

## 17 Noise and Vibration

This chapter considers the potential noise and vibration impacts of the proposed scheme on noise sensitive receptor(s) (NSR).

The study area and calculation area were determined using DMRB guidance. Noise modelling was undertaken for all NSR, noise sensitive committed developments and noise sensitive amenity areas within the defined calculation area which extended 600m from the proposed scheme and affected routes.

As part of the assessment a baseline noise survey was undertaken at 11 identified NSR to gain an understanding of the existing noise climate within the vicinity of the proposed scheme.

For the purposes of this assessment and when identifying mitigation requirements, impacts were considered to be 'significant' where the significance of impact was assessed to be Slight/Moderate adverse or higher and where the predicted absolute noise level exceeds 59.5dB  $L_{A10,18h}$  at ground floor level. For night-time noise levels impacts were considered to be 'significant' where the significance of impact was assessed to be Slight/Moderate adverse or higher significance and where the predicted absolute noise level exceeds 55.0dB  $L_{night, outside}$  at ground and/or first floor level. Measures embedded in the proposed scheme design that attenuate noise include the use of low noise road surfacing and earthworks. NSR specific mitigation includes a section of the existing A9 to the north of the proposed scheme to be upgraded with a low noise road surfacing.

An indicative assessment of potential eligibility for noise insulation for all NSR under the Noise Insulation (Scotland) Regulations was also undertaken. The results indicated that no NSR would meet the eligibility requirements.

In the Do-Minimum scenario (i.e. if the proposed scheme were not to go ahead) the operational noise assessment determined that in the long-term no NSR was predicted to experience a noise impact higher than Slight Adverse significance due to the existing A9.

The results of the operational noise assessment indicate that in the short-term at ground floor level there are 55 dwellings and ten other NSR predicted to have a residual impact of Slight/Moderate Adverse significance or higher based on the receptor point with the least beneficial change in noise level. Of these NSR, ten were considered to be significantly affected as the absolute noise level was greater than 59.5dB  $L_{A10,18h}$ . In addition, a further two NSR were considered to be significantly affected when considering all receptor points around the building. Consideration was given to providing noise mitigation, however, due to the location of these properties on side roads there was either limited space or there were gaps in property boundaries for driveways. Therefore, there was no opportunity to provide effective noise mitigation.

The results of the operational noise assessment indicate that in the long-term at ground floor level there is a single dwelling predicted to have a residual impact of Slight/Moderate Adverse significance or higher. However, the absolute noise level at this dwelling was less than 59.5dB  $L_{A10,18h}$  and was therefore not considered to be significantly affected.

In addition, results for the predicted noise impacts at first floor level for all NSR are reported in full within the chapter. As required by DMRB the results of the noise nuisance and vibration nuisance are also reported.

### 17.1 Introduction

17.1.1 This chapter presents the DMRB Stage 3 assessment of potential noise and vibration impacts as a result of construction and operation of the proposed scheme. The chapter is supported by the following appendices, which are cross-referenced in the text where relevant:

- Appendix A17.1: Noise and Vibration Terminology;
- Appendix A17.2: Detailed Baseline Noise Survey Results and Notes;
- Appendix A17.3 Predicted Noise Levels at Receptors;
- Appendix A17.4: Noise Impacts on Committed Developments;
- Appendix A17.5: Noise Impacts on Amenity Areas;
- Appendix A17.6: Residual Noise Impacts; and
- Appendix A17.7: Closest Noise Sensitive Receptors to Construction Works.

- 17.1.2 The assessment of noise and vibration impacts associated with the proposed scheme has been undertaken in accordance with the Detailed Assessment Methodology of DMRB Volume 11, Section 3, Part 7 HD 213/11 Revision 1 Noise and Vibration (The Highways Agency et al., 2011), hereafter referred to as DMRB Noise and Vibration. Road traffic noise levels were predicted in accordance with the guidance contained in the Department of Transport Welsh Office publication: Calculation of Road Traffic Noise (CRTN, The Department of Transport, 1988) and supplemented with the additional guidance contained in Annex 4 of DMRB Noise and Vibration.
- 17.1.3 To assist in the understanding of the noise assessment it is useful to consider the units of noise and how noise is described quantitatively.
- 17.1.4 The World Health Organisation (WHO, 1999) defines noise as unwanted sound, and sound is measured in terms of decibels (dB). The decibel is not an absolute unit of measurement; it is a ratio between a measured quantity and an agreed reference level. The measured quantity is the variation in atmospheric pressure and the reference level is taken as the lowest pressure to which a healthy ear is able to hear as sound, i.e.  $2 \times 10^{-5}$  Pascal's (20µPa). It should be appreciated that whilst the audible range of hearing extends from 20 Hertz (Hz) to 20,000Hz, human hearing is not equally sensitive to sound across this range of frequencies and therefore corrections or "weightings" are applied to the measured linear levels to simulate the response of the ear. The A-weighting is most often used to represent the response of the ear to environmental noise. When considering noise levels, it may be of assistance to note that doubling or halving of the traffic flow is equivalent to a change of approximately 3dB(A), and a subjective impression of a doubling of loudness generally corresponds to a 10dB(A) sound level increase. Given that noise is assessed as a logarithmic ratio of pressure levels it is often useful to consider the relationship between the subjective evaluations of objective noise levels as shown in Table 17.1.

**Table 17.1: Typical Noise Levels and Subjective Evaluation**

<b>A-weighted Noise Level <math>L_A</math> (dB)</b>	<b>Description</b>
120	Threshold of Pain
100	Diesel drop hammer at 10m distance
95	Pneumatic drill (unsilenced) at 7m distance
85	Heavy diesel lorry (travelling at 40km/h) at 7m distance
85	Jet aircraft take-off at 150m distance
70	Passenger car (travelling at 60km/h) at 7m distance
65	Train (travelling at 40km/h) at 25m distance
60	Busy general office
55	Communication starts becoming difficult
40	Quiet library
35	Typical bedroom
20	Leaves rustling lightly
0	Threshold of hearing

### **Road Traffic Noise**

- 17.1.5 In terms of road traffic noise, it is useful to understand the causes of noise associated with a flow of road traffic vehicles.
- 17.1.6 Road traffic noise can be separated into two main components. The first is generated by the engine, exhaust system and transmission, and is the dominant noise source when traffic is not freely flowing. This is particularly apparent from heavy good vehicles (HGV), when accelerating, braking or changing gears and this contributes a significant proportion of low frequency noise. The second noise source component is generated from the interaction of tyres with the road surface and is the dominant noise source under free flow traffic conditions at moderate to high road speeds and contributes a significant proportion of higher frequency noise.

- 17.1.7 The noise from a stream of traffic at a receptor point is an aggregation of noise from each of a number of vehicles at various distances. There are several factors that influence the noise level experienced at a receptor point and these can be separated into two categories. Firstly, there are factors that affect the noise emissions at source, such as traffic volume, speed and composition (i.e. the percentage of HGVs), the gradient of the carriageway and the surface characteristics of the carriageway. Secondly there are those factors affecting the propagation characteristics, such as the distance of the receptor from the source, the topography and characteristics of the ground between the source and receptor, the presence of any screening or barrier effects and the wind strength and direction.

#### **Measurement of Road Traffic Noise**

- 17.1.8 Noise from traffic on a road will change as traffic flows alter during the day and will also fluctuate within shorter time periods as vehicles pass the reception point. In order to compare situations with different traffic noise levels it is necessary to use an index to produce single figure estimates of overall noise levels. The metric used for road traffic noise is  $L_{A10,18h}$  which is the arithmetic mean value of the A-weighted noise levels, which are exceeded for 10% of the time in each of the 18 one hour periods between 06:00 hours and 00:00 hours. Paragraph A3.11 of DMRB Noise and Vibration advises that a reasonably good correlation has been shown to exist between traffic noise levels expressed in  $L_{A10,18h}$  and residents' dissatisfaction with the noise over a wide range of values.

