsysteme). The software package follows the procedures given in CRTN.

17.2.34 The mapping product that has been used is the Ordnance Survey (OS) MasterMap product, which has been used to allow the spatial position of features, such as buildings, road kerb-lines and areas of different ground types, to be identified. Other IMMI noise model input data includes the following:

- Road traffic flow data, as 18-hour AAWT, road speeds in kilometers per hour (kph) and HDV percentages
- Existing topography for the study area and at least 600m beyond the study area in all directions, including of 3D digital terrain data
- Topography of the Proposed Scheme for the Do-Something assessment as 3D digital data taken from the MX road design model
- Road surface types, where the majority of the existing road surface is modelled as Hot Rolled Asphalt (HRA), with one area of existing Low Noise Surface (LNS) on the A9 from south of the scheme start point going north to approximate chainage (ch.) 285, adjacent to Dalnaspidal
- The A9 surfaces are expected to be resurfaced with the Transport Scotland surface 'TS2010', which is considered to be a LNS, between the opening year of 2026 and the future assessment year of 2041 in the Do-Minimum situation as part of routine maintenance

- All new roads constructed on the dual carriageway alignment for the Proposed Scheme will be surfaced with the Transport Scotland surface 'TS2010', and this surface is assumed for the Do-Something scenario in both 2026 and 2041
- The standard assumptions stated by HD213/11 are applied in the noise model for LNS. That is a -2.5dB(A) surface correction should be used for any existing LNS in the opening year. For the future assessment year, a correction of -3.5dB(A) is applied for any LNS which is expected to be present. Where there will be a new LNS laid in the Do-Something scenarios then a -3.5dB(A) correction is assumed.
- The ground surface in the surrounding area is assumed to be soft, with the exception of areas of water where a hard surface is assumed
- Building heights have been assumed to be a standard 8m. Small buildings of an area of less than 25m^2 have been excluded from the model

Night time road traffic noise assessment

17.2.35 In accordance with the HD213/11 Detailed Assessment, this chapter also undertakes a night time noise assessment for the design year (2041). The assessment of noise is based on AAWT flows for the period between 2300 and 0700 hours. The assessment was undertaken for receptors where traffic noise levels are predicted to exceed 55dB $L_{night, outside}$ in any scenario. The night-time noise levels were calculated using Method 3 of the TRL report *"Converting the UK traffic noise index $L_{A10, 18h}$ to EU noise indices for noise mapping"*.

Road traffic noise nuisance assessment

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

17.2.37 In line with HD 213/11, noise nuisance takes into account both the long-term and short-term impacts. The results are presented for the Do-Minimum and Do-Something comparisons. The noise nuisance level changes are directly calculated from the predicted noise level changes.

Operational road traffic airborne vibration

17.2.38 A method for the assessment of traffic induced vibration is outlined in HD 213/11, and this includes the assessment of the numbers of people bothered by airborne vibration. It states that vibration associated with road traffic sources would not normally have any influence at distances outside of 40m from an affected road. As such the assessment of vibration has been limited to buildings within 40m of the scheme. Additionally, only properties which have predicted traffic noise levels greater than 58dB $L_{A10, 18h}$ are considered, as outlined in HD213/11.

17.2.39 Ground borne vibration is not anticipated to be a major issue for the Proposed Scheme as ground borne vibrations are only generally perceptible where the road surface is uneven, which is not the case within the extents of the Proposed Scheme. Operational ground borne vibration is therefore not discussed further.

Baseline Data Sources

17.2.40 The baseline data sources used to help inform this assessment comprise of:

- OS MasterMap
- OS Address Base
- Traffic data for the AAWT between 0600–0000 hours (18hr period) were provided for the following parameters for each road link for the baseline and future year scenarios:
  - Total traffic flow (AAWT 18hr)
  - Percentage HDVs
  - Vehicle speed (km/h)

Assigning Sensitivity

17.2.41 Identification of sensitive receptors is based on OS MasterMap and Address Base data. The HD213/11 methodology requires the assessment of dwellings and other sensitive receptors that include schools, community facilities, designated areas (e.g. National Park, SAC, SPA, SSSI, SM) and pubic rights of way that are identified within the study area. All Bed and Breakfasts and Guest Houses have been assessed as residential dwellings, on the assumption that there are also permanent residents at these locations.

17.2.42 This approach is broadly in line with the criteria reproduced in **Table 17-2** from the *Scottish Government's Technical Advice Note (TAN) on the Assessment of Noise*, tailored to less urban environments and where only High sensitivity receptors are assessed.

17.2.43 Designated areas are not mentioned within this table, but these have been assessed following the guidance presented within HD213/11.

Table 17-2: Criteria Used to Define Noise Sensitive Receptors

Sensitivity	Description	Examples of Receptor Usage
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate Quiet outdoor areas used for recreation Conference facilities Theatres/ auditoria/ studios Schools during the daytime Hospitals/ residential care homes Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/ cafes/ restaurants where external noise may be intrusive Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance is minimal	Buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator noise is a normal part of the event

17.2.44 Where applicable, noise levels at sensitive receptors have been predicted at a distance of 1m from the most exposed façade, and include a 2.5dB façade correction. Noise levels for sensitive receptors positioned in open spaces are free-field, which is at least 3.5m from any reflecting surface.

17.2.45 A total of 13 residential receptors have been identified in the study areas for both operational noise and construction noise. A full list of the receptors, together with calculation results, is presented in **Appendix 17.4** (**Volume 2**). The locations of these receptors are indicated in **Drawing 17.1** (**Volume 3**).

17.2.46 There are four designated sites within the study area, and these are shown in **Drawing 6.1** (**Volume 3**). These are the River Spey SAC and the Drumochter Hills SPA, SAC and SSSI.

17.2.47 There are also eight public rights of way running through the study area, as shown in **Drawing 9.1** (**Volume 3**). NMU1 is east of the A9 and runs adjacent to the A9 at varying distances for the length of the scheme. NMU2, NMU3 and NMU4 start in Dalnaspidal and runs perpendicular away from the A9 to the east. NMU5 starts at the A9 in Dalnaspidal and runs adjacent to the A9 northwards and back to the A9. NMU6 runs perpendicular away from the A9, as do NMU7 and NMU8.

