17 Noise and Vibration

17.1 Introduction

17.1.1 This chapter assesses the potential noise and vibration impacts of the Proposed Scheme for Project 9, Crubenmore to Kincraig of the A9 Dualling Programme. It considers the potential operational and construction impacts of the Proposed Scheme on existing noise sensitive receptors. The Proposed Scheme alignment assessed for Project 9 is described in **Chapter 6**, **Volume 1**, and shown in **Drawings 6.1** to **6.10** in **Volume 3** of this report.

17.1.2 The objective of this Environmental Impact Assessment (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. The Do-Minimum scenario assumes that there would be no change to the A9, and the Do-Something scenario assumes that the scheme is fully developed and operational. 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 assessment of the potential noise and vibration impacts for noise 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 BS5228:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites*' 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 impacts, construction is presumed to occur over a period of approximately 3 to 3.5 years, up to the scheme opening year of 2026.

17.1.6 At the time of undertaking this assessment, drawings detailing the final construction of the northern tie-in, where dualling of Project 10 – Kincraig to Dalraddy is now complete, were not available. Therefore, the noise modelling has been undertaken based on a single carriageway road north of the Proposed Scheme in both the Do-Minimum and Do-Something scenario. The traffic data used for the one-way roads in this section include the same level of traffic growth with the scheme as would be attracted to the dualled section. This approach has not affected the outcome of the assessment.

17.1.7 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' is provided in **Appendix 17.1 (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 the *Transportation Noise 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 site 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 also been published. This guidance is predominantly for those organisations involved in implementing the *Noise Action Plan*, including 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 68 dB $L_{A10,18h}$ requires a roads authority to make offers of insulation to eligible dwellings. The conditions are that the noise level must also increase by at least 1 dB, with a 1 dB contribution to the increase in noise level to be from the new or altered roads.

17.2.7 The NISR also require an eligible building to be:

- A dwelling or a building used for residential purposes
- Within 300m of the edge of a new or altered highway
- Occupied prior to the opening to traffic of the new or altered road
- Not subject to a compulsory purchase or demolition order or be within a clearance area
- Not receiving a grant for noise insulation work under any other statutory scheme

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 Calculation of Road Traffic Noise (CRTN) methodology. 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 HD213/11
Operational airborne vibration	DMRB HD213/11

Study Areas

17.2.12 The study area for temporary construction noise is the same as that for operational noise, and for temporary construction vibration the study area covers approximately 100m from any construction activities likely to result in vibration, as shown on **Drawing 17.2 (Volume 3).**

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 on **Drawing 17.2 (Volume 3).**

[1] Sources:

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, British Standards Institution.

BS 5228-2:2009+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.

17.2.14 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 1km 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).

17.2.16 A 600m boundary is then defined around all affected routes within the 1km 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. 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.

17.2.17 The road traffic noise study area is presented in **Volume 3, Drawing 17.2**. The drawing also indicates the noise sensitive receptors and noise measurement positions within the study area.

17.2.18 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 assessment year compared to the baseline year.

17.2.19 As the A9 Dualling Programme is currently being assessed as several individual projects, 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.

17.2.20 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.

17.2.21 For the assessment of 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

17.2.22 Given that the study area presents a relatively long section of road running through a mix of sparsely populated areas and also close to towns, 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.

17.2.23 A mix of long-term (at least 24-hour) 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 has been reproduced in **Volume 2, Appendix 17.2**.

17.2.24 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 19th and 30th September 2014 at 23 locations, ten of which are representative of the nearest noise sensitive receptors to project

9. 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 contained in **Volume 2, Appendix 17.2**.

Construction Noise

17.2.25 Construction noise impacts from the proposed works were considered for receptors within the operational noise study area. 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

17.2.26 Construction vibration impacts from the proposed works were considered for receptors up to 20m from general vibration generating activities such as rolling and compaction and up to 100m from potential piling locations, as shown on **Drawing 17.2 (Volume 3).** Listed buildings or scheduled monuments within 1km of potential piling locations have also been identified. 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

17.2.27 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 on a typical weekday. This takes account of the diurnal variation in traffic noise.

17.2.28 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.

17.2.29 The procedure for predicting the noise level from a road is described in the Department of Transport and Welsh Office technical memorandum Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988), which also applies in Scotland.

17.2.30 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 façade to calculate the $L_{A10,18h}$ dB noise level.

17.2.31 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
- 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 NMU routes) 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
- Assessment tables completed 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
- There are no 'affected routes' identified outside the study area. 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 or 3 dB(A) or more in the long-term. Definition of the study area is explained in the next section. A count of the number of dwellings and other sensitive receptors within 50m of the centreline of any affected routes identified outside of the study area should also be undertaken, however none are identified for this project.
- Where a building is predicted to experience different changes on different façades, the least beneficial change in noise level should be reported
- Maps are provided that show the study area and the dwellings and other sensitive receptors that are included in the assessment. Maps are also provided indicating the noise change for the three scenarios assessed.
- A list of predicted noise levels for all sensitive receptors in the study areas shall be provided
- Evaluation of any cumulative impacts was carried out, and is presented in **Chapter 20**
- Assessment of possible airborne and ground borne vibration impacts was carried out

17.2.32 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.

17.2.33 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 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 three sections of existing Low Noise Surface (LNS) on the A9. The first is to the south of the scheme start point, the second from approximate Ch. 45,950 to 54,290 and also from approximate Ch. 55,980 to the end of the scheme and beyond
- The A9 surfaces are expected to be resurfaced with a Low Noise Surface (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 a LNS, 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

17.2.34 In accordance with the HD213/11 Detailed Assessment, this chapter also undertakes a night time noise assessment for the future assessment year (2041). 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

17.2.35 HD213/11 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.

17.2.36 In line with HD213/11, 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

17.2.37 A method for the assessment of traffic induced vibration is outlined in HD213/11, 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.

17.2.38 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

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

- OS MasterMap
- OS Address Base
- Traffic data for the AAWT between 06:00–00:00 (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 Heavy Duty Vehicles (HDV)
  - Vehicle speed (km/h)

Road traffic data has been provided for the scheme by the project transport consultants.