#### **Road Traffic Vibration**

- 17.1.9 Traffic induced vibration is a low frequency disturbance which can be transmitted through the air or ground. Air-borne vibration from traffic is produced by the engine and exhaust of the vehicle, whereas ground-borne vibration is produced by the interaction between rolling wheels and the road surface.
- 17.1.10 There are two potential effects of traffic vibration that need to be considered; the effects on buildings, and the disturbance caused to occupiers of properties. Extensive research has been carried out on a range of buildings of various ages and types, and no evidence has been found to support the theory that traffic-induced ground-borne vibration is a source of significant damage to buildings (Watts, 1990). As such, ground-borne vibration is not assessed in this chapter. Ground-borne vibration is much less likely to be the cause of disturbance to occupiers than airborne vibration (Baughan & Martin, 1981; Watts, 1984). DMRB Noise and Vibration states:
- 'Normal use of buildings such as closing of doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to that from traffic'.*
- 17.1.11 In addition, there is no evidence that traffic induced airborne vibration can cause even minor damage to buildings. However, it can be a source of annoyance to local people, causing vibrations of flexible built elements within the building (such as doors, windows and, on occasions floors) of properties close to the carriageway. Accordingly, the issue of DMRB Noise and Vibration defined nuisance at properties caused by road traffic induced airborne vibration has been evaluated.

#### **Legislative and Policy Background**

- 17.1.12 The assessment of potential noise and vibration impacts has been carried out with reference to the following documents:
- DMRB Volume 11 Section 3 Part 7 (HD 213/11 – Revision 1) (The Highways Agency et al., 2011);
  - CRTN (Department of Transport Welsh Office, 1988);
  - The Noise Insulation (Scotland) Regulations (NISR) (HMSO, 1975a);
  - Memorandum on the Noise Insulation (Scotland) Regulations (Memorandum) (HMSO, 1975b);
  - The Environmental Noise (Scotland) Regulations (HMSO, 2006);
  - Control of Pollution Act 1974 (HMSO, 1974);
  - Planning Advice Note (PAN) 1/2011– Planning and Noise (The Scottish Government, 2011a);
  - Technical Advice Note (TAN) – Assessment of Noise (The Scottish Government, 2011b);

- BS 5228:2009+A1:2014 “Code of practice for noise and vibration control on construction and open sites” Part 1 - Noise and Part 2 – Vibration (BSI, 2014);
- WHO Guidelines for Community Noise (WHO, 1999); and
- WHO Night Noise Guidelines (NNG) for Europe (WHO, 2009).

17.1.13 In addition, a review of relevant national, regional and local planning policies and guidance relevant to noise and vibration are identified in Chapter 19 (Policies and Plans).

## **17.2 Approach and Methods**

### **Scope of Assessment (Study Area)**

- 17.2.1 The assessment study area has been determined in accordance with Paragraph A1.11 of DMRB Noise and Vibration, which sets out the procedure for defining the ‘study area’ and ‘calculation area’. Figure 17.1 details both the study area and calculation areas used for the noise and vibration impact assessment of the proposed scheme.
- 17.2.2 The main study area extends 1km from existing routes that are being improved or bypassed (for example the short sections where a localised offline alignment is being proposed between ch9300-10500 and ch11600-12300) and any proposed new routes, between the start and end points of the physical works associated with the proposed scheme. Within the 1km boundary the calculation area is then defined as being the area that extends:
- 600m from existing and bypassed and/or improved routes or new routes; and
  - 600m from any affected routes within the 1km study area.
- 17.2.3 An affected route is defined as a road where there is a possibility of a 1dB  $L_{A10,18h}$  or more change in noise levels as a consequence of the proposed scheme in the short-term or a 3dB  $L_{A10,18h}$  or more in the long-term. Roads where a change of at least 1dB is predicted to occur can be determined by considering changes in traffic flow; where a 25% increase equates to an increase in noise of 1dB and a 20% decrease in the traffic flow equates to a 1dB decrease in noise level, assuming other factors remain unchanged. Similarly, a change in noise level of 3dB  $L_{A10,18h}$  would be equivalent to an increase in traffic flows of 100% or a decrease of 50%, assuming other factors such as speed, road surface, gradient and % of HGVs remain unchanged.
- 17.2.4 Noise levels are calculated at all identified noise sensitive receptor(s) (NSR) within the 600m calculation area that is within the 1km study area boundary. In addition, the predicted change in noise levels has also been assessed for:
- all identified noise sensitive committed developments (committed developments are extant planning applications that have been received or determined by the local planning authority in the last three years), which are also assessed in Chapter 8 (Community and Private Assets) and Appendix A8.4 (Development Land Assessment); and
  - Amenity areas (which include Sites of Special Scientific Interest, Special Areas of Conservation, core paths, National Parks, golf courses etc.).
- 17.2.5 DMRB Noise and Vibration also requires an assessment of noise impacts be undertaken for the wider road network on the Basic Noise Level<sup>1</sup>. The wider road network relates to those roads beyond the study area and the assessment is undertaken for affected roads, defined as those roads where there is a 1 dB increase or decrease of noise in the baseline year and/or a 3 dB increase or decrease in the future assessment year when compared to the baseline year.
- 17.2.6 As the A9 dualling programme is currently being assessed in 11 shorter sections between Perth and Inverness, 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 A9 dualling

<sup>1</sup> The Basic Noise Level as defined in CRTN is “The basic noise level at a reference distance of 10m away from the nearside carriageway edge is obtained from the traffic flow, the speed of the traffic, the composition of the traffic, the gradient of the road and the road surface”

programme level will be undertaken using traffic data generated by the central traffic model, which will assess the wider network noise and vibration impacts of the A9 dualling programme.

- 17.2.7 Therefore, the wider network is the area beyond all of the individual A9 dualling project detailed study areas to the extent of the validated traffic model. It is noted that the wider network study area will need to include the sections of the A9 that are currently dual carriageway, and will consider receptors such that there is no double counting in these areas.
- 17.2.8 To obtain an overview of the existing ambient noise environment at NSR within the vicinity of the proposed scheme, 11 monitoring locations were identified to undertake unattended baseline noise level measurements. Ambient noise monitoring allows existing road traffic noise sources in addition to other sources of noise to be measured and observed prior to construction and operation of the proposed scheme. The measured noise levels are used to validate the noise model predictions. The monitoring locations were agreed with the Environmental Health Department of Perth & Kinross Council (PKC). These properties were considered to be representative of their surrounding locale.

### **Requirements of a DMRB Stage 3 Noise and Vibration Detailed Assessment**

- 17.2.9 The assessment follows the detailed assessment methodology set out in DMRB Noise and Vibration and requires consideration of permanent impacts including traffic noise, traffic nuisance and traffic induced vibration, together with temporary and cumulative impacts of the proposed scheme.
- 17.2.10 To assess the potential permanent noise and vibration impacts, it is necessary to make comparisons of noise levels in the 'short-term' (the baseline year, which for this proposed scheme is 2026) and in the 'long-term' (the future assessment year, which for this proposed scheme is 2041).
- 17.2.11 When referring to the short-term and long-term, DMRB Noise and Vibration uses the terminology 'Do-Minimum' to refer to the existing road network should the proposed scheme not be built and 'Do-Something' when referring to the road network if the proposed scheme is built. The comparisons are as follows:
- Do-Minimum scenario in the baseline year (DM 2026) versus Do-Minimum scenario in the future assessment year (DM 2041);
  - Do-Minimum scenario in the baseline year (DM 2026) versus the Do-Something scenario in the Baseline Year (DS 2026); and
  - Do-Minimum scenario in the baseline year (DM 2026) versus the Do-Something scenario in the future assessment year (DS 2041).