17.2.48 Several receptor locations were selected to represent each designated sites and public right of way, in order to assess the predicted change in road traffic noise for each receptor. The least beneficial change in road traffic noise for each of these receptors has been presented in the assessment for operational road traffic noise, and the results for all locations are presented in **Appendix 17-4** (**Volume 2**). The locations for the results presented in the assessment tables are indicated in **Drawing 17.1** (**Volume 3**).

Assigning Magnitude and Significance of Impact

Construction Noise

17.2.49 **Table 17-3** is reproduced from Table E.1 in BS5228-1 Annex E, which describes methods for evaluating the potential significant effect of construction noise.

Table 17-3: Threshold of potential significant adverse and adverse effects at dwellings in dB $L_{Aeq,t}$

Period	Category A	Category B	Category C
Daytime weekday (0700-1900 hours) and Saturdays (0700-1300 hours)	65	70	75
Evenings weekday (1900-2300 hours), Saturdays (1300-2300 hours) and Sundays (0700-2300 hours)	55	60	65
Night-time (2300-0700 hours)	45	50	55
Note: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.			
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values			
Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values			
Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values			

Construction Vibration

17.2.50 **Table 17-4** and **Table 17-5** below are reproduced from BS5228-2+A1 and provide thresholds and guide values for significant effects for construction vibration on structures and human response respectively.

Table 17-4: Threshold of significant effects for construction vibration on structures

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s at 4Hz and above	50 mm/s at 4Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings	15mm/s at 4Hz increasing to 20mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40Hz and above

Table 17-5: Threshold of potential significant adverse and adverse effects at dwellings in dB $L_{Aeq,t}$

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments

Operational Road Traffic Noise

17.2.51 HD213/11 provides classification for the magnitude of changes in road traffic noise. A change in road traffic noise of 1 dB(A) in the short term (Do-Minimum to Do-Something in the baseline year) is the smallest that is considered perceptible. In the long term (Do-Minimum in the baseline year to Do-Something in the future assessment year) a 3dB(A) change is the smallest change considered to be perceptible. The magnitudes of impact in the short and long term are therefore considered to be different.

17.2.52 For road traffic noise the classification of magnitude of change is reproduced from HD213/11 in **Table 17-6** for both the short and long term respectively.

Table 17-6: Classification of Magnitude of Noise Impacts from a Change in Road Traffic Noise

Magnitude of Impact	Noise Change $L_{A10,18h}$ dB	
	Short Term	Long Term
No change	0	0
Negligible	0.1-0.9	0.1-2.9
Minor	1-2.9	3-4.9
Moderate	3-4.9	5-9.9
Major	5+	10+

Operational road traffic induced vibration

17.2.53 For vibration from traffic, a Peak Particle Velocity (PPV) of 0.3mm/s measured in the vertical direction is considered to be perceptible, and structural damage to buildings can occur when levels are above 10mm/s.

17.2.54 Where PPV from road traffic will rise above a level of 0.3mm/s, or existing levels above 0.3mm/s are predicted to increase are predicted, then this should be considered as an adverse impact from vibration.

Assigning Significance of Impact

17.2.55 The general approach to environmental assessment requires the identification of impact significance taking into account the value or sensitivity of receptors and the magnitude of impact.

17.2.56 As discussed in paragraph 3.36 of HD213/11, in terms of road traffic noise a standard methodology has not yet been developed to assign a significance according to both value/ sensitivity and magnitude. However, the Scottish Government TAN guidance sets out an approach that was used in this chapter, and is reproduced in **Table 17-7**.

Table 17-7: Significance of Noise Impacts

Magnitude	Sensitivity		
	Low	Medium	High
Major	Slight/ Moderate	Moderate/ Large	Large/ Very Large
Moderate	Slight	Moderate	Moderate/ Large
Minor	Neutral/ Slight	Slight	Slight/ Moderate
Negligible	Neutral/ Slight	Neutral/ Slight	Slight
No change	Neutral	Neutral	Neutral

17.2.57 This significance criteria has been applied to residential receptors, but not to designated sites as the guidance as been developed for human receceptors. For designated sites noise impacts have been considered within **Chapter 12** where the overall significance of impacts is discussed.

17.2.58 The TAN describes how these impacts should be considered in the decision making process, as outlined in **Table 17-8**.

Table 17-8: Consideration of Impacts in the Decision Making Process

Significance	Decision Making Process
Very Large	These effects represent key factors in the decision-making process. They are generally, but not exclusively associated with impacts where mitigation is not practical or would be ineffective.
Large	These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.
Moderate	These effects, if adverse, while important, are not likely to be key decision making issues.
Slight	These effects may be raised but are unlikely to be of importance in the decision making process.
Neutral	No effect, not significant, noise need not be considered as a determining factor in the decision making process.

17.2.59 In consideration of the descriptions provided in this table, Large and Very Large impacts are considered to be **Significant**, and Moderate, Slight and Neutral impacts are considered to be **Not Significant**.

Operational Noise Mitigation Threshold Criteria

17.2.60 For guidance on the impacts of noise, reference can be made to the current World Health Organisation (WHO) document entitled '*Community Noise*' (WHO 1999). This document does not contain recommendations but provides guideline values based on the precautionary principle. The WHO document states that:

> '*To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas.*
>
> *To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq}.*
>
> *Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development*'.

17.2.61 HD213/11 suggests that permanent operational noise increases of 1dB(A) in the short term and 3dB(A) in the long term should be mitigated if possible. This level of change is of a Minor magnitude, which corresponds to a Slight/ Moderate impact significance (**Table 17-7**). However, when the advice from the TAN (**Table 17-8**) stated that "*These effects, if adverse, while important, are not likely to be key decision making issues*".

17.2.62 **Table 17-8** describes 'Large adverse' significance of impacts or worse for both short and long-term impacts as resulting in noise mitigation. This corresponds to a Moderate magnitude of road traffic noise increase of 3dB or greater in the short-term or 5dB or greater in the long-term.

17.2.63 Considering the advice from WHO, HD213/11 and the TAN together the following approach is implemented for this assessment. Mitigation is considered where the road traffic noise level exceeds $L_{Aeq,T}$ 50dB and where there is a Moderate magnitude of noise increase in order to protect the majority of people from being moderately annoyed. Mitigation will also be considered where the noise level exceeds $L_{Aeq,T}$ 55dB and there is a Minor magnitude of change, to protect the majority of people from being seriously annoyed.