Assigning Sensitivity

17.2.40 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 NMU routes 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.

17.2.41 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.

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

17.2.42 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.

17.2.43 A total of 659 residential receptors have been identified in the study area for operational noise, and three other sensitive receptors that are buildings. These are St Columba's Church in Kingussie, Kingussie High School and Clan MacPherson House. A full list of all 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)**.

17.2.44 There are several designated sites within the study area, and these are shown in **Drawing 12.1 (Volume 3)**. The sites cover a wide area along the full length of the scheme and the same areas of ground in some places. The designated sites include the River Spey SSSI and SAC and also the Insh Marshes SSSI and SPA, Ramsar and NNR. Additionally, there are areas of Ancient Woodland, for which predictions of road traffic noise have been undertaken.

17.2.45 There are also numerous NMU routes running through the study area, as shown in **Drawing 9.1 (Volume 3)**.

17.2.46 Receptor locations were selected to represent each designated site and public right of way in order to assess the predicted change in road traffic noise for each receptor. In some cases several locations were selected, and the least beneficial change in road traffic noise for each of these receptors is presented in the assessment tables 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

17.2.47 **Table 17-3** is reproduced from Table E.1 in BS 5228-1 Annex E, which describes methods for evaluating the potential significant effect of construction noise.

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

Period	Category A	Category B	Category C
Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00)	55	60	65
Night-time (23:00-07:00)	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

17.2.48 **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: Transient vibration guide values for cosmetic damage

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: Guidance on effects of vibration levels 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

17.2.49 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.

17.2.50 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 $L_{A10,18\text{-}hr}$ 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

17.2.51 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.

17.2.52 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

17.2.53 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.

17.2.54 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

17.2.55 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.

Operational Noise Mitigation Threshold Criteria

17.2.56 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*'.

17.2.57 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, the advice from the TAN (**Table 17-8**) states that "*These effects, if adverse, while important, are not likely to be key decision-making issues*".

17.2.58 **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.

17.2.59 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.

17.2.60 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 59.5dB $L_{A10,18h}$ respectively.

17.2.61 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 $L_{A10,18h}$

17.2.62 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.

17.2.63 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). Other examples which could preclude the use of mitigation are disproportionate cost and unacceptable visual impact.

Limitations to Assessment

17.2.64 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.

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

17.2.66 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 a development 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.

17.2.67 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 AddressBase data.

Construction Noise

17.2.68 There are limited construction details available at this stage and therefore, the construction noise predictions have used typical road construction activities reported in BS 5228-1 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 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.

17.2.69 It has been identified that some 'blasting' may be required in order to excavate some areas of rock. The details regarding any such blasting are undeveloped at this stage of assessment, and assessment of possible noise and vibration from blasting events cannot therefore be assessed at this stage as impacts would be dependent on each individual blast design and specifics of the rocks to be blasted. It is anticipated that the blasting contractor would undertake all necessary assessment and mitigation planning when developing any such blasting requirements.

17.2.70 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.

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

Construction Vibration

17.2.72 There are limited construction details available at this stage. Construction vibration impacts are considered for dwellings up to about 20m from general vibration activities such as compaction, and up to 100m from potential piling locations. Listed buildings and scheduled monuments within 1km from potential piling locations are also considered.

17.2.73 There are methodologies contained within BS5228-2 that allow the prediction of construction vibration from percussive and vibratory piling, but not from other forms of construction. The **Table 17-9** below indicates the distances as which certain construction activities give rise to a just perceptible level of vibration, based on historical field measurements.

Table 17-9: Distances at which vibration may just be perceptible

Construction Activity	Distance from activity when vibration may just be perceptible, metres
Excavation	10 to 15
Compaction	30 to 40
Heavy Vehicles (e.g. dump trucks)	5 to 10
Hydraulic Breaker	15 to 20
Auger Piling (e.g. CFA Piling)	15 to 20

17.2.74 There are no receptors within 10m, and six receptors within about 10m up to 40m of the A9, which is within the distance ranges presented above for most activities. Vibration from the majority of construction activities is therefore likely to be perceptible at these closest sensitive receptors, when works are being undertaken close to the site boundaries. When works are being undertaken further along the A9, and outside of 10-40m away from receptors, then vibration from construction activities is unlikely to be perceptible.

17.2.75 The contractor may decide to use piling during construction of various structures. As the structures are all in excess of 100m from dwellings, any piling that may be required is not likely to result in adverse levels of vibration at dwellings. The closest listed building or scheduled monument has been identified at a distance of 300m from piling locations at the River Spey, potential vibration levels at this distance have been estimated and are presented in **Paragraphs 17-4-14 to 17-4-16**.

17.2.76 Should piling be identified by the contractor as a method of works at any other location then assessment should be undertaken of any listed buildings or scheduled monuments within 1km of the piling, and any dwellings or other structures within 100m.

Operational Road Traffic Noise

17.2.77 Traffic data has been produced and applied to the assessment of the Proposed Scheme, and it is assumed that this is accurate.

17.2.78 **Table 17-10** presents the uncertainties associated with the operational traffic noise modelling and assessment.

Table 17-10: Uncertainty 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

Parameter	Description	Level of Uncertainty
Road Pavement in Do-Minimum	Information on existing road pavement on the A9 has been provided by Transport Scotland. The A9 is surfaced with a combination of standard HRA with three sections of LNS. 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 a LNS. 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 Mainline 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 (06:00 – 24:00) and night-time (00:00 – 06:00) 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 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.