### **Assessment of Construction Noise and Vibration Impacts**

- 17.2.12 Guidance on the approach to control construction noise is contained within British Standard BS 5228: Part 1:1997 and Part 4:1992 Noise and Vibration Control on Construction and Open Sites<sup>2</sup>. BS 5228 states that '*Good relations with people living and working in the vicinity of site operations are of paramount importance*'. It suggests that the early establishment and maintenance of these relations throughout the contract would go some way to allaying people's concerns.
- 17.2.13 The standard also advises that it is not possible to provide detailed guidance for determining whether or not noise from a site would constitute a problem in a particular situation as a number of factors would affect the acceptability of the site noise and vibration. These factors are:
- site location;
  - existing ambient noise and vibration levels;
  - duration of site operations;

<sup>2</sup> It should be noted that a newer version of BS 5228 came into force on 1 January 2009, which was subsequently amended in February 2014. At present the previous 1997 version is still officially approved under Section 71 of the Control of Pollution Act 1974 via The Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002. Therefore, BS 5228: Part 1:1997 and Part 4:1992 are still referred to in this context.

- hours of work;
  - attitude to site operator; and
  - noise and vibration characteristics.
- 17.2.14 The level of noise experienced by inhabitants in the vicinity would vary according to the following factors:
- sound power outputs of processes and plant;
  - periods of operation of processes and plant;
  - distance from source(s) to receiver(s);
  - presence of screening by barriers;
  - reflection of sound associated with topographical features;
  - phasing/programming of demolition works;
  - soft ground attenuation; and
  - meteorological factors.
- 17.2.15 To facilitate accurate prediction of noise levels it is necessary to know working methods, timing and phasing of the works and the number and type of plant likely to be used. At this stage such information is not available.
- 17.2.16 However, should the proposed scheme proceed and a contractor be appointed a construction noise and vibration assessment is usually required. Whilst residents may accept that it is inevitable that, as with any major infrastructure development, there would be some disturbance caused to those living nearby during the construction phase and that the provisions of Sections 60 and 61 of the Control of Pollution Act 1974 offer some protection to them. Section 60 enables a local authority to serve a notice specifying its noise control requirements covering:
- plant or machinery that is or is not be used;
  - hours of working; and
  - levels of noise or vibration that can be emitted.
- 17.2.17 Section 61 relates to prior consent, and is for situations where a contractor or developer takes the initiative and approaches the local authority before work starts to obtain approval for the methods to be used and any noise and vibration control techniques that may be required.
- 17.2.18 With regard to construction noise impacts BS 5228-1:2009+A1:2014 Annex E provides examples of criteria for the assessment of the potential significance of noise effects and the adoption of any of these examples should be fully justified.
- 17.2.19 BS 5228-2:2009+A1:2014 provides recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry specific guidance. With consideration to the nature and size of the proposed scheme as well as the likely construction processes, it is considered that any required blasting, piling or heavy earthmoving processes are the key construction activities that have the potential to give rise to significant vibration impacts.
- 17.2.20 In cognisance of the above, a qualitative assessment of potential construction noise and vibration impacts has been undertaken in order to determine the likely significance of noise impact associated with the construction of the proposed scheme based on the guidance above and using professional judgement.
- 17.2.21 The significance of noise impacts during construction noise was determined as follows:
- Construction noise 10dB below ambient noise level = Neutral;

- Construction noise between 10 to 0dB below ambient noise level = Slight adverse;
- Construction noise between 0 to 5dB above ambient noise level = Slight/Moderate adverse;
- Construction noise between 5 to 10dB above ambient noise level = Moderate/Large adverse; and
- Construction noise greater than 10dB above ambient noise level = Large/Very Large adverse.

17.2.22 It should be noted that although a NSR may have a Significance of Impact of greater than Slight/Moderate adverse, this is not necessarily an indication of a significant construction noise impact as the methods for assessing potential significant impacts from construction noise in BS 5228 is subject to exceedances of a noise level limit

### **Operational Noise Impact Assessment**

#### Predicting Noise Levels – Noise Modelling

- 17.2.23 All road traffic noise levels for the base, Do-Minimum and Do-Something scenarios are predicted using the CadnaA® noise modelling software, which predicts the  $L_{A10,18h}$  traffic noise level at dwellings and other NSR in accordance with CRTN and the supplementary CRTN guidance contained in DMRB Noise and Vibration. The base scenario includes the traffic flow information for the existing A9 and surrounding roads for 2015 and is used to compare predicted noise levels with measured noise levels.
- 17.2.24 Receptor points around buildings have been modelled at 5m intervals, 1m from the façade. In accordance with DMRB Noise and Vibration, where noise levels are predicted at different façades of dwellings and other buildings, the summary of assessment results report the least beneficial change in noise level. DMRB Noise and Vibration acknowledges that the results from this assessment may often show the worst case and highlight mainly the adverse impacts.
- 17.2.25 All modelled calculations are based on predicted traffic flows and associated variables in the form of 18 Hour Annual Average Weekday Traffic (AAWT) using traffic data modelled for the following scenarios, based on the latest available Transport Model for Scotland 2014 (TMfS 2014):
- Base Model Traffic Data (BMDT 2015);
  - Do-Minimum in the first full year of operation (DM 2026);
  - Do-Something in the first full year of operation (DS 2026);
  - Do-Minimum in the design year (DM 2041); and
  - Do-Something in the design year (DS 2041).
- 17.2.26 The prediction methodology of CRTN has a lower validity range of 1000 vehicles per day (06:00 – 00:00 hours). Accordingly, road links that have flows of less than 1000 vehicles have been excluded from the noise model. There is an exception where a road link may have a flow of less than 1000 in the Do-Minimum scenario but greater than 1000 in the Do-Something scenario and these road links have been included within the noise model.
- 17.2.27 It should be noted that the terminology used when referring to the TMfS is different from the terminology used in DMRB Noise and Vibration. Accordingly, where the TMfS refers to the ‘first full year of operation’ this is equivalent to the term ‘baseline year’ in DMRB Noise and Vibration, and where the TMfS refers to a ‘design year’ this is the equivalent of the ‘future assessment year’.
- 17.2.28 Additional CadnaA® noise model input data includes:
- Road speeds in kilometres per hour (km/h).
  - HGV percentages.
  - Existing topography for the calculation area comprised of survey data undertaken for the proposed scheme and supplemented with a 3D digital terrain model (DTM) using 5m resolution height data.
  - Proposed topography (3D DTM data taken from the MX road design model).

- Existing road surface types for the Do-Minimum in the baseline year are assumed to be impervious bitumen, such as hot rolled asphalt (HRA), with 2mm texture depth, with the exception of the following sections of the existing A9 which are surfaced with existing low noise road surfacing (LNRS):
  - the north and southbound carriageways at approximately ch2298-2662, ch15346-15523 and ch15685-15995.
  - the southbound carriageway at approximately ch14085-14535, ch16746-16987 and ch20943-21128.
  - the northbound carriageway at approximately ch3852-4111.
- Road surface types for the existing A9 in the Do-Minimum in the future assessment year are all assumed to be LNRS and all other roads are assumed to be impervious bitumen, such as hot rolled asphalt (HRA), with 2mm texture depth.
- All new roads constructed on the mainline and slip roads of the proposed scheme will be LNRS.
- Conventional HRA surfacing of 2mm texture depth is assumed to have a surface correction of 0dB(A) at speeds where the mean traffic speed is  $\geq 75$ km/h and -1dB(A) where the mean traffic speed is  $<75$ km/h (Paragraph 16 of CRTN).
- Existing LNRS in the baseline year is assumed to have a surface correction of -2.5dB(A) at speeds where the mean traffic speed is  $\geq 75$ km/h and -1dB(A) where the mean traffic speed is  $<75$ km/h (Paragraphs A4.25 and A4.27 of DMRB Noise and Vibration).
- New LNRS in the baseline year and the future assessment year and existing LNRS in the future assessment year<sup>3</sup> is assumed to have a surface correction of -3.5dB(A) at speeds where the mean traffic speed is  $\geq 75$ km/h and -1dB(A) where the mean traffic speed is  $<75$ km/h (Paragraphs A4.26 and A4.29 of DMRB Noise and Vibration).
- Ground absorption factor: for open land and grassed areas (G=1); surfaces within residential areas (G=0.5) and roads and water (G=0).
- Existing buildings are assumed to be 8m high, equivalent of a two story building.
- Small buildings, defined as those which have a total footprint area of less than 25m<sup>2</sup> are not included in the noise model.