17.2.64 The WHO refers to a daytime time base of 16 hours ($L_{Aeq,16hr}$), and CRTN predictions are in terms of $L_{A10,18h}$. To convert the WHO $L_{Aeq,16h}$ to $L_{A10,18h}$ a correction of +2dB is required, with a further +2.5dB necessary to translate into façade levels. When this conversion is applied to 50dB and 55dB $L_{Aeq,16h}$, this results in an equivalent threshold façade level of 54.5dB and 59.4dB $L_{A10,18h}$ respectively.

17.2.65 Mitigation would therefore be considered where practicable *and* where there is an increase of 3dB or greater in the short-term or 5dB or greater in the long-term, and where the predicted façade level is between 54.5dB and 59.5 $L_{A10,18h}$; and also where there is an increase of 1dB or greater in the short-term or 3dB or greater in the long-term, and where the predicted façade road traffic noise level exceeds 59.5dB $L_{A10,18h}$

17.2.66 In addition mitigation, taking cognisance of the WHO Night Noise Guidelines publication, is also considered during the night-time period in the long-term where the significance of impact at a receptor has been assessed as 'Large adverse' or worse, and where the predicted noise level exceeds 55dB $L_{night,outside}$. It should be noted that only receptors where the predicted $L_{night,outside}$ level exceeds 55dB are presented in the assessment tables.

17.2.67 It is also necessary that in all cases considered appropriate, mitigation should comply with acceptable standards in terms of traffic, safety, environmental and economic issues (HD213/11

Noise and Vibration Chapter 4 – Design and Mitigation, paragraph 4). Specific examples which could preclude the use of mitigation are disproportionate cost and unacceptable visual impact.

Limitations to Assessment

17.2.68 It is considered that all data inputs for this assessment are of an adequate level to support a Detailed Assessment as defined in HD213/11.

17.2.69 A number of limitations have been identified during the assessment. Each limitation has been minimised as far as practicable and are outlined below.

17.2.70 The assessment of significant noise and vibration effects, as in any predictive process, is characterised by some degree of uncertainty. How the receiving environment reacts to changes in noise will always be uncertain to an extent. There are unknowns around what other external factors will influence the receiving environment and what happens in the future. The further into the future predictions reach, the greater the degree of uncertainty.

17.2.71 The information used in this chapter represents only the readily available information at the time of the assessment. For example, the receptors only include existing receptors included in the OS AddressBasePlus data.

Construction Noise

17.2.72 There are limited construction details available at this stage and therefore, the construction noise predictions have used typical road construction activities reported in BS5228-1 Annexes C and D. Assumptions have been made of the possible phases of construction, construction plant and methods and also times and durations of activities, based on previous experience of on-line road construction schemes. These would be finally determined by the contractor, who is unable to input into the assessment at this stage. However, it is considered that the assumptions outlined provide a reasonable representation of road traffic noise for the purposes of this assessment. This is usual for the assessment of construction noise at this stage, and construction methodologies would be expected to become more defined at later stages in the project. **Appendix 17.3** (**Volume 2**) provides details of the assumptions made for the calculation of the construction noise. **Table 17-9** details each of the construction elements and shows the level of uncertainty related to each of them.

17.2.73 Other uncertainties include the assessment of potential temporary changes in road traffic noise during the construction phase. Haul routes have been identified, but there is not yet any traffic data available on which to base an assessment.

17.2.74 A clear view of works was assumed for all receptors, with no account of the actual topography or existing screening, such as other receptors located closer to the road. This gives a potential worst-case scenario for the assessment.

Construction Vibration

17.2.75 There are limited construction details available at this stage. Since there are no vibration sensitive receptors in close proximity to the scheme (i.e. at less than 20m) the only potential source of perceptible vibration would be limited to piling where a receptor is identified within 100m of a structure or other piling requirement. Piling is not currently anticipated as a method that will be used for the majority of works, although three locations for possible piling have been identified in order to reduce peat excavation volumes. These are located on the northbound

carriageway within ch. 3,900 to 4,100; ch. 4,250 to 4,300; and ch. 7,100 to 7,200. It is possible that the contractor may also decide to use piling during construction of structures.

17.2.76 A 100m study area has been drawn around the three areas identified for piling and the main structures, and there is one receptor that lies within this study area. The scheme includes a new overbridge (ch. 500) approximately 95m to the east of Station Cottages, where piling could be used as a method of construction, and there may therefore be the potential for adverse vibration at this location.

Operational Road Traffic Noise

17.2.77 **Table 17-9** presents the assumptions associated with the operational traffic noise modelling and assessment.

Table 17-9: Assumptions in relation to the operational road traffic noise assessment

Parameter	Description	Level of Uncertainty
Future development	Schemes affecting traffic flows have been incorporated into the traffic model and have been utilised for the noise operational assessment. The traffic model assumes that all sections of the A9 Dualling are open and operational in the Do-Something scenario.	Low
Noise sensitive receptors	Sensitive receptors identified through OS AddressBase data.	Low
Road Pavement in Do-Minimum	Information on existing road pavement on the A9 has been provided by Transport Scotland. Most of the A9 is currently surfaced with a standard HRA with one section of a LNS at the southern end of the Proposed Scheme. It is assumed that this section of LNS is the Transport Scotland surface 'TS2010'. All existing roads that are not the A9 are assumed to be surfaced with a standard HRA. In the future assessment year of 2041 it is assumed that all parts of the A9 would be resurfaced with a LNS as part of routine maintenance.	Low
Road Pavement in Do-Something	All parts of the A9 will be re-surfaced with the Transport Scotland surface 'TS2010', which is a LNS relative to HRA. All existing roads that are not the A9 are assumed to be surfaced with a standard HRA.	Low

17.3 Baseline Conditions

17.3.1 A summary of the results of the baseline surveys are presented below. Noise from regular traffic running along the A9 (including heavy trailers and tour buses), trains passing along the Highland Main Line (HML) railway, which runs close to the A9 in this area, aircraft flying overhead and birds singing regularly could be heard at all monitoring locations. Other main noise sources observed during the measurement period at each monitoring location are also described below. It should be noted that the noise sources described for the unattended long-term surveys were those observed at the time of installing the equipment.