There are ten noise monitoring locations as listed below and indicated in **Drawing 17.1 (Volume 3)**. The noise measurement results are presented in **Table 17-11**. These receptors are representative of residential locations:

- MP8 – Invernahavon Caravan Park, Glentruim, PH2 1BE
- MP9 – Ptarmigan Lodge, West Ralia, PH2 1BD
- MP10 – Upper Nuide, Newtonmore, PH20 1BD
- MP11 – Ruthven Farm House, Kingussie, PH21 1NR
- MP12 – The Spinney, Spey Street, Kingussie, PH21 1JQ
- MP13 – Craig-An-Darach, Kingussie, PH21 1HG
- MP14 – Three Bridges, Kingussie, PH21 1LS
- MP15 – Kerrow Cottage, Kingussie, PH21 1LS
- MP16 – Croila Road, Kingussie, PH21 1PH
- MP17 – Ard Dalle, Lynchat, Kingussie, PH21 1LT

Table 17-11: Summary of Baseline Noise Measurements

Location	Distance to A9 (m)	Date	Time	$L_{Aeq,T}$ dB	L_{AFmax} dB	$L_{A10,T}$ dB	$L_{A90,T}$ dB
MP8	315	19/09/14	10:00-13:00	44.7	78.5	47.0	40.5
MP9	25	23/09/14	10:00-13:00	61.3	99.3	60.4	39.8
MP10	175	19/09/14	13:20-16:20	49.4	64.3	54.3	35.5
MP11	235	22/09/14	10:00-13:00	50.9	75.1	55.3	41.8
MP12	490	22-23/09/14	Day	50.3	82.0	47.8	36.8
			Night	39.2	61.4	42.7	28.1
MP13	185	23-24/09/14	Day	52.0	79.3	54.6	40.4
			Night	45.9	64.4	50.2	25.9

Location	Distance to A9 (m)	Date	Time	$L_{Aeq,T}$ dB	L_{AFmax} dB	$L_{A10,T}$ dB	$L_{A90,T}$ dB
MP14	315	30/09/14	10:00-13:00	53.2	76.3	57.3	47.5
MP15	50	30/09/14	13:15-16:15	52.8	69.7	57.6	44.6
MP16	325	23/09/14	13:20-16:20	45.9	80.9	42.1	35.7
MP17	90	30/09/14	Day	52.0	76.9	54.2	45.2
			Night	49.7	63.9	50.2	38.0

17.3.4 The main source of noise at most locations is from road traffic on the A9, and sometimes other local roads. The exceptions are MP8, MP12 and MP16 where traffic noise from the A9 was noted in the distance, and not as the main noise source.

17.3.5 At MP8 the main source of noise was noted to be from activity on the caravan site itself, including the movement of cars and caravans on and off of the site, waste collection and grounds maintenance. Little noise from the A9 was discernible. Other noise sources included passenger trains on the Highland Mainline and overflights by aircraft.

17.3.6 The main noise sources at MP12 and MP16 was noted to be road traffic noise from local traffic within Kingussie, with the A9 in the distance at both locations. Railway traffic from the Highland Mainline was also noted at MP9 and MP12. At MP16 the open area used for the measurement location was being used by local residents to exercise their dogs.

17.3.7 Other observations recorded sources including some domestic activity (such as gardening) and a shooting activity from the nearby game estate at MP10. There was some agricultural activity at MP11, including the use of bird scarers or shotguns. At MP13 there was some nearby residential activity, thought to include DIY. Noise from the railway was noted at MP14, and the barking of working dogs located in a nearby pen was noted at MP15. Noise from children in the after-school period was noted at MP17.

17.3.8 The overflight of aircraft in general was noted at all locations, as was the overflight of military aircraft at MP11, which is a common occurrence in the area.

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.
- An improvement in the A9 road surface. The majority of the existing A9 at this location 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 both Do-Minimum 2041 and Do-Something scenarios for both 2026 and 2041 the model reflects that the A9 will have been resurfaced with 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**, **Volume 1**.

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:

- Phases of construction and their interaction
- 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 17-12**. The plant and equipment lists were established through experience based upon previous similar large-scale construction activities in the UK. Appendix 5.1, Volume 2 presents an outline of the construction activities and a high-level discussion of phasing. The plant and equipment assumed for the various phases of construction as listed below are presented in **Appendix 17.3**, **Volume 2**.

Table 17-12: 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	Rock Breaking
Phase 9	Sub-formation
Phase 10	Drainage
Phase 11	Pavement
Phase 12	Central Reserve Works
Phase 13	Road Marking Works
Phase 14	Signage Works
Phase 15	Spey Bridge Demolition – Breaking and Clearing
Phase 16	Spey Bridge Demolition – Deck Removal
Phase 17	Spey Bridge Demolition – Pier Breakdown
Phase 18	Bridge Foundation Construction
Phase 19	Bridge Abutment Construction
Phase 20	Bridge Deck Construction

17.4.5 The construction programme is anticipated to be of 3 to 3.5-year duration, and the detailed programme will be developed by the Principal contractor. The dualling of the A9 will take place in two sections north and south of Kingussie, and the major bridge works will be undertaken in periods of activity and quiet across the full 3 to 3.5 year duration of the construction programme.

17.4.6 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.

17.4.7 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.

17.4.8 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.

17.4.9 There are multiple areas of residential receptors in the study area for the scheme, and designated areas and NMUs in the vicinity of the A9. The closest residential receptors are within about 10m of the scheme boundary, at Railabeag, Knappach and Mains of Balavil. Residential receptors are located at various distances from about 10m all the way out to the edge of the study area. The designated sites and NMUs also cover a wide area, some immediately adjacent to the A9, and covering ground out to the edge of the study area and beyond. As such this assessment has considers potential construction noise levels at 10m, and at various distances away from the works to provide an indication of changes in construction noise.

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 17-11** and included in the first row of the **Table 17-13** for information. As the predicted construction noise levels are not at particular receptors, but at set distances, a baseline measured noise level from a receptor at a similar distance from the A9 has been selected.