#### Significance of Impacts

- 17.2.29 It should be noted that whilst DMRB Noise and Vibration provides guidance for the magnitude of noise level changes, it does not provide any guidance on assessing the significance of noise impacts. Accordingly, the reported noise impacts have been assessed using the significance of noise impact scale provided in the Scottish Government's Technical Advice Note (TAN) (The Scottish Government, 2011b) which accompanies PAN 1/2011 (The Scottish Government, 2011a) together with the mitigation threshold in determining an overall significant effect. The significance of impact matrix, presented in Table 17.5, is based on the predicted noise levels, the magnitude of noise level change between each scenario (based on the magnitude of impact tables of DMRB Noise and Vibration and the sensitivity of NSR (presented in the TAN).

#### Sensitivity of Noise Sensitive Receptors

- 17.2.30 The sensitivity of NSR to road traffic noise has been determined based on the criteria provided in Table 17.2 (reproduced from TAN Table 2.1, Scottish Government 2011b).

---

<sup>3</sup> It is assumed that existing LNRS will be resurfaced before the future assessment year and hence a -3.5dB(A) correction is applied, instead of the -2.5dB(A) correction assumed for the baseline year.

**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	<ul style="list-style-type: none"> <li>Residential, including private gardens where appropriate</li> <li>Quiet outdoor areas used for recreation</li> <li>Conference facilities</li> <li>Theatres/Auditoria/Studios</li> <li>Schools during the daytime</li> <li>Hospitals/residential care homes</li> <li>Places of worship</li> </ul>
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	<ul style="list-style-type: none"> <li>Offices</li> <li>Bars/Cafes/Restaurants where external noise may be intrusive</li> <li>Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)</li> </ul>
Low	Receptors where distraction or disturbance is minimal	<ul style="list-style-type: none"> <li>Buildings not occupied during working hours</li> <li>Factories and working environments with existing high noise levels</li> <li>Sports grounds when spectator noise is a normal part of the event</li> <li>Night Clubs</li> </ul>

Magnitude of Noise Impacts

17.2.31 In general, when considering two sounds with similar acoustic properties, i.e. similar spectral and temporal characteristics, a change of more than 3dB(A) is regarded as being just perceptible to the human ear. However, with respect to changes in road traffic noise levels, DMRB Noise and Vibration (Paragraph 3.37) advises:

*'A change in road traffic noise of 1dB  $L_{A10,18h}$  in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term (typically 15 years after project opening), a 3dB  $L_{A10,18h}$  change is considered perceptible.'*

17.2.32 Similarly, the Department for Transport document Transport Appraisal Guidance Unit 3.3.2 (Department for Transport, 2014) states:

*'For freely flowing traffic, a difference of about 3dB in noise level is required before there is a statistically significant change in the average assessment of nuisance. The assessment of nuisance however could still be affected even if there is only a 1dB change in the noise level if the change is associated with changes in the view of traffic or if the change occurs suddenly.'*

17.2.33 This highlights that people are more sensitive to abrupt changes in traffic noise associated with new road schemes than would be predicted from steady state evidence. In the period following a change in traffic flow, people may experience adverse or beneficial effects when the noise changes are as small as 1dB.

17.2.34 Section 3 of DMRB Noise and Vibration provides guidance on the magnitude of impacts for road traffic noise. The magnitude of impacts is considered for both the short-term and long-term. As stated above a change in road traffic noise of 1dB  $L_{A10,18h}$  in the short-term, for example, when a project is opened, is the smallest that is considered perceptible. In the long-term, a change in road traffic noise levels of 3dB  $L_{A10,18h}$  is considered perceptible. The classification of noise impacts is detailed in Table 17.3 and Table 17.4, below reproduced from DMRB Noise and Vibration Tables 3.1 and 3.2 (The Highways Agency et al., 2011).

**Table 17.3: Short-term Road Traffic Noise Level Magnitude of Impacts**

Noise Level Change (rounded to 0.1dB) $L_{A10, 18h}$	Magnitude of Impact
0.0	No Change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate

Noise Level Change (rounded to 0.1dB) L <sub>A10, 18h</sub>	Magnitude of Impact
5.0+	Major

Table 17.4: Long-term Road Traffic Noise Level Magnitude of Impacts

Noise Level Change (rounded to 0.1dB) L <sub>A10, 18h</sub> /L <sub>night, outside</sub>	Magnitude of Impact
0.0	No Change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10.0+	Major

17.2.35 DMRB Noise and Vibration does not differentiate between adverse and beneficial impacts. It is assumed that any increase in noise level would have an adverse impact while any decrease in noise level would have a beneficial impact.

Significance of Noise Impacts

17.2.36 The short and long-term significance of operational road traffic noise impacts are then determined according to the relationship between the magnitude of noise level change and the noise sensitivity of the receptor, as shown in Table 17.5 (based on TAN Table 2.6, Scottish Government, 2011b).

Table 17.5: Significance of Noise Impacts

Sensitivity \ Magnitude	High	Medium	Low
	<b>Major</b>	<b>Large/Very Large</b>	<b>Moderate/Large</b>
<b>Moderate</b>	<b>Moderate/Large</b>	<b>Moderate</b>	Slight
<b>Minor</b>	<b>Slight/Moderate</b>	Slight	Neutral/Slight
<b>Negligible</b>	Slight	Neutral/Slight	Neutral/Slight
<b>No Change</b>	Neutral	Neutral	Neutral

17.2.37 The EIA Regulations (refer to Chapter 6: Overview of Assessment Process) require consideration of the 'likely significant effects', but do not provide a definition of what constitutes a significant environmental effect as this is determined according to the environmental parameter under consideration, and in the context in which the relevant assessment is made. For the purposes of this assessment and when identifying mitigation requirements, impacts were considered to be 'significant' where the significance of impact was assessed to be **Slight/Moderate** adverse or higher (shown in bold in Table 17.5) **and** where the predicted absolute noise level exceeds 59.5dB L<sub>A10,18h</sub> at ground floor level. For night-time noise levels impacts were considered to be 'significant' where the significance of impact was assessed to be **Slight/Moderate** adverse or higher significance **and** where the predicted absolute noise level exceeds 55.0dB L<sub>night, outside</sub> at ground and/or first floor level. The reasoning for the absolute noise level is discussed in more detail below. Significant impacts are defined in bold above, and are highlighted in bold throughout the remainder of this chapter.

Noise Mitigation Threshold Criteria

17.2.38 Mitigation would be implemented, where practicable, where the noise impact is of 'Slight/Moderate Adverse' or of higher significance at ground floor for either short and long-term impacts. This is an onerous target as mitigation would therefore be considered where there is an increase of greater than 1dB in the short-term (in recognition of the sudden change effects as reported within DMRB Noise and Vibration), or 3dB in the long-term irrespective of the absolute existing ambient noise level, and should be applied with caution in areas where there are existing low levels of ambient noise.