17.3.2 The daytime (0600 – 2400 hours) and night-time (0000 – 0600 hours) noise levels corresponding to the long-term surveys were obtained by logarithmically averaging the individual $L_{Aeq, 1h}$ measured within each period.

17.3.3 From the measurement results it can be noted that the main daytime noise source in this area is the road traffic using the A9 as the noise levels increase the closer the monitoring location is to the road. It should be noted that during all measurements, the Average Speed Cameras (ASC) on the A9 were installed but were not yet operational, as such the measurement results represent typical road traffic noise conditions.

17.3.4 There are three noise monitoring locations as listed below, and indicated in **Drawing 17.1** (**Volume 3**). The noise measurement results are presented in **Table 17-10**. These receptors are representative of residential locations:

- MP1 – Station House, Dalnaspidal, Pitlochry, PH18 5UJ
- MP2 – Balsporran Cottages, Dalwhinnie, PH19 1AF
- MP3 – Drumochter Lodge, Dalwhinnie, PH19 1AF

Table 17-10: Summary of Baseline Noise Measurements

Monitoring Location	Distance to A9 (m)	Date	Time	$L_{Aeq,T}$ dB	L_{AFmax} dB	$L_{A10,T}$ dB	$L_{A90,T}$ dB
MP1	58	16/09/2014	10:10-13:10	57.5	78.2	61.3	45.8
MP2	133	16-17/09/2014	Day	57.4	87.6	59.6	43.1
			Night	51.0	69.0	55.5	30.4
MP3	50	16 /09/2014	13:20-16:20	58.8	81.4	63.6	44.8

17.3.5 At measurement location MP1 the main source of noise was noted to be road traffic on the A9, passenger trains on the HML railway and overflights by aircraft (including low flying military aircraft). The sound of birdsong was also noted throughout the survey at this location.

17.3.6 At location MP2 the main source of noise was noted to be road traffic on the A9, passenger and freight trains on the HML railway and overflights by aircraft (including low flying military aircraft). The sound of birdsong was also noted throughout the survey. At MP2 activities at the property itself were also noted, and there was light rain in the last hour of the survey, which resulted in a damp road surface on the A9.

17.3.7 At MP3 the main source of noise was noted to be road traffic on the A9, passenger and freight trains on the HML railway and overflights by aircraft (including low flying military aircraft). The barking of dogs and movement of vehicles within the car parking area were also noted at this location. As with other locations, the sound of birdsong was also noted throughout the surveys.

17.4 Potential Impacts

17.4.1 Throughout the DMRB Stage 3 iterative design process, a number of environmentally led workshops considered each aspect of the developing design and made recommendations for certain features to be included within the Proposed Scheme. These aspects have been defined as 'embedded mitigation' and, where they are included in the Proposed Scheme design, they are considered within the context of the impact assessment as providing mitigation to avoid or reduce environmental impacts, and in some cases, provide environmental benefits. With respect to the topics under consideration in this chapter, the relevant aspects of embedded mitigation include:

- Alignment informed by consideration of proximity to local sensitive receptors
- There will be an improvement in the A9 road surface. The majority of the existing A9 is surfaced with Hot Rolled Asphalt (HRA). The A9 is being resurfaced as part of the scheme design, and the new pavement will utilise a Lower Noise Surface (LNS). In Do-Minimum 2041 and Do-Something scenarios for both 2026 and 2041 it is assumed that the A9 will have been resurfaced with the LNS for the length of the scheme.

17.4.2 While the impact assessment has been undertaken in cognisance of the embedded mitigation features noted above, in order to ensure that all project mitigation requirements (including embedded, specific and standard mitigation) are captured, they have been included within the summary of mitigation section of this chapter, and the Schedule of Environmental Commitments contained in Chapter 21.

Construction Noise (Temporary) Impacts

17.4.3 In order to assess the construction impacts, it is necessary to consider the following matters to enable calculations of the worst-case construction noise impact:

- Likely phases of construction and their interaction
- Likely plant and equipment to be used
- Noise emissions from the specific plant
- Distances from nearest residential receptors

17.4.4 A simplified list of phasing, considering the main elements of the construction works, is presented below in **Table 17-11**. The plant and equipment lists were established through experience based upon previous similar large scale construction activities in the UK. The plant and equipment complements for the phases of construction as listed below are presented in **Appendix 17.3** (**Volume 2**).

Table 17-11: Simplified List of Possible Construction Phasing

Phase	Description
Phase 1	Site Clearance
Phase 2	Compound Construction
Phase 3	Compound Operation
Phase 4	Stock Proofing Site
Phase 5	Pre-earthworks Drainage
Phase 6	Earthworks General
Phase 7	Earthworks Rolling and Compaction
Phase 8	Sub-formation
Phase 9	Drainage
Phase 10	Pavement
Phase 11	Central Reserve Works
Phase 12	Road Marking Works
Phase 13	Signage Works
Phase 14	Bridge Construction
Phase 15	Bridge Abutment Construction
Phase 16	Bridge Deck Construction

17.4.5 It is assumed that there will not be any particular screening between construction activities and receptors. The ground cover has been assumed to be acoustically soft.

17.4.6 For the times of operation of the construction works themselves, a typical 12-hour working day is assumed, (0700-1900 hours) during the week. It is assumed that construction activities will take

place for 10-hours, allowing for breaks. A similar percentage of activity time would be assumed for any weekend working, to enable a worst-case assessment.

17.4.7 Acoustic 'On-Times' have been derived based upon experience, given the definition of the term contained in BS5228-1:2009+A1:2014. The acoustic on-time is the period of time that the equipment is working at full power or within 3dB of its maximum.

17.4.8 There are three areas of residential receptors in the study area for the scheme. These are ten residential dwellings located at Dalnaspidal, all on the west side of the A9. There is a single receptor, Balsporran Cottage, approximately 130m west of the A9. Finally, there are two residential receptors at Drumochter, 45m and 120m respectively to the east of the A9. For each group, distance measurements are made from the closest receptor for the assessment.

17.4.9 **Table 17-12** presents the distances assumed for receptors from different phases of work. The shortest potential distance for each activity is presented, where in practice construction activities will be variably at larger distances as the works progress. This is in order to present a potential worst case assessment. Where an activity will be undertaken in excess of 350m from receptors, then the construction phase is not assessed and no distance is included in **Table 17-12.**

Table 17-12: Distances of Receptors to various phases of Construction

Receptor Location		Distance to Receptor (m) in Construction Phase(s)				
		1&4	2&3	5-9	10-13	14-16
1A	Dalnaspidal*	20	60	20	65	95
1B	Dalnaspidal*	210	350	210	270	400
2	Balsporran	100	-	100	130	-
3	Drumochter	40	-	40	50	210
* 1A is closest receptor to works, 1B is furthest receptor.						