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	Distance					
	10m	20m	50m	100m	200m	350m
Measured $L_{Aeq,T}$ dB	(MP9) 61.3	(MP9) 61.3	(MP15) 52.8	(MP17) 52.0	(MP13) 52.0	(MP16) 45.9
1	86.9	80.9	71.4	64.1	57.7	51.6
2	75.0	69.5	60.2	54.9	52.7	46.6
3	77.6	71.9	62.5	56.4	53.2	47.1
4	85.5	79.5	70.1	62.9	56.7	50.7
5	80.3	74.4	65.0	58.3	54.0	47.9
6	87.0	81.0	71.6	64.3	57.8	51.7
7	84.4	78.4	69.0	61.9	56.0	49.9
8	90.1	84.1	74.6	67.2	60.3	54.2
9	86.5	80.5	71.1	63.8	57.4	51.3

Phase	Distance					
	10m	20m	50m	100m	200m	350m
10	80.3	74.4	65.0	58.3	54.0	47.9
11	86.6	80.6	71.2	63.9	57.5	51.4
12	84.0	78.1	68.7	61.5	55.8	49.7
13	80.0	74.2	64.8	58.2	53.9	47.8
14	87.0	81.0	71.6	64.3	57.8	51.7
15	90.6	84.6	75.1	67.7	60.7	54.6
16	76.6	71.0	61.7	55.8	53.0	46.9
17	88.1	82.1	72.7	65.3	58.7	52.6
18	89.5	83.5	74.0	66.6	59.7	53.6
19	85.9	79.9	70.5	63.2	57.0	50.9
20	83.4	77.4	68.0	60.9	55.4	49.3

17.4.12 The results indicate that for receptors within 50m of construction works, noise during construction periods are likely to exceed the 65dB $L_{Aeq,T}$ threshold for significant construction noise impact. With increased distance, noise from almost all construction activities decreases to below the 65dB $L_{Aeq,T}$ threshold level by a distance of 100m. There are approximately 34 residential dwellings within 100m of the scheme earthworks that may experience construction noise levels at or above the threshold level for those periods of time when rock breaking and bridge works are occurring within 100m of them. There are 13 residential dwellings within 50m, where construction noise levels would be above the threshold for most of the construction activities.

17.4.13 In the case of demolition of the Spey Bridge, some parts of the demolition would exceed the 65dB $L_{Aeq,T}$ threshold level at distances of greater than 100m, up to around 115m from the demolition. The closest residential receptors to the current River Spey Bridge are located on Manse Road, at approximately 200m from the existing bridge, and around 245m from the proposed location of the new bridge, and associated works. Therefore, the bridge demolition and construction works presented in Phases 15 through to 20 would not be expected to exceed the 65dB $L_{Aeq,T}$ threshold level at any residential dwellings.

17.4.14 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

17.4.15 The empirical methods provided in BS5228-2 have been used to estimate vibration levels from piling in the River Spey at the closest listed building or scheduled monument 'Ruthven Barracks', which is located at the approximate distance of 300m. Piling levels at some intervening distances have also been presented for information. 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 pile driving. Both are presented in **Table 17-14** below.

Table 17-14: Predicted Vibration from Piling during Construction, PPV (mm/s)

Method		Distance		
		10m	100m	300m
Vibratory Pile Driving	Start-up and run-down	16.8	1.1	0.3
	Steady State	10.6	0.4	0.1
Rotary Bored Piling*	Start-up and run-down	1.68	0.11	0.03
	Steady State	1.06	0.04	0.01
*Based on assumption that rotary augered piling results in vibration levels one order of magnitude less than vibratory pile driving				

17.4.16 The results indicated in **Table 17-4** above are below the guide values for cosmetic damage to buildings from construction works, with the exception of vibratory pile driving at 10m, however there are no receptors identified at this distance. For the receptor under consideration at 300m from piling in the River Spey, the predicted levels of vibration are well below the guide values.

17.4.17 There is not predicted to be any permanent vibration impact from piling at dwellings, in the form of damage to buildings, although there may be complaints if pile driving occurs within 100m of dwellings. Where rotary bored piling is used, there would not be expected to be any complaints or building damage.

Operational Road Traffic Noise

17.4.18 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 in **Volume 3, Drawing 17.1**.

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

17.4.20 **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 **Drawings 17-3** to **17-15 (Volume 3)**.

17.4.21 The calculation of night-time noise levels indicates that there are 118 receptors with noise levels in excess of $L_{night, outside}$ 55dB in either scenario. 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	280	4	110
	3.0-4.9	Minor			
	5.0-9.9	Moderate			
	10.0 +	Major			
No Change	0	No Change	18		1
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	0.1-2.9	Negligible	351	28	7
	3.0-4.9	Minor	10	6	
	5.0-9.9	Moderate			
	10.0 +	Major			

17.4.22 Over the long term, and without the development of the Proposed Scheme in the Do-Minimum scenario, noise levels are predicted to both increase and decrease, with No Change in road traffic noise also predicted for 18 dwellings. There would be noise increases of a Negligible magnitude of 0.1 to 2.9dB at 280 dwellings and four other sensitive receptors. There would be noise decreases of a Negligible magnitude of -0.1 to -2.9dB at 351 dwellings and 28 other sensitive receptors, and also of a Minor magnitude of -3 to -4.9dB at 10 dwellings and six other sensitive receptors.

17.4.23 The largest decreases in road traffic noise are in areas adjacent to sections of the A9 where the existing noise surface in a standard HRA, where the surface is expected to be replaced by a LNS as part of routine maintenance by the future assessment year of 2041.

17.4.24 The assessment of night-time noise levels in the long term Do-Minimum assessment indicates Negligible magnitude noise increase at 110 dwellings and Negligible magnitude decrease at 7 dwellings.

17.4.25 The level of noise changes are predicted to range between +0.7dB to -3.1dB in the daytime, and between +0.6dB to -2.7dB in the night-time assessment.

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 Adverse** and **Slight/ Moderate Beneficial**.

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 with embedded mitigation, 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 **Drawings 17-16** to **17.28 (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	161	3
	1.0-2.9	Minor	398	23
	3.0-4.9	Moderate	4	2
	5.0 +	Major	2	2
No Change	0	No Change	9	1
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	0.1-0.9	Negligible	62	1
	1.0-2.9	Minor	22	5
	3.0-4.9	Moderate	1	1
	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 predicted at nine dwellings and one other sensitive receptor. Noise increases are predicted that are of a Negligible magnitude of 0.1 to 0.9dB at 161 dwellings and three other sensitive receptors and increases of a Minor Magnitude of 1 to 2.9dB at 398 dwellings and 23 other sensitive receptors. There would also be noise increases of a Moderate magnitude of 3 to 4.9dB at four dwellings and two other sensitive receptors and increases of a Major magnitude of 5dB or more at two dwellings and two other sensitive receptors.