- 17.2.39 For guidance on the effects of noise, reference can be made to the current 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  $L_{Aeq,4}$  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'.*
- 17.2.40 For the purposes of this noise assessment mitigation is considered where the noise level exceeds 55dB  $L_{Aeq,T}$ . The WHO refers to a daytime time base of 16 hours ( $L_{Aeq,16h}$ ), and CRTN predictions are in terms of  $L_{A10,18h}$ . To convert the WHO  $L_{Aeq,16h}$  to  $L_{A10,18h}$  a correction of approximately +2dB is required (Transport Appraisal Guidance Unit A3 (Department for Transport, 2014)), with a further +2.5dB necessary to translate into façade levels. When this conversion is applied to 55dB  $L_{Aeq,16h}$ , this results in an equivalent threshold façade level of 59.5dB  $L_{A10,18h}$ .
- 17.2.41 In addition, it is necessary that in all cases where it is considered, mitigation should comply with acceptable standards in terms of traffic, safety, environmental and economic issues (DMRB Volume 11, Section 3, Part 7, Chapter 4 – Design and Mitigation, Paragraph 4.10). Considerations which could preclude the use of mitigation are disproportionate cost, unacceptable visual impact and road safety.
- 17.2.42 Due to the increasing use of the strategic road network by long distance goods traffic during night-time hours and the associated potential to increase the level of noise and the potential for disturbance at night, a night-time noise impact assessment is now to be considered as part of the DMRB Noise and Vibration assessment process where the noise level is greater than 55dB  $L_{night,outside}$  in any scenario. The  $L_{night,outside}$  noise metric is the free-field A-weighted average sound level over the 8 hour night-time period of 23:00 – 07:00 hours.
- 17.2.43 The Transport Research Laboratory (TRL) report 'Converting the UK traffic noise index  $L_{A10,18h}$  to EU noise indices for noise mapping' (Abbott & Nelson, 2002) has been used to derive the night-time noise levels for each scenario using Method 3 of the TRL report which converts the predicted daytime noise levels ( $L_{A10,18h}$ ) to equivalent  $L_{night,outside}$ .
- 17.2.44 In summary, taking into account the above WHO and DMRB Noise and Vibration guidance, mitigation is considered where the significance of impact at a NSR has been assessed as Slight/Moderate Adverse or higher, and where the predicted façade level exceeds 59.5dB  $L_{A10,18h}$  at ground floor level. In addition, mitigation taking cognisance of the WHO Night Noise Guidelines for Europe (WHO, 2009) publication has also been considered during the night-time period in the long-term where the significance of impact at a NSR has been assessed as Slight/Moderate Adverse or higher, and where the predicted noise level exceeds 55dB  $L_{night,outside}$  at ground and first floor levels.
- 17.2.45 In general, mitigation will be considered in terms of NSR specific measures that could comprise acoustic screens of various forms and/or revised earthworks. This can be summarised as shown in Table 17.6. The use of low noise road surfacing is embedded in the design of the proposed scheme.

**Table 17.6: Summary of General Aim of Measures Employed to Address Potential Noise Impacts**

Type of Measure	Description
Prevent	Where practicable, road aligned to avoid closely populated areas
Reduce	Construction of noise barriers, earthwork bunds to reduce the predicted road traffic noise levels
Offset	A list of properties that may be eligible for noise insulation in terms of the NISR due to the increase in noise caused by the new road will be drawn up and assessed prior to construction.

<sup>4</sup> The  $L_{Aeq,T}$  noise index is the equivalent continuous A-weighted sound pressure level and is further defined in Appendix A17.1

### **Noise Nuisance Assessment**

- 17.2.46 The term 'nuisance' is defined in Paragraph A.5.3 of DMRB Noise and Vibration as "*the percentage of people bothered by traffic noise (i.e. those who say they are 'very much' or 'quite a lot' bothered on a four point scale)*", and should not be confused with statutory nuisance. The response to noise by individuals varies widely. However, average or community response is deemed to be relatively stable, with community average degree of annoyance, associated with long-term average exposure. Consequently, change in average noise emission levels between assessed scenarios, together with estimates of population density, based on residential property counts and assumptions on the numbers of residents per property, enable changes in estimated populations annoyed to be determined.
- 17.2.47 DMRB Noise and Vibration advises the following noise nuisance assessments should be undertaken:
- Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year; and
  - Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.
- 17.2.48 DMRB Noise and Vibration (Paragraph A1.29) advises that the change in DMRB Noise and Vibration defined noise nuisance should be carried out for each property where noise calculations have been undertaken. Due to variability in individual responses, DMRB Noise and Vibration recommends that community annoyance ratings are used for each noise level. It is therefore important to note that the results of the DMRB Noise and Vibration nuisance assessment should not be related to individual annoyance responses.
- 17.2.49 The method of assessing traffic noise and vibration nuisance is outlined in Annex 6 of DMRB Noise and Vibration.

### **Noise Insulation Assessment**

- 17.2.50 Although it is not a requirement of DMRB Noise and Vibration, consideration has also been given to the number of properties that are likely to be eligible for statutory insulation. The NISR provide for acoustic insulation to be offered for residential properties. The qualifying criteria are detailed within the NISR and within the Memorandum on the Noise Insulation (Scotland) Regulations 1975, Regulations 3 and 6 (HMSO, 1975b). The qualifying criteria, which all must be met, are as follows:
- the properties are situated within 300m of the new or altered carriageway;
  - the properties lie within the triangular area at the terminal point of the new road, the apexes of which are 50m along the centreline of the existing road from the terminal point of the bases of which extend from points 300m on either side of the road to the nearest point on the carriageway, at right angles to the centreline of the carriageway;
  - a straight line can be drawn from any point of the property to a point on the carriageway without passing another building;
  - the use of the road causes, or is expected to cause, noise at a level not less than 68dB(A); and
  - the property will experience noise levels exceeding the 'prevailing noise level' by at least 1.0dB(A).
- 17.2.51 A full NISR noise impact assessment is required within 12 months of the proposed scheme opening and again in the 5<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> year after the year of opening.

### **Vibration Assessment**

- 17.2.52 DMRB Noise and Vibration requires an assessment of traffic induced vibration, including an assessment of the numbers of people bothered by airborne vibration (ground-borne vibration has been scoped out as stated in Paragraph 17.1.10). It should be appreciated that the vibration assessments are for comparison only and, as such, are not indicative of an individual's responses. Also, only properties within approximately 40m of carriageways of all modelled roads which have predicted or measured road traffic noise levels greater than 58dB L<sub>A10,18h</sub> are included in the vibration assessment.

This is because the DMRB Noise and Vibration, vibration-bothered relationship is only validated up to a distance of 40m from carriageways (DMRB Noise and Vibration Paragraph 3.46).

- 17.2.53 DMRB Noise and Vibration advises that the following vibration assessments are undertaken:
- Do-Minimum scenario in the baseline year against the Do-Minimum scenario in the future assessment year (Do-Minimum); and
  - Do-Minimum scenario in the baseline year against the Do-Something scenario in the future assessment year (Do-Something).

### Consultation

- 17.2.54 The PKC Environmental Health Department and Planning Department was consulted regarding the baseline noise survey. Both the noise monitoring locations and the noise measurement procedure were agreed with an Environmental Health Officer from PKC via email letter and phone call during June 2016, prior to the surveys commencing.

### Limitations of Assessment

- 17.2.55 The road traffic noise prediction methodology of the NISR Memorandum has, through the publication of CRTN, been updated and improved. However, this update has yet to be incorporated into either the NISR or NISR Memorandum. Indeed, DMRB Noise and Vibration notes that the NISR Memorandum methodology is to be used to determine NISR eligibility in Scotland. However, the prediction methodology employed in the DMRB assessment is based on the more detailed and accurate predictive methods set out in CRTN, supplemented with the additional guidance contained in Annex 4 of DMRB Noise and Vibration.
- 17.2.56 Therefore, to facilitate an indicative assessment of NISR noise insulation eligibility, a CRTN predicted level of  $L_{A10,18h}$  65dB has been used as a proxy for  $L_{A10,18h}$  68dB, in conjunction with the other qualifying criteria
- 17.2.57 In addition, there are limitations with undertaking a construction noise impact assessment which are discussed fully in Section 17.4 (Potential Impacts).

## 17.3 Baseline Conditions

- 17.3.1 The baseline noise monitoring locations (listed in a south to north direction) are provided in Table 17.7 and also on Figure 17.2.