17.4.10 The total noise level from construction activities in each phase are presented in **Table 17-13**. The total construction noise level includes the contribution from the existing baseline noise level, summarised in **Table 17-10** and included in the first row of the **Table 17-13** for information. There are no predicted total construction noise levels presented in **Table 17-13** where an activity will be undertaken in excess of 350m from receptors.

17.4.11 Existing measured noise levels at all receptors are below 65dB $L_{Aeq,T}$ which indicates that the Category A threshold of 65dB $L_{Aeq,T}$ indicated in **Table 17-3** applies for the determination of significant effects. Predicted levels of construction noise above this level are shaded grey in **Table 17-13**.

Table 17-13: Predicted Total Construction Noise Levels in each Construction Phase

Phase	Receptors			
	1A	1B	2	3
Measured $L_{Aeq,T}$ dB	MP1 – 57.5		MP2 – 57.4	MP3 – 58.8
1	80.8	59.7	64.7	73.9
2	60.4	57.6	-	-
3	62.0	57.6	-	-
4	79.5	59.2	63.7	72.6
5	74.3	58.1	60.3	67.7
6	81.0	59.8	64.9	74.1

Phase	Receptors			
	1A	1B	2	3
7	78.4	58.9	62.8	71.6
8	80.5	59.6	64.4	73.6
9	74.3	58.1	60.3	67.7
10	68.6	58.8	62.4	71.4
11	66.3	58.2	60.8	69.0
12	63.1	57.8	59.1	65.5
13	69.0	58.9	62.7	71.8
14	64.7	58.0	-	60.4
15	64.4	57.9	-	60.3
16	62.5	57.8	-	59.7

17.4.12 The results indicate that nearly all phases of work occurring at the closest points to the sensitive receptors to the A9 at Dalnaspidal are predicted to result in adverse noise impacts exceeding 65dB $L_{Aeq,T}$. As the works move further away, then predicted noise levels reduce to below the 65dB $L_{Aeq,T}$ threshold for adverse effects. The duration of different phases of works are not yet known.

17.4.13 At Balsporran Cottage, construction activities would be of a sufficient distance that predicted construction noise levels would be below the 65dB $L_{Aeq,T}$ threshold for adverse impacts.

17.4.14 At the northern end of the study area, and for the receptors at Drumochter, construction noise levels are predicted to exceed the 65dB $L_{Aeq,T}$ threshold level for most activities, resulting in predicted adverse impacts. As the works move further away, then predicted noise levels will reduce to below the 65dB $L_{Aeq,T}$ threshold for adverse effects. The duration of different phases of works in different locations is not yet known.

17.4.15 A discussion of construction noise impacts for designated ecological sites is presented in **Chapter 12**.

17.4.16 Noise mitigation measures for all construction activities should be considered to minimise noise levels, particularly for those receptors predicted to be adversely impacted.

Construction Vibration (Temporary) Impacts

17.4.17 The empirical methods provided in BS5228-2 have been used to estimate vibration levels from possible piling at the proposed new bridge, located approximately 95m from Dalnaspidal Lodge. Two methods of piling are presented, vibratory pile driving and rotary piling, which is typically a quieter method of piling. BS5228-2 does not contain calculation methods for rotary piling, however data contained within BS5228-2 suggests that vibration from bored piling results in vibration levels that are **approximately** one order of magnitude lower than for vibratory drive piling. Both are presented in **Table 17-14** below.

Table 17-14: Predicted Vibration from Piling during Construction

Method	Predicted Vibration PPV (mm/s) at 95m	
	Start-up and run-down	Steady State
Vibratory Pile Driving	1.1	0.5
Rotary Bored Piling*	0.11	0.05
* Based on the assumption that rotary augured piling results in vibration levels one order of magnitude less than vibratory pile driving		

17.4.18 The results indicated above are below the guide values for cosmetic damage to buildings from construction works, provided in **Table 17-4**. However, vibratory drive piling may be perceptible at Dalnaspidal Lodge, as indicated in **Table 17-5**.

17.4.19 There is not predicted to be any permanent vibration impact from the works, in the form of damage to buildings, although there may be complaints when pile driving occurs. Where rotary bored piling is used, there would not be expected to be any complaints or building damage.

Operational Road Traffic Noise

17.4.20 This section summarises the potential operational noise impacts of the proposed A9 dualling. The change in road traffic noise is presented for noise sensitive receptors within the study area, indicated **Drawing 17.2** (**Volume 3**).

17.4.21 The full lists of calculated road traffic noise levels at each receptor, for each modelled scenario, are provided in the tables in **Appendix 17.4** (**Volume 2**).

17.4.22 **Table 17-15** presents the changes in daytime road traffic noise in the long-term comparison of the Do-Minimum scenario in the opening year 2026, with the Do-Minimum scenario in the future assessment year 2041 (based on magnitude of impact **Table 17-6**). The calculated noise levels for each individual receptor are presented in **Appendix 17.4** (**Volume 2**), and noise change contour plots are displayed in **Drawing 17-3** (**Volume 3**).

17.4.23 Night-time noise level changes are only reported for those receptors where 55 dB $L_{night,outside}$ is exceeded. The calculation of night-time noise levels indicates that there are only three receptors with noise levels in excess of $L_{night, outside}$ 55dB in either 2026 or 2041. The receptors are School Cottage and Schoolhouse in Dalnaspidal, and Drumochter Lodge towards the northern end of the scheme. The night-time results for these receptors are also indicated in **Table 17-15**.