17.4.29 Road traffic noise decreases are predicted that are of a Negligible magnitude of -0.1 to -0.9dB at 62 dwellings and one other sensitive receptor and decreases of a Minor Magnitude of -1 to -2.9dB at 22 dwellings and five other sensitive receptors. Noise decreases of a Moderate magnitude of -3 to -4.9dB are also predicted at one dwelling and one other sensitive receptor.

17.4.30 The level of noise change is predicted to range between +5.9dB to -3.2dB.

17.4.31 The 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 surface with a LNS road surface offsets noise increases from traffic composition and alignment change in most locations, and results in noise decreases in other locations.

17.4.32 The two dwellings where a Major magnitude increase in road traffic noise is predicted are at Lynvoan (approx. chainage 52,580) and Knappach Cottage (approx. chainage 48,500). The receptor results for these two receptors and the four receptors where a Moderate magnitude increase is predicted are provided in **Table 17-17**.

Table 17-17: Predicted Road Traffic Noise Levels for Moderate and Major magnitude Short-Term Change in Road Traffic Noise

Receptor	Approx. Chainage or Road Number	Predicted Road Traffic Noise $L_{A10,18hr}$ dB		
		Do-Minimum 2026	Do-Something 2026	Change
Lynvoan	52,580	57.5	63.2	+5.7
Knappach Cottage	48,500	56.6	62.5	+5.9
The Smithy	B9150	60.9	64.3	+3.4
Laggan One	51,200	53.9	57.3	+3.4
Spey Bridge	B9150	59.8	62.9	+3.1
Old Raila	B9150	58.5	61.6	+3.1

17.4.33 The predicted road traffic noise level at all receptors listed in **Table 17-17**, where short term noise increases are predicted to be 3.0dB or greater, are above the threshold level of 54.5dB for noise mitigation. These receptors will be considered for potential noise mitigation later in this Chapter.

17.4.34 There are a further nine receptors where the predicted road traffic noise level is above 59.5dB $L_{A10,18h}$ and there is also a short-term change in road traffic noise of 1dB or greater. These would also qualify for consideration of noise mitigation and are listed in **Table 17-18**.

Table 17-18: Predicted Road Traffic Noise Levels for Consideration of Noise mitigation in the Short-Term

Receptor	Approx. Chainage or Road Number	Predicted Road Traffic Noise $L_{A10,18hr}$ dB		
		Do-Minimum 2026	Do-Something 2026	Change
The Aspens	B9150	60.2	63.0	+2.8
Fir Grove	B9150	60.7	63.5	+2.8
Glen Hotel	B9150	57.7	60.4	+2.7
Balvatin Cottages	B9150	58.1	60.7	+2.6
Balavil Mains	53,550	63.5	66.0	+2.5
Bruach	52,540	57.2	59.6	+2.5
Eagle View	B9150	59.9	62.4	+2.5
West Lodge, Dunachton	B9152 / Northern Tie-in	60.6	62.5	+1.9
West Lodge, Balavil	B9152	65.3	66.8	+1.5

17.4.35 The Other Sensitive receptors with the highest predicted change in road traffic noise are NMU23 and NMU24 (**Drawing 9.1 (Volume 3)**) close to chainage 52,400, where the predicted increase in road traffic noise is +5.8dB. The noise increase for these NMU routes are highest at the location closest to the A9, the change in road traffic noise would decrease with distance from the A9.

17.4.36 When considered against the matrix presented in **Table 17-7** the Significance of impacts for the Do-Something in the short term would be **Slight Adverse** for 164 receptors, **Slight/ Moderate Adverse** at 421 receptors, **Moderate/ Large Adverse** at six receptors and **Large/ Very Large Adverse** at four receptors. There is also **Slight Benefit** for 63 receptors, and **Slight/ Moderate Benefit** at 27 receptors and **Moderate/ Large Benefit** at two receptors.

17.4.37 **Table 17-19** 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-Something scenario with embedded mitigation 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).**

17.4.38 The calculation of night-time noise levels indicates that there are 33 dwellings with noise levels in excess of $L_{night, outside}$ 55dB in either scenario. The night-time results for these dwellings are also indicated in **Table 17-19**.

Table 17-19: 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	587	25	23
	3.0-4.9	Minor	8	4	3
	5.0-9.9	Moderate	2	2	2
	10.0 +	Major			
No Change	0	No Change	10		
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	0.1-2.9	Negligible	52	7	5
	3.0-4.9	Minor			
	5.0-9.9	Moderate			
	10.0 +	Major			

17.4.39 Over the long term with the Proposed Scheme in place, both increases and decreases in road traffic noise are predicted at receptors, and No Change predicted at 10 dwellings. Noise increases are predicted that are of a Negligible magnitude of 0.1 to 2.9dB at 587 dwellings and 25 other sensitive receptors and increases of a Minor Magnitude of 3 to 4.9dB at 8 dwellings and four other sensitive receptors. There would also be noise increase of a Moderate magnitude of 5 to 9.9dB at two dwellings and two other sensitive receptors.

17.4.40 Road traffic noise decreases are predicted that are of a Negligible magnitude of -0.1 to -2.9dB at 52 dwellings and seven other sensitive receptors.

17.4.41 The assessment of night-time noise levels in the long term Do-Something assessment indicate Negligible magnitude noise increase at 23 dwellings, Minor increase at three dwellings and Moderate increase at two dwellings. There are also predicted to be Negligible magnitude decrease at five dwellings.

17.4.42 The level of noise changes is predicted to range between +6.1dB to -2.9dB in the daytime and between +5.4dB to -2.6dB in the night-time assessment.

17.4.43 The two dwellings where a Moderate magnitude increase in road traffic noise is predicted are at Lynvoan (approx. chainage 52,580) and Knappach Cottage (approx. chainage 48,500). The receptor results for these two receptors and the eight receptors where a Minor magnitude increase is predicted are provided in **Table 17-20**.