**Table 17.7: Baseline Noise Monitoring Locations**

ID	Address	Grid Reference	
		Easting	Northing
R5.001	Old Faskally House, Killiecrankie, Pitlochry	291794	763075
R5.002	Coille Essan, Killiecrankie, Pitlochry, PH16 5LG	291555	762967
R5.003	House of Urrard, Killiecrankie, Pitlochry, PH16 5LN	290807	763417
R5.004	2 Essengal Cottages, Killiecrankie, Pitlochry, PH16 5LT	289184	764299
R5.005	The Bothy, Garrybank, Blair Atholl, PH18 5SW	287123	764859
R5.006	2 Woodend, Blair Atholl, Pitlochry, PH18 5TN	284491	765910
R5.007	Tom Ban Farmhouse, Calvine, Pitlochry, PH18 5UD	282953	765322
R5.008	Old Reading Room, Pitgowan, Blair Atholl, PH18 5TW	281887	765850
R5.009	Tigh Sona, Calvine, Pitlochry, PH18 5UA	280526	765789
R5.010	Clunes Cottage, Calvine, Pitlochry, PH18 5UN	278237	767054
R5.011	Dalreoch Cottage, Calvine, Pitlochry, PH18 5UL	276072	769335

- 17.3.2 The noise survey was undertaken from 14 June 2016 to 06 July 2016 with the intention of capturing a minimum of two days' worth of noise data in favourable weather conditions (i.e. light wind speeds and

no rain). The actual period of monitoring varied between each property but can be viewed in Appendix A17.2 (Detailed Baseline Noise Survey Results and Notes). At all measurement locations noise monitoring equipment was left unattended within the garden area of the NSR. Although the monitoring was unattended, survey staff did visit each location for a period of 20 to 30 minutes in the morning, afternoon and evening periods during the measurement period in order to subjectively characterise the noise climate and make detailed notes on meteorological conditions.

- 17.3.3 Appendix A17.2 (Detailed Baseline Noise Survey Results and Notes) provides detailed site notes, photographs and noise levels measured at each of the monitoring locations. However, for ease of reference the average measured  $L_{A10,18h}$ ,  $L_{Aeq,16h}$  and  $L_{night,outside}$  noise levels over the survey periods are summarised in Table 17.8 and Table 17.9.

**Table 17.8: Summary of Unattended Baseline Noise Measurements, including periods of rainfall**

ID	Address/Representative Location	Average Measured Noise Levels (dB)		
		$L_{A10,18h}$	$L_{Aeq,16h}$	$L_{night,outside}$
R5.001	Old Faskally House	60.4	58.4	52.8
R5.002	Coille Essan	50.3	54.1	47.7
R5.003	House of Urrard	52.4	59.9	49.0
R5.004	2 Essengal Cottages	67.2	66.9	58.9
R5.005	The Bothy	61.4	60.2	54.0
R5.006	2 Woodend	54.7	55.9	49.8
R5.007	Tom Ban Farmhouse	59.8	60.3	52.7
R5.008	The Old Reading Room	65.8	63.4	56.9
R5.009	Tigh Sona	56.1	61.0	49.0
R5.010	Clunes Cottage	48.8	52.5	43.6
R5.011	Dalreoch Cottage	49.2	50.0	44.8

**Table 17.9: Summary of Unattended Baseline Noise Measurements, excluding periods of rainfall**

ID	Address/Representative Location	Average Measured Noise Levels (dB)		
		$L_{A10,18h}$	$L_{Aeq,16h}$	$L_{night,outside}$
R5.001	Old Faskally House	60.5	58.1	52.8
R5.002	Coille Essan	50.1	49.9	47.6
R5.003	House of Urrard	52.5	63.6	48.8
R5.004	2 Essengal Cottages	68.4	65.9	58.6
R5.005	The Bothy	61.0	61.4	53.8
R5.006	2 Woodend	54.2	56.0	48.9
R5.007	Tom Ban Farmhouse	59.9	61.4	51.7
R5.008	The Old Reading Room	65.9	63.5	56.9
R5.009	Tigh Sona	56.0	63.2	48.8
R5.010	Clunes Cottage	48.3	54.1	42.4
R5.011	Dalreoch Cottage	49.2	51.1	45.0

### Comparison of Measured Noise levels with Modelled Predicted Noise Levels

- 17.3.4 To undertake a validation of the 3D Cadna® noise model, modelled predicted noise levels were compared with the measured noise levels at the 11 sample NSR. The predicted noise levels associated with the existing road network were calculated using the assumptions previously discussed in Paragraph 17.2.28 and traffic data from the TMfS model for BMDT 2015.
- 17.3.5 It should be noted that there will rarely be perfect agreement between predicted and measured noise levels as the predicted noise levels use traffic flow data for an 18-hour period and the measured levels also comprise of other noise sources other than road traffic noise. Accordingly, the measured noise levels are likely to be slightly higher than predicted noise levels. Table 17.10 provides a comparison between the predicted and measured noise levels.

**Table 17.10: Modelled Predicted Noise Levels versus Measured Noise Levels**

ID	Address/Representative Location	Modelled Predicted Noise Level (L <sub>A10,18h</sub> ) (dB)	Measured Noise Level (L <sub>A10,18h</sub> ) (dB)	Noise Level Difference (dB)
R5.001	Old Faskally House	61.3	60.5	+0.8
R5.002	Coille Essan	55.2	50.1	+5.1
R5.003	House of Urrard	53.7	52.5	+1.2
R5.004	2 Essengal Cottages	65.2	68.4	+3.2
R5.005	The Bothy	63.7	61.0	+2.7
R5.006	2 Woodend	52.8	54.2	-1.4
R5.007	Tom Ban Farmhouse	57.9	59.9	-2.0
R5.008	The Old Reading Room	68.1	65.9	+2.2
R5.009	Tigh Sona	58.3	56.0	+2.3
R5.010	Clunes Cottage	51.4	48.3	+3.1
R5.011	Dalreoch Cottage	57.7	49.2	+8.5

17.3.6 The results in Table 17.10 show that at nine of the locations there is a reasonably good correlation (a difference of less than approximately 2dB) between the modelled predicted noise levels and the measured noise levels. At the two remaining locations the discrepancies between the measured and modelled levels are discussed in further detail below:

- At NSR R5.002 the difference between the predicted and measured noise levels is +5.1dB. A dense line of trees approximately 160m in depth is situated between this NSR and the A9, and it is considered likely that the tree belt identified is providing noise attenuation to NSR R5.002. This would explain the difference in measured and predicted noise levels. DMRB Noise and Vibration details that the use of shrubs or trees as a noise barrier is effective only if the foliage is at least 10m deep, dense and consistent for the full height of the vegetation. HD 213/11 makes reference to the Department for Transport (TRL) publication 'The use of vegetation for traffic noise screening'. The TRL publication details that 10m of dense vegetation can result in a noise reduction of 5dB greater than grass or 8dB greater than a hard reflecting surface.
- At NSR R5.011 the difference between the predicted and measured noise levels is +8.5dB. It should be noted that as stated in Paragraph 17.2.28 buildings of less than 25m<sup>2</sup> were removed from the noise models. However, at Dalreoch Cottage on site observations determined there were a series of garden structures located between the measurement location and the existing A9. These structures would provide partial screening which explain the differences between the predicted and measured noise levels.

17.3.7 Based on the above, the modelled results were determined to be suitable for use and, as such, no further amendments were made to the noise models.

## 17.4 Potential Impacts

### Construction

17.4.1 Temporary impacts for road schemes normally occur between the start of advance works and the end of the construction period. Although temporary, construction-related noise and vibration impacts can be significant.

17.4.2 Construction work of any type that involves heavy plant activities will generate noise, which may result in complaints if sensitive scheduling and control of works is not exercised. The noise levels generated by construction activities and experienced by nearby NSR such as residential properties, depends upon a number of variables, the most notable of which are:

- the noise generated by plant or equipment used on site, generally expressed as sound power levels (SWL);
- the periods of operation of the plant on the site, known as its 'on-time';
- the distance between the noise source and the NSR; and

- the attenuation due to ground absorption, air absorption and barrier effects.