Table 17-15: Long-term Traffic Noise Change Do-Minimum 2026 to Do-Minimum 2041

Change in Noise Level, dB		Long-term Magnitude	Daytime		Night-time
			Number of Dwellings	Number of Other Sensitive Receptors	Number of dwellings
Increase (Adverse) in Noise Level $L_{A10,18h}$	0.1-2.9	Negligible			
	3.0-4.9	Minor			
	5.0-9.9	Moderate			
	10.0 +	Major			
No Change	0	No Change			
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	0.1-2.9	Negligible	12	11	3
	3.0-4.9	Minor	1	1	
	5.0-9.9	Moderate			
	10.0 +	Major			

17.4.24 Over the long term, and without the development of the Proposed Scheme in the Do-Minimum scenario, noise levels are predicted to decrease at all receptors, by a **Negligible** magnitude of less than 3dB at 12 dwellings and 11 other sensitive receptors, and to decrease by a **Minor** magnitude of -3.0to-4.9dB at one dwelling and one other sensitive receptor.

17.4.25 The level of noise changes are predicted to range between -0.7 down to -3.1dB, including the changes in night-time noise levels. The increases in noise are due to the changes in traffic composition between 2026 and 2041, and the decreases are due to the implementation of a lower noise road surface between 2026 and 2041.

17.4.26 When considered against the matrix presented in **Table 17-7** the Significance of impacts over the Do-Minimum long term would be **Slight Benefit** for all receptors.

17.4.27 **Table 17-16** presents the changes in daytime road traffic noise in the short-term comparison of the Do-Minimum scenario in the opening year 2026, with the Do-Something in the opening year 2026 (based on magnitude of impact **Table 17-6**). The results presented are based on the Proposed Scheme, and do not include potential noise mitigation measures. The calculated noise levels for each individual receptor are presented in **Appendix 17.4** (**Volume 2**), and noise change contour plots displayed in **Drawing 17-4** (**Volume 3**). The assessment of night-time noise levels in the short term is not required.

Table 17-16: Short-term Traffic Noise Change Do-Minimum 2026 to Do-Something 2026

Change in Noise Level, dB		Short-term Magnitude	Number of Dwellings	Number of Other Sensitive Receptors
Increase (Adverse) in Noise Level $L_{A10,18h}$	0.1-0.9	Negligible	2	
	1.0-2.9	Minor	2	1
	3.0-4.9	Moderate		3
	5.0 +	Major		
No Change	0	No Change	2	
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	0.1-0.9	Negligible	2	3
	1.0-2.9	Minor	5	5
	3.0-4.9	Moderate		
	5.0 +	Major		

17.4.28 In the short term there are both predicted increases and decreases in road traffic noise at receptors, and No Change at 2 receptors. There are **Negligible** magnitude increases of less than 1dB at two dwellings, and **Negligible** decreases of less than 1dB at two dwellings and three other sensitive receptors (described further in **sub-section 17.4.33** below). There are also predicted to be **Minor** magnitude increases of +0.1to+2.9dB at two dwellings and one other sensitive receptor, and **Moderate** magnitude increases of +3.0to+4.9dB at three other sensitive receptors. There would also be **Minor** magnitude decreases of -1.0to-2.9dB at five dwellings and five other sensitive receptors.

17.4.29 There are two residential receptors where noise increases are predicted of greater than 1dB. These are Drumochter Lodge and North Drumochter Cottage towards the northern end of the scheme. There is predicted to be a +2.5dB increase on the east façade of Drumochter Lodge and +1.0dB increase on the north façade of North Drumochter Cottage, where the absolute façade noise level is 55dB $L_{A10,18h}$, which is below the level of 59.5dB above which changes of greater than 1dB would trigger consideration of noise mitigation.

17.4.30 There are no receptors where the conditions for consideration of noise mitigation are met.

17.4.31 The three other sensitive receptors predicted to experience noise increases of a **Moderate** magnitude are the Drumochter Hills SSSI, SAC and SPA, with footpath NMU5 predicted to experience a **Minor** adverse magnitude of change. It should be noted that the worst case prediction is presented for these receptors, and with increased distance from the A9 noise changes would reduce.

17.4.32 Short term increases in road traffic noise are due to a combination of increases in overall traffic flows and speeds, and the change in A9 alignment and topography. The replacement of the HRA road surface with a LNS offsets noise increases from traffic composition and alignment change in some locations, and results in overall noise decreases in other locations.

17.4.33 When considered against the matrix presented in **Table 17-7** the Significance of impacts for the Do-Something in the short term for residential receptors would be **Slight Adverse** for two receptors, **Slight/ Moderate Adverse** for two receptors. Additionally **Slight Benefit** for two receptors and **Slight/ Moderate Benefit** for five receptors significance is also predicted. No significance is presented for Designated sites, as this is discussed in **Chapter 12**.

17.4.34 **Table 17-19** presents the changes in daytime and night-time road traffic noise in the long-term comparison of the Do-Minimum scenario in the opening year 2026, with the Do-Something scenario in the future assessment year 2041 (based on magnitude of impact **Table 17-6**). The results presented are based on the Proposed Scheme, and do not include any potential noise mitigation measures. The calculated noise levels for each individual receptor are presented in **Appendix 17.4** (**Volume 2**) and noise change contour plots displayed in **Drawing 17-5** (**Volume 3**).

17.4.35 Night-time noise level changes are only reported for those receptors where 55 dB $L_{night,outside}$ is exceeded. The calculation of night-time noise levels indicates that there are three dwellings with noise levels in excess of $L_{night, outside}$ 55dB in either Do-Minimum 2026 or Do-Somehting 2041. These are School Cottage and Schoolhouse in Dalnaspidal and Drumochter Lodge towards the northern end of the scheme. The night-time results for these dwellings are also indicated in **Table 17-17**.

Table 17-17: Long-term Traffic Noise Change Do-Minimum 2026 to Do-Something 2041

Change in Noise Level, dB		Long-term Magnitude	Daytime		Night-time
			Number of Dwellings	Number of Other Sensitive Receptors	Number of dwellings
Increase (Adverse) in Noise Level $L_{A10,18h}$	0.1-2.9	Negligible	6	1	
	3.0-4.9	Minor		3	
	5.0-9.9	Moderate			
	10.0 +	Major			
No Change	0	No Change		1	
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	0.1-2.9	Negligible	7	7	1
	3.0-4.9	Minor			2
	5.0-9.9	Moderate			
	10.0 +	Major			

17.4.36 Over the long term, with the Proposed Scheme, traffic noise is predicted to both increase and decrease at receptors. Increases would be of a **Negligible** magnitude of +0.1to+2.9dB at six dwellings and one other sensitive receptor and a **Minor** magnitude of +3to+4.9dB at three other sensitive receptors. There are also predicted decreases in noise of a **Negligible** magnitude of -

0.1to-2.9dB at seven dwellings and seven other sensitive receptors as well as **No Change** at one other sensitive receptor.