Table 17-20: Predicted Road Traffic Noise Levels for Minor and Moderate Magnitude Long-Term Change in Road Traffic Noise

Receptor	Approx. Chainage	Predicted Road Traffic Noise $L_{A10,18hr}$ dB		
		Do-Minimum 2026	Do-Something 2041	Change
Lynvoan	52,580	57.5	63.5	+6.0
Knappach Cottage	48,500	56.7	62.8	+6.1
The Smithy	B9150	60.9	64.9	+4.0
Spey Bridge	B9150	59.8	63.4	+3.7
Laggan One	51,200	53.9	57.6	+3.7
Old Raila	B9150	58.5	62.0	+3.5
Fir Grove	B9150	60.7	64.1	+3.4
Glen Hotel	B9150	57.7	61.0	+3.3
The Aspens	B9150	60.2	63.4	+3.1
Balvatin Cottages	B9150	58.1	61.2	+3.1

17.4.44 The predicted road traffic noise level and level of change at nine of the ten receptors listed in **Table 17-20** meet the conditions for noise mitigation. As such, these receptors will be considered for potential noise mitigation later in this Chapter. The road traffic noise levels at Laggan One are below the 59.5dB $L_{A10,18h}$ threshold for consideration of noise mitigation where the change is less than +5dB.

17.4.45 The Other Sensitive receptors with the highest predicted change in road traffic noise are NMU23 and NMU24 close to chainage 52,400, where the predicted increase in road traffic noise is +6.1dB over the long term. The noise increase for these public rights of way are highest at the location closest to the A9, the change in road traffic noise would decrease with distance from the A9.

17.4.46 When considered against the matrix presented in **Table 17-7** the Significance of impacts for the Do-Something in the short term would be **Slight Adverse** for 612 receptors, **Slight/ Moderate Adverse** at 12 receptors and **Moderate/ Large Adverse** at four receptors. There is also **Slight Benefit** for 59 receptors.

17.4.47 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 surface with a LNS road surface offsets noise increases from traffic composition and alignment change in most locations, and results in noise decreases in other locations.

17.4.48 The long-term assessment results have also been used to provide an indication of whether any dwellings would be eligible for noise insulation under the conditions of the NISR (**Paragraph 17.2.5 - 17.2.10**). There are no receptors where the predicted road traffic noise level is 68dB $L_{A10,18h}$ or higher and where there is a road traffic noise increase of 1dB or greater. As such there are no dwellings identified where the requirements for the provision of noise insulation would be met.

Road Traffic Noise Nuisance

17.4.49 The predicted noise nuisance results are presented in **Table 17-21.** This includes comparison of the Do-Minimum 2026 against the Do-Minimum in 2041 and also the Do-Something scenario 2041.

17.4.50 In the Do-Minimum assessment, 282 dwellings are predicted to lie within the nuisance increase band of <10% of people living within those dwellings would be bothered "very much" or "quite a lot" by road traffic noise nuisance. There is one dwelling with no change, and a further 376 dwellings 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 the numbers of people bothered "very much" or "quite a lot" by noise nuisance would increase, which would move 128 dwellings into the noise increase band of 10<20%, 415 dwellings into the noise nuisance increase band of 20<30% and six into the noise nuisance increase band of 30<40%. Fourty-eight dwellings would remain in the nuisance decrease band of <10% of people bothered "very much" or "quite a lot" by noise nuisance.

Table 17-21: 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%	282	48
	10<20%		128
	20<30%		415
	30<40%		6
	>40%		
No Change	0%	1	14
Decrease (Beneficial) in Nuisance Level $L_{A10,18h}$	<10%	376	48
	10<20%		
	20<30%		
	30<40%		
	>40%		

Road Traffic Noise Vibration Nuisance

17.4.51 There are six 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 per cent is assumed.

17.4.52 The predicted traffic airborne vibration nuisance results are presented in **Table 17-22**. This includes comparison of the Do-Minimum 2026 against the Do-Minimum in 2041 and also the Do-Something scenario 2041.

17.4.53 In the Do-Minimum assessment two dwellings are predicted to lie within the nuisance increase band of <10%, and four 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 an increase in airborne vibration nuisance from road traffic with three dwellings remaining in the <10% decrease band and one dwelling in the noise increase band of 10<20%, and two dwellings in the noise nuisance increase band of 20<30%.

Table 17-22: 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%	2	
	10<20%		1
	20<30%		2
	30<40%		
	>40%		
No Change	0%		
Decrease (Beneficial) in Nuisance Level $L_{A10,18h}$	<10%	4	3
	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. Noise mitigation for the operation of the Proposed Scheme is also considered for those receptors that meet the conditions for noise mitigation, as outlined in **Paragraphs 17.2.56** to **17.2.63**.

Embedded Mitigation

17.5.2 Embedded mitigation included within the scheme design are outlined in **Table 17-23**.

Table 17-23: Embedded Noise and Vibration Mitigation Commitments

Mitigation Item	Location	Description
EMC-NV1	Throughout Proposed Scheme	The Proposed Scheme includes cuttings and embankments. Although the earthworks were not specifically designed to provide noise mitigation to particular receptors, in some locations a greater degree of noise attenuation will be present than if they were not included.
EMC-NV2	Throughout Proposed Scheme	The mainline A9 will be surfaced with a Low Noise Surface. This is assumed to reduce noise levels by 3.5dB when compared with Hot Rolled Asphalt.

Construction

17.5.3 The standard mitigation commitments for the construction phase for the A9 are detailed in **Table 17-24.**

Table 17-24: 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 Mitigation					
SMC-NV1	Throughout Proposed Scheme	Pre-Construction and Construction	A scheme of noise and vibration monitoring will therefore be agreed with the Environmental Health Officer Department, and noise and vibration limits will be contained within the CEMP (refer to Mitigation Item S1 in **Table 21-1**). 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 SMC-NV2, where required.	Local Authority Environmental Health Officer
SMC-NV2	Throughout Proposed Scheme	Pre-Construction and 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 the works will be fitted with effective exhaust silencers and will be maintained in good,	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
			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 relevant Local Authority would be consulted regarding any proposed working out-with normal working hours.		
n/a (note)			*In addition to the above, Mitigation item S3 in **Table 21-1** 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

17.5.4 There are 15 receptors that have been identified for the consideration of noise mitigation due to increases in road traffic noise over both the short term and long term. Of these, nine are located adjacent to the B9150, one adjacent to the B9152 and one close to the northern tie-in. At all of these locations the noise increases are due to increases in traffic flow and speeds predicted on local roads as a result of the scheme, and not due to the physical changes to the A9. All of these locations are outside of the scheme extents, and the provision of noise barriers is not feasible at these locations due to requirements of access to the properties from the adjacent B-roads. In order to be effective, noise barriers should be continuous and close to the source of noise. Any gaps in a noise barrier to provide access to the dwellings would result in an ineffective noise barrier. At all of these locations, the requirements of consideration for noise insulation under the NISR are not met.