- 17.4.3 In order to evaluate the noise during the construction it is necessary to have knowledge of the various activities that would be undertaken. Contractors may use different working methods and plant to achieve the same ends. An accurate demolition and construction noise and vibration impact assessment is not normally possible until appointment of the approved Contractor with knowledge of the exact working routine and plant schedule. However, during the construction phase the use of plant, and the likely noise impact thereof, would be determined following the guidance detailed in BS 5228:2009+A1:2014 and, where necessary, mitigation would be provided. Moreover, should complaints be received from local residents, the local authority would determine whether the best practicable means to reduce noise and vibration impacts are being applied. Therefore, best practicable means would be employed to ensure that noise levels are minimised. Outline mitigation measures to reduce construction impacts can be found in Section 17.5 (Mitigation).
- 17.4.4 It is likely that the potentially worst affected NSR in respect of construction noise would be those located immediately adjacent to the proposed scheme, with lesser impacts at those properties located adjacent to the existing road network due to potential increase in HGV movements.
- 17.4.5 Disturbance due to construction noise from a proposed scheme of this sort, although it may be significant, is usually short-term as the period of noisy construction work is relatively limited and disturbance normally ceases once the noisy parts of the construction phase are completed.
- 17.4.6 Although a quantitative assessment of construction noise impacts has not been undertaken, based on professional judgement it is not unreasonable to assume that, without mitigation, the significance of construction noise impacts may result in temporary, short-term impacts of **Moderate/Large** adverse significance at the NSR closest to the works.
- 17.4.7 The 2008 version of DMRB Noise and Vibration previously advised that construction impacts should be considered by providing an estimate of the number of dwellings within 100m of the alignment of the proposed scheme. In practice, construction noise levels and resulting impacts are likely to vary during the different construction phases of the proposed scheme depending upon the works activities, location and proximity of receptors. Furthermore, best practicable means of mitigation will be employed to minimise construction noise impacts. There are 87 NSR within 100m of the indicative land made available for construction of the proposed scheme (detailed in Appendix A17.7: Noise Sensitive Receptors Closest to Construction Works), the closest of which are The Bothy (Garrybank), the Old School House, Garry View, Tomban Farmhouse, Hillside, Laurelbank, Dalreoch, The Shieling, Ruanroarie, 2 Essangal Cottages, Clunebeg Bungalow and Pitaldonich Farm which are within 20m of the indicative LMA.
- 17.4.8 Concern is often expressed by local residents that vibration from construction activities could cause structural damage to their properties. However, DMRB Noise and Vibration states that:
- 'it has been shown that vibrations that can be felt indoors and which often cause occupants anxiety are an order of magnitude smaller than would be needed to activate pre-existing strains and cause cracks to propagate. It should be borne in mind that superficial cracks in plaster around openings such as doors and windows can often appear during the life of a building'.*
- 17.4.9 Surface plant, such as cranes, compressors and generators, are not recognised as sources of high levels of environmental vibration. Also, it is generally accepted that without a highly detailed understanding of the media, waveform and frequency distribution, ground-borne vibration prediction methods are complex and beset with uncertainties. Whilst it is considered unlikely that typical road construction working methods would generate levels of vibration at local receptors above which cosmetic damage would be expected to be sustained, given the proximity of some NSRs to the proposed scheme there is the potential that vibration impacts could cause complaints at the closest NSR. However, the level of impact at different receptors would be dependent upon a number of factors including the precise distance between the works and NSR, ground conditions and activities being undertaken at any given time. Based upon professional judgement at this stage, as a worst case and without mitigation in place, vibration impacts of up to **Moderate/Large** adverse significance might be experienced by the nearest residents to the works.

- 17.4.10 Where heavy earthwork, piling, or other significant vibration producing operations are proposed in the vicinity of existing NSR, further consideration should be given to potential impacts once the main works Contractor is appointed and the construction requirements are developed. Potential mitigation measures are discussed in Section 17.5 (Mitigation).

## Operation

### Introduction

- 17.4.11 The modelled noise levels and the associated significance of impact at the 11 sample NSR (identified in Table 17.7) are summarised in Tables 17.11 to 17.15, whilst the results for all 368 NSR modelled are provided in Appendix A17.3 (Predicted Noise Levels at Noise Sensitive Receptors). In the following tables, where reference is made to the predicted daytime and night-time noise levels, the assessment has been undertaken at both the ground and first floors of all buildings. Noise contour change maps for the DM 2026 versus the DM 2041, the DM 2026 versus the DS 2026 and the DM 2026 versus the DS 2041 scenarios are provided in Figures 17.3 to 17.8.
- 17.4.12 It is important to note that the methodology in DMRB Noise and Vibration requires that the least beneficial change in noise level is reported. Accordingly, the DM 2026 noise levels in each of the tables may be different for the same sample NSR. This is because, for example, in the DM 2026 versus the DM 2041 scenario the least beneficial noise impact may occur at one receptor point of a property, whereas in the DM 2026 versus the DS 2026 or DS 2041 scenario a different receptor point of a property could experience the least beneficial noise impact.

### Sample NSR Locations (see Figure 17.2)

#### *Do-Minimum Scenario in the Baseline Year vs Do-Minimum Scenario in the Future Assessment Year (Long-term Assessment)*

- 17.4.13 The predicted noise levels at the sample NSR for the DM 2026 and the DM 2041 scenarios with the associated long-term significance of impacts for the daytime period are presented in Table 17.11.

**Table 17.11: Sample NSR – DM 2026 vs. DM 2041 – Day**

ID	Address/ Representative Location	Predicted L <sub>A10,18h</sub> (dB) Noise Level (Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DM 2041	Significance of Impact	DM 2026	DM 2041	Significance of Impact
R5.001	Old Faskally House	53.2	50.4	Slight Beneficial	55.2	52.3	Slight Beneficial
R5.002	Coille Essan	47.5	45.0	Slight Beneficial	49.5	46.9	Slight Beneficial
R5.003	House of Urrard	52.4	51.0	Slight Beneficial	53.1	51.7	Slight Beneficial
R5.004	2 Essengal Cottages	54.5	53.2	Slight Beneficial	56.8	55.2	Slight Beneficial
R5.005	The Bothy	72.7	69.7	Slight/Moderate Beneficial	76.2	73.2	Slight/Moderate Beneficial
R5.006	2 Woodend	55.2	52.3	Slight Beneficial	58.0	55.2	Slight Beneficial
R5.007	Tom Ban Farmhouse	58.4	55.3	Slight/Moderate Beneficial	59.0	55.9	Slight/Moderate Beneficial
R5.008	The Old Reading Room	68.0	64.9	Slight/Moderate Beneficial	61.0	58.0	Slight/Moderate Beneficial
R5.009	Tigh Sona	59.2	56.1	Slight/Moderate Beneficial	60.3	57.2	Slight/Moderate Beneficial
R5.010	Clunes Cottage	50.7	49.8	Slight Beneficial	51.8	50.9	Slight Beneficial
R5.011	Dalreoch Cottage	63.2	60.1	Slight/Moderate Beneficial	64.7	61.6	Slight/Moderate Beneficial

- 17.4.14 The results show that, should the proposed scheme not go ahead no sample NSR is considered to be significantly affected (i.e. an impact of Slight Moderate/Adverse significance or higher and an absolute noise level in excess of 59.5dB L<sub>A10,18h</sub>). Moreover, it should be noted that at all sample NSR there is predicted to be a decrease in noise levels, due to the introduction of a LNRS should the proposed

scheme not proceed. Five NSR are predicted to experience an impact of Slight/Moderate Beneficial significance with the remaining properties experiencing a Slight Beneficial impact.

- 17.4.15 The analysis of night-time noise levels indicates that there are two sample NSR (The Bothy and The Old Reading Room) with night-time noise levels in excess of 55dB  $L_{night, outside}$ , in the long-term without the proposed scheme. The night-time assessment results at these two sample NSR are shown in Table 17.12.