17.4.37 The night-time assessment indicates road traffic noise decreases of a **Negligible** magnitude of -0.1to-2.9dB at one dwelling and a **Minor** magnitude decrease of -3to-4.9dB at two dwellings.

17.4.38 As predicted road traffic noise increases over the long term are all of a **Negligible** magnitude, with the largest predicted increase of +2.8dB at Drumocheter Lodge, there are no receptors that meet the conditions for consideration of noise mitigation.

17.4.39 The three other sensitive receptors predicted to experience road traffic noise increases of a **Minor** magnitude are Drumochter Hills SPA, SAC and SSSI. The other sensitive receptor predicted to experience noise increases of a **Negligible** magnitude is NMU5. It should be noted that the worst case prediction is presented for these receptors, and with increased distance from the A9 noise changes would reduce.

17.4.40 The increases in road traffic noise over the long term are due to a combination of increases in overall traffic flows and speeds, and the change in A9 alignment and topography. The replacement of the HRA road surface with a LNS road surface offsets noise increases from traffic composition and alignment change in some locations, and results in noise decreases in other locations.

17.4.41 When considered against the matrix presented in **Table 17-7** the Significance of impacts for residential receptors for the Do-Something in the long term would be **Slight Adverse** for six receptors and **Slight Benefit** at seven receptors. No significance is presented for Designated sites, as this is discussed in **Chapter 12**.

17.4.42 The long-term assessment results have also been used to establish whether any dwellings would be eligible for noise insulation under the conditions of the NISR (**sub-sections 17.2.5 -17.2.10**). There are no dwellings where road traffic noise levels are predicted to exceed 68dB $L_{A10,18h}$ with the introduction of the Proposed Scheme in the future assessment year, and where there is an increase in road traffic noise of greater than 1dB. There are no dwellings that meet the conditions for an offer of noise insulation under the NISR. It is considered unlikely that the use of the NISR calculation methodology (see **Paragraph 17.2.10**) would result in any dwellings becoming eligible as the highest predicted noise level with the scheme is below 62dB $L_{A10,18hr}$, a margin of 6dB below the threshold for eligibility.

Road Traffic Noise Nuisance

17.4.43 The predicted noise nuisance results are presented in **Table 17-18**. This includes comparison of the Do-Minimum 2026 against the Do-Minimum in 2041 and also the Do-Something scenario 2041.

17.4.44 In the Do-Minimum assessment 13 dwellings are predicted to lie within the nuisance decrease band of less than 10% of people would be bothered “very much” or “quite a lot” by noise nuisance. With the introduction of the Proposed Scheme the numbers of people bothered “very much” or “quite a lot” by noise nuisance would increase, which would move two dwellings into the noise increase band of less than 10%, two dwellings in the noise nuisance increase band of 10 to 20% and two dwellings into the noise nuisance increase band of 20 to 30%. Seven dwellings would remain in the nuisance decrease band of less than 10% of people bothered “very much” or “quite a lot” by noise nuisance.

Table 17-18: Summary of Traffic Noise Nuisance for Dwellings

Change in Nuisance Level, dB		Do-Minimum	Do-Something
Increase (Adverse) in Nuisance Level $L_{A10,18h}$	<10%		2
	10<20%		2
	20<30%		2
	30<40%		
	>40%		
No Change	0%		
Decrease (Beneficial) in Nuisance Level $L_{A10,18h}$	<10%	13	7
	10<20%		
	20<30%		
	30<40%		
	>40%		

Road Traffic Noise Vibration Nuisance

17.4.45 There are five receptors within 40m of the Proposed Scheme for which the change in road traffic induced vibration nuisance has been calculated. For those receptors the percentage of people who would be bothered "very much" or "quite a lot" by noise, vibration nuisance is considered to be 10% less than the corresponding figure for noise nuisance. For those receptors where noise exposure levels are below 58dB $L_{A10, 18h,}$ zero percent is assumed.

17.4.46 The predicted traffic airborne vibration nuisance results are presented in **Table 17-19**. This includes comparison of the Do-Minimum 2026 against the Do-Minimum in 2041 and also the Do-Something scenario 2041.

17.4.47 In the Do-Minimum assessment there is no change in vibration nuisance at one dwelling and the remaining four dwellings are predicted to lie within the nuisance decrease band of <10% of people would be bothered "very much" or "quite a lot" by noise nuisance. With the introduction of the Proposed Scheme there would be no change in airborne vibration nuisance from road traffic with the dwellings remaining in the same bands of change.

Table 17-19: Summary of Traffic Airborne Vibration Nuisance for Dwellings

Change in Nuisance Level, dB		Do-Minimum	Do-Something
Increase (Adverse) in Nuisance Level $L_{A10,18h}$	<10%		
	10<20%		
	20<30%		
	30<40%		
	>40%		
No Change	0%	1	1
Decrease (Beneficial) in Nuisance Level $L_{A10,18h}$	<10%	4	4
	10<20%		
	20<30%		
	30<40%		
	>40%		

17.5 Mitigation

17.5.1 This section discusses options for noise mitigation for the construction and operation phases of the Proposed Scheme. Noise mitigation during construction is likely to be necessary in some areas, to minimise predicted noise levels as far as possible. The embedded noise mitigation for the operation of the Proposed Scheme is also listed, although there is no project specific noise mitigation as there are no receptors predicted to experience impacts that meet the conditions for noise mitigation, as outlined in **sub-sections 17.2.58** to **17.2.65**.