17.5.5 Noise mitigation in the form of noise barriers has been considered for the remaining five receptors, that are directly adjacent to the Proposed Scheme. A range of different height and length of noise barriers have been considered, and by an iterative process the noise barriers as described in **Table 17-25** are proposed. The location of the noise barriers is indicated in the noise contour plots presented in **Drawings 17.42** to **45 (Volume 3)**.

Table 17-25: Noise and Vibration Mitigation Commitments for the Operational Phase

Mitigation Item	Approx. Chainage	Description	Purpose/Objective
P09-NV1	48,389 to 48,610	Noise Barrier (reflective) of 4m height relative to ground level located along the top of the embankment, south of the A9.	To reduce road traffic noise levels for the dwelling 'Knappach Cottage'
P09-NV2	51,100 to 51,350	Noise Barrier (absorptive) of 3m height relative to ground level located along the top of the embankment, south of the A9.	To reduce road traffic noise levels for the dwelling 'Laggan One'
P09-NV3	52,460 to 52,635	Noise Barrier (absorptive) of 3m height relative to ground level located along the top of the embankment, north of the A9. To be constructed together with Mitigation Item P09-NV4.	To reduce road traffic noise levels for the dwelling 'Lynvoan'
P09-NV4	52,635 to 52,700	Noise Barrier (absorptive) of 3m height relative to ground level located along the top of the embankment, north of the A9. To be constructed together with Mitigation Item P09-NV3.	To reduce road traffic noise levels for the dwelling 'Lynvoan'
P09-NV5	52,495 to 52,650	Noise Barrier (absorptive) of 2.5m height relative to ground level located along the top of the embankment, south of the A9.	To reduce road traffic noise levels for the dwelling 'Bruach'
P09-NV6	53,490 to 53,590	Noise Barrier (absorptive) of 2.5m height relative to ground level located along the top of the embankment, north of the A9.	To reduce road traffic noise levels for the dwelling 'Balavil Mains'

17.5.6 Noise barriers have been assessed based on a noise fence, but could also take the form of an appropriately designed earth bund. The detail of the proposed noise barriers will be considered further at detailed design, although an initial consideration of the treatment to the proposed noise mitigation has been undertaken within the Landscape and Visual chapters, see the Mitigation commitment **P09-LV26** as outlined in **Table 13-18** of the Landscape Chapter. The absorptive noise barriers must have a DLα performance of 8 or better in accordance with BS EN 1793-1:2017 '*Road traffic noise reducing devices. Test method for determining the acoustic performance. Part 1: Intrinsic characteristics of sound insulation under diffuse sound field conditions'* (British Standards Institution, 2017). The reflective noise barriers must have a DLR performance of 25 or better in accordance with of BS EN 1793-2:2018 '*Road traffic noise reducing devices. Test method for determining the acoustic performance. Part 2: Intrinsic characteristics of sound insulation under diffuse sound field conditions'* (British Standards Institution, 2018).

17.6 Residual Impacts

Construction

17.6.2 Appropriate controls and mitigation measures would be implemented to reduce construction noise impacts where practicable, as detailed in **Table 17-24**. 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 would be temporary in nature.

Operation

17.6.3 The provision of noise barriers as described in **Table 17-25** are expected to reduce noise impacts at the worst affected receptors. Road traffic noise levels have been predicted with the proposed noise mitigation in place for the nearby noise receptors, and updated road traffic noise model results are provided in **Table 17-26**.

Table 17-26: Predicted Road Traffic Noise Levels for Dwellings where Noise Mitigation is Recommended

Receptor	Predicted Road Traffic Noise $L_{A10,18hr}$ dB				
	Do-Minimum 2026	Do-Something with Mitigation 2026	Do-Something With Mitigation 2041	Short Term Change	Long Term Change
Lynvoan	57.5	59.5	59.8	+2.0	+2.3
Knappach Cottage	56.7	59.5	59.9	+2.8	+3.2
Laggan One	53.9	56.5	56.8	+2.6	+2.9
Balavil Mains	63.5	64.0	64.4	+0.5	+0.9
Bruach	57.2	58.2	58.5	+1.0	+1.3

17.6.4 Predicted road traffic noise levels are lower at all of the dwellings listed in **Table 17-26** with the implementation of the noise barriers that are outlined in **Table 17-25**. The magnitude of change is reduced from short-term Major noise increase to Minor noise increase at Lynvoan and Knappach Cottage. The magnitude of road traffic noise increase would be reduced from short-term Moderate to Minor at Laggan One and from Moderate to Negligible at Balavil Mains. At Bruach, the magnitude of change remains the same as short term Minor Adverse, but the level of road traffic noise decreases to below the 59.5 $L_{A10,18hr}$ threshold for consideration of noise mitigation.

17.6.5 At five of the six receptors, the predicted road traffic noise levels would be reduced to be below the Noise Mitigation Threshold Criteria with the proposed noise barriers. The exception is Knappach Cottage where the noise level change remains greater than +1dB in the short term, with a predicted noise level exceeding 59.5dB. It is considered that a noise barrier exceeding the proposed 4m barrier would be too large.

17.6.6 **Table 17-27** provides the residual short-term and long-term road traffic noise assessment tables summarising changes in daytime road traffic noise, with noise mitigation in place. The results without the proposed noise barriers are provided in brackets for comparison, where different. A full list of road traffic noise results for receptors in the vicinity of the noise barriers is presented in **Appendix 17.4 (Volume 2)**.

Table 17-27: Residual Number of Receptors with Traffic Noise Changes Short-Term and Long-Term

Change in Noise Level, dB	Magnitude	Short-Term		Long-Term		
		Number of Dwellings	Number of Other Sensitive Receptors	Number of Dwellings	Number of Other Sensitive Receptors	Night-time Number of Dwellings
Increase (Adverse) in Noise Level $L_{A10,18h}$	Negligible	162(161)	3	589 (587)	25	23
	Minor	499 (398)	23	8	4	3
	Moderate	3 (4)	2	(2)	2	(2)
	Major	(2)	2			
No Change	No Change	9	1	10		
Decrease (Beneficial) in Noise Level $L_{A10,18h}$	Negligible	62	1	52	7	5
	Minor	22	5			
	Moderate	1	1			
	Major					

17.6.7 There is a reduction of the number of dwellings and other sensitive receptors that would experience the highest predicted levels of change in road traffic noise.

17.6.8 There are some receptors that are predicted to experience a Moderate road traffic noise increase in the short term, even with the provision of noise barriers. These are those that are located away from the scheme extents on the B9150, B9152 and the northern tie-in, where the provision of noise barriers is not considered feasible.

17.6.9 **Table 17-28** provides the residual change in number of properties affected by road traffic noise nuisance and vibration nuisance for the Do-Something scenarios with noise mitigation in place. The results without the proposed noise barriers are provided in brackets for comparison, where different.

Table 17-28: Residual Number of Properties Affected by Road Traffic Noise Nuisance and Airborne Vibration Nuisance

Change in Nuisance Level, dB		Road Traffic Noise Do-Something with Mitigation	Airbourne Vibration Do-Something with Mitigation
Increase (Adverse) in Nuisance Level $L_{A10,18h}$	<10%	48	
	10<20%	128	2(1)
	20<30%	417 (415)	1(2)
	30<40%	4 (6)	
	>40%		
No Change	0%	14	
Decrease (Beneficial) in Nuisance Level $L_{A10,18h}$	<10%	48	3
	10<20%		
	20<30%		
	30<40%		
	>40%		

17.6.10 There are fewer dwellings in the highest noise nuisance increase bands with the implementation of noise mitigation.

17.6.11 There is a reduction in predicted airbourne vibration nuisance for one receptor with the implementation of the proposed noise barriers.

Summary

17.6.12 A summary of residual noise and vibration impacts with the inclusion of noise mitigation for the scheme is indicated in **Table 17-29**.

Table 17-29: Summary of Noise and Vibration Residual Impacts

Receptor	Value	Significance of Impact	Mitigation	Magnitude of Residual Impact	Significance of Residual Impact
Construction (Residential Receptors)					
Receptors within 50m of earthworks (~13 dwellings)	High	Noise Threshold Exceedance	Standard Measures	N/A	No Significant Impact
Receptors 50-100, of earthworks (~21 dwellings)	High	Some Noise Threshold Exceedance	Standard Measures	N/A	No Significant Impact
Receptors >100m from earthworks	High	No Adverse Impact	Standard Measures	N/A	No Significant Impact
Operation Do-Minimum 2026 to Do-Something 2026					
Lynvoan and Knappach Cottage	High	Large/Very Large Adverse (significant)	Noise Barriers	Short-term Minor Adverse	Slight/ Moderate Adverse (not significant)
Laggan One	High	Moderate/Large Adverse (significant)	Noise Barrier	Short-term Minor Adverse	Slight/ Moderate Adverse (not significant)
Balavil Mains	High	Slight/Moderate Adverse (significant)	Noise Barrier	Short-term Negligible	Slight Adverse (not significant)
Bruach	High	Slight/Moderate Adverse (not significant)	Noise Barrier	Short-term Minor Adverse	Slight/Moderate Adverse (not significant)
Three Dwellings (The Smithy, Spey Bridge, Old Raila)	High	Moderate/Large Adverse (significant)	No Appropriate Mitigation Feasible	N/A	Moderate/Large Adverse (significant)
396 Dwellings	High	Slight/ Moderate Adverse (not significant)	No Mitigation	N/A	Slight/ Moderate Adverse (not significant)
161 Dwellings	High	Slight Adverse (not significant)	No Mitigation	N/A	Slight Adverse (not significant)
One Dwelling	High	Moderate/Large Beneficial (not significant)	No Mitigation	N/A	Moderate/Large Beneficial (not significant)
22 Dwellings	High	Slight/Moderate Benefit (not significant)	No Mitigation	N/A	Slight/ Moderate Benefit (not significant)
62 Dwellings	High	Slight Benefit (not significant)	No Mitigation	N/A	Slight Benefit (not significant)
9 Dwellings	High	Neutral (not significant)	No Mitigation	N/A	Neutral (not significant)

Receptor	Value	Significance of Impact	Mitigation	Magnitude of Residual Impact	Significance of Residual Impact
Operation Do-Minimum 2026 to Do-Something 2041					
Lynvoan	High	Moderate/Large Adverse (significant)	Noise Barriers	Long-term Negligible Adverse	Slight Adverse (not significant)
Knappach Cottage	High	Moderate/Large Adverse (significant)	Noise Barriers	Long-term Minor Adverse	Slight/ Moderate Adverse (not significant)
Laggan One	High	Slight/ Moderate Adverse (not significant)	Noise Barriers	Long-term Negligible Adverse	Slight Adverse (not significant)
Balavil Mains and Bruach	High	Slight Adverse (not significant)	Noise Barriers	Long-term Negligible Adverse	Slight Adverse (not significant)
Seven Dwellings	High	Slight/ Moderate Adverse (not significant)	No Mitigation	N/A	Slight/ Moderate Adverse (not significant)
585 Dwellings	High	Slight Adverse (not significant)	No Mitigation	N/A	Slight Adverse (not significant)
52 Dwellings	High	Slight Benefit (not significant)	No Mitigation	N/A	Slight Benefit (not significant)
10 Dwellings	High	Neutral (not significant)	No Mitigation	N/A	Neutral (not significant)

17.6.13 There are three receptors where a significant adverse impact remains in the short-term following the implementation of the scheme with the proposed noise mitigation. Over the long term the significance of impact reduces to not significant at these three receptors.

17.7 References

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