Construction

17.5.2 The standard mitigation commitments for the construction phase for the A9 are detailed in **Table 17-20** below.

Table 17-20: Standard Noise and Vibration Mitigation Commitments for the Construction Phase

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Purpose/ Objective	Specific Consultation or Approval Required
Standard A9 Mitigation					
SMC-NV1	Throughout Proposed Scheme	Pre-Construction & Construction	A scheme of noise and vibration monitoring will theresfore be agreed with the Environmental Health Department, and noise and vibration limits will be contained within the CEMP (refer to **Mitigation Item SMC-S1** in **Chapter 21**). The contractor will be required to develop and implement a Noise and Vibration Management Plan to meet these requirements. The assessment will include the design of any necessary NSR specific construction mitigation over and above the standard mitigation included within this ES chapter.	To predict the noise and vibration levels during the construction of the Proposed Scheme. It will include the design of receptor specific mitigation, over and above the standard mitigation detailed in **Mitigation Item SMC-NV2** in **Chapter 21**, where required.	The relevant Local Authority Environmental Health Officer
SMC-NV2	Throughout Proposed Scheme	Pre-Construction & Construction	Best Practicable Means will be used to limit the level of noise to which operators and others in the vicinity of site operations would be exposed. This includes the following: • the hours of working will be planned and account will be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on site, taking into account the nature of land use in the areas concerned, the duration of work and the likely consequence of any lengthening of work periods; • any work outside of normal working hours will be agreed with the relevant local authority; • where reasonably practicable, quiet working methods will be employed, including use of the most suitable plant, reasonable hours of working for noisy operations, and economy and speed of operations; • permanent noise mitigation measures such as acoustic screens and earthwork bunds are to be constructed as early as practical; • noise will be controlled at source, for example, by modification of existing plant/ equipment, its use and location and ensuring maintenance of all noise-generating equipment; • the spread of noise will be limited, i.e. by distance between source and receiver and/ or screening; • on-site noise levels will be monitored regularly, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose. A method of noise measurement would be agreed with the local authority prior to the commencement of site works; • on those parts of a site where high levels of noise are likely to be a hazard to persons working on the site, prominent warning notices will be displayed and, where necessary, ear protectors will be provided; • proper use of plant with respect to minimising noise emissions and regular maintenance in line with plant manuals; • where practicable, vehicles and mechanical plant used for the purpose of	To reduce, as far as practicable, the level of noise to which operators and others in the vicinity of site operations would be exposed.	Local Authority if any working outwith normal working hours

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Purpose/ Objective	Specific Consultation or Approval Required
			the works will be fitted with effective exhaust silencers and will be maintained in good, efficient working order; • where appropriate, inherently quiet plant will be selected. All major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers; • machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum; • all ancillary plant such as generators, compressors and pumps will be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures will be provided; and • adherence to the codes of practice for construction working and piling given in British Standard 'BS 5228:2009+A1:2014' and the guidance given therein minimising noise emissions from the site. In addition, the Local Authority would be consulted regarding any proposed working out-with normal working hours.		
n/a (note)			*In addition to the above, standard **Mitigation Item SMC-S3** in **Chapter 21** will also mitigate potential for noise disturbance through the overall communications strategy for the A9 Dualling Programme and appointed Community Liaison Officer and liaison team.*		

Operation

17.5.3 Embedded mitigation is detailed in **Table 17-21** below.

Table 17-21: Embedded Noise and Vibration Mitigation Commitments for the Operation of the A9

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Purpose/ Objective	Specific Consultation or Approval Required
Embedded Mitigation					
P07-NV1	Throughout Proposed Scheme	To be laid during road construction	There will be an improvement in the A9 road surface. The majority of the existing A9 is surfaced with Hot Rolled Asphalt (HRA). The A9 is being resurfaced as part of the Proposed Scheme design, and the new pavement will utilise a Lower Noise Surface (LNS). In Do-Minimum 2041 and Do-Something scenarios for both 2026 and 2041 it is assumed that the A9 will have been resurfaced with the LNS for the length of the Proposed Scheme	Reduce Road Traffic Noise	None

17.6 Residual Impacts

Construction Noise and Vibration

17.6.2 The assessment has indicated that receptors are at a sufficient distance from potential sources of construction vibration that adverse levels of vibration are not anticipated.

17.6.3 Appropriate controls and mitigation measures would be implemented to reduce construction noise impacts where practicable, as detailed in **Table 17-20**. It is expected that construction noise levels would be reduced to below the threshold level of 65dB $L_{Aeq,t}$ for the majority or receptors. It should also be noted that construction noise impacts will be temporary in nature.

Summary

17.6.4 A summary of residual noise impacts with the inclusion of noise mitigation for the construction phase of the scheme is indicated in **Table 17-22**. Under operation, there are no receptors where the requirements for consideration of noise mitigation during operation were met, for any receptors. As such no receptors are summarised within this part of the table. There are no significant vibration impacts predicted, so vibration is also not included within this table.

Table 17-22: Summary of Noise Residual Impacts for Noise Sensitive Receptors

Receptor Name	Value	Significance of Impact	Mitigation	Magnitude of Residual Impact	Significance of Residual Impact
Construction (Residential Receptors)					
Dalnaspidal, closest to works	High	Noise Threshold Exceedance	Standard Measures	Not Applicable	No Significant Impact
Dalnaspidal, furthest from works	High	Noise Threshold Exceedance	Standard Measures	Not Applicable	No Significant Impact
Balsporran	High	Noise Threshold Exceedance	Standard Measures	Not Applicable	No Significant Impact
Drumochter	High	Noise Threshold Exceedance	Standard Measures	Not Applicable	No Significant Impact
Operation Do-min 2026 to Do something 2026					
Dalnaspidal Lodge and Staff Cottage	High	Slight Adverse	No mitigation required	N/A	Slight Adverse
Drumochter Lodge and North Drumochter Cottage	High	Slight/ Moderate Adverse	No Mitigation	N/A	Slight/ Moderate Adverse
Dalnaspidal Farm and Balsporran Cottages	High	Slight Benefit	No Mitigation	N/A	Slight Benefit
1 and 2 Station Cottages, School House, School Cottage and Station House	High	Slight/ Moderate Benefit	No Mitigation	N/A	Slight/ Moderate Benefit
Keepers House and Headkeepers House	High	Neutral	No Mitigation	N/A	Neutral

Receptor Name	Value	Significance of Impact	Mitigation	Magnitude of Residual Impact	Significance of Residual Impact
Operation Do-min 2026 to Do something 2041					
Dalnaspidal Lodge, Staff Cottage, Keepers House, North Drumochter Cottage, Drumochter Lodge, 2 - Station Cottages	High	Negligible Adverse	No Mitigation	N/A	Negligible Adverse
Headkeepers House, Station House School Cottage, Dalnaspidal Farm, Balsporran Cottage, Schoolhouse, 1 Station Cottages	High	Negligible Beneficial	No Mitigation	N/A	Negligible Beneficial

17.7 References

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