**Table 17.12: Sample NSR – DM 2026 vs. DM 2041 – Night**

ID	Address/ Representative Location	Predicted $L_{night, outside}$ (dB) Noise Level (Free Field at Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DM 2041	Significance of Impact	DM 2026	DM 2041	Significance of Impact
R5.005	The Bothy	59.4	56.7	Slight Beneficial	62.6	59.9	Slight Beneficial
R5.008	The Old Reading Room	55.2	52.4	Slight Beneficial	48.9	46.2	Slight Beneficial

- 17.4.16 Although there are two sample NSR with noise levels in excess of 55dB  $L_{night, outside}$  these are not considered to be significant as the noise levels are predicted to decrease and therefore have an impact of Slight Beneficial significance. Furthermore, R5.008 is predicted to have noise levels above 55dB  $L_{night, outside}$  in the DM 2026 scenario which will reduce to below 55dB  $L_{night, outside}$  in the DM 2041 scenario.

*Do-Minimum Scenario in the Baseline Year vs Do-Something Scenario in the Baseline Year (Short-term Assessment)*

- 17.4.17 The predicted noise levels at the sample NSR for the DM 2026 and the DS 2026 scenarios with the associated short-term significance of impacts for the daytime period are presented in Table 17.13.

**Table 17.13: Sample NSR – DM 2026 vs. DS 2026 – Day (without NSR Specific Mitigation)**

ID	Address/ Representative Location	Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DS 2026	Significance of Impact	DM 2026	DS 2026	Significance of Impact
R5.001	Old Faskally House	56.6	56.3	Slight Beneficial	58.5	58.1	Slight Beneficial
R5.002	Coille Essan	47.5	47.7	Slight Adverse	50.1	50.2	Slight Adverse
R5.003	House of Urrard	52.0	53.6	Slight/Moderate Adverse	52.7	54.2	Slight/Moderate Adverse
R5.004	2 Essengal Cottages	68.1	68.7	Slight Adverse	67.3	67.2	Slight Beneficial
R5.005	The Bothy	65.4	64.3	Slight/Moderate Beneficial	65.5	63.0	Slight/Moderate Beneficial
R5.006	2 Woodend	50.4	51.2	Slight Adverse	58.0	57.8	Slight Beneficial
R5.007	Tom Ban Farmhouse	55.6	55.3	Slight Beneficial	56.5	56.4	Slight Beneficial
R5.008	The Old Reading Room	53.0	48.0	Large/Very Large Beneficial	54.3	49.5	Moderate/ Large Beneficial
R5.009	Tigh Sona	57.3	57.8	Slight Adverse	58.2	59.1	Slight Adverse
R5.010	Clunes Cottage	50.7	54.9	Moderate/Large Adverse	51.8	56.4	Moderate/Large Adverse
R5.011	Dalreoch Cottage	56.0	54.5	Slight/Moderate Beneficial	57.7	56.3	Slight/Moderate Beneficial

- 17.4.18 The results show that at ground floor level, without mitigation, although there are two sample NSR (House of Urrard and Clunes Cottage) with an impact of Slight/Moderate Adverse significance or higher, neither of these are predicted to have a DMRB Noise and Vibration predicted noise level (i.e. the least beneficial change in noise level) of greater than 59.5dB  $L_{A10,18h}$ . Accordingly, based on the

least beneficial change in noise the impacts on these NSR are not considered to be significant. Furthermore, five of the sample NSR (Old Faskally House, The Bothy, Tom Ban Farmhouse, The Old Reading Room and Dalreoch Cottage) are predicted to experience a reduction in noise levels as a result of the proposed scheme and three (The Bothy, The Old Reading Room and Dalreoch Cottage) of these are predicted to have an impact of Slight/Moderate Beneficial significance or better. Significant impacts at all facades, not only at the least beneficial façade are considered in Section 17.5 (Mitigation).

- 17.4.19 It should be noted that a short-term night-time assessment of noise impacts in the baseline year is not required by DMRB Noise and Vibration.

*Do-Minimum Scenario in the Baseline Year vs Do-Something Scenario in the Future Assessment Year (Long-term Assessment)*

- 17.4.20 The predicted noise levels at the sample NSR for the DM 2026 and the DS 2041 scenario with the associated long-term significance of impacts for the daytime period are presented in Table 17.14.

**Table 17.14: Sample NSR – DM 2026 vs. DS 2041 – Day (without NSR Specific Mitigation)**

ID	Address/ Representative Location	Predicted L <sub>A10,18h</sub> (dB) Noise Level (Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DS 2041	Significance of Impact	DM 2026	DS 2041	Significance of Impact
R5.001	Old Faskally House	56.6	56.5	Slight Beneficial	56.6	56.3	Slight Beneficial
R5.002	Coille Essan	47.9	47.6	Slight Beneficial	50.1	49.8	Slight Beneficial
R5.003	House of Urrard	52.0	53.7	Slight Adverse	52.7	54.4	Slight Adverse
R5.004	2 Essengal Cottages	68.1	68.6	Slight Adverse	67.3	67.1	Slight Beneficial
R5.005	The Bothy	65.4	64.5	Slight Beneficial	65.5	63.3	Slight Beneficial
R5.006	2 Woodend	50.4	51.4	Slight Adverse	58.0	58.0	Neutral
R5.007	Tom Ban Farmhouse	55.6	55.5	Slight Beneficial	53.4	53.5	Slight Adverse
R5.008	The Old Reading Room	53.0	48.3	Slight/Moderate Beneficial	54.3	49.8	Slight/Moderate Beneficial
R5.009	Tigh Sona	57.3	58.0	Slight Adverse	58.2	59.3	Slight Adverse
R5.010	Clunes Cottage	50.7	55.2	Slight/Moderate Adverse	51.8	56.6	Slight/Moderate Adverse
R5.011	Dalreoch Cottage	56.0	54.8	Slight Beneficial	62.5	61.3	Slight Beneficial

- 17.4.21 The results show that at ground floor level, without mitigation, there is a single sample NSR (Clunes Cottage) with an impact of Slight/Moderate Adverse significance or higher. However, the NSR is predicted to have a DMRB Noise and Vibration noise level (i.e. the greatest change in noise level) of less than 59.5dB L<sub>A10,18h</sub>. Accordingly, this impact is not considered to be significant. With regards to beneficial impacts a single sample NSR is predicted to have an impact of Slight/Moderate Beneficial significance. Significant impacts at all facades, not only at the least beneficial façade are considered in Section 17.5 (Mitigation).

- 17.4.22 The analysis of night-time noise levels indicates that there is a single sample NSR (2 Essengal Cottages) with night-time noise levels in excess of 55dB L<sub>night,outside</sub>, in the long-term with the proposed scheme. The night-time assessment results at this sample NSR are shown in Table 17.15.

**Table 17.15: Sample NSR – DM 2026 vs. DM 2041 – Night (without NSR Specific Mitigation)**

ID	Address/ Representative Location	Predicted L <sub>night,outside</sub> (dB) Noise Level (Free Field at Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DM 2041	Significance of Impact	DM 2026	DM 2041	Significance of Impact
R5.004	2 Essengal Cottages	55.3	55.7	Slight Adverse	54.6	54.4	Slight Beneficial

17.4.23 Although there is a single sample NSR with noise levels in excess of 55dB  $L_{night, outside}$  these are not considered to be significant, as the significance of impact at ground floor level is only Slight Adverse. Furthermore, at first floor level there is predicted to be an impact of Slight Beneficial significance at this sample NSR.

Summary Tables for all NSR within 600m Calculation Area

*Do-Minimum Scenario in the Baseline Year vs Do-Minimum Scenario in the Future Assessment Year (Long-term Assessment)*

17.4.24 In accordance with Table A1.2 DMRB Noise and Vibration, summaries of the magnitude of noise impacts at dwellings and other NSR for the daytime period at the ground and first floor for the DM 2026 scenario versus the DM 2041 scenario are presented in Table 17.16. These tables include the predicted noise level change at all dwellings and other NSR (defined as ‘High’ sensitivity in Table 17.2) within the 600m calculation area and therefore provides a broader view of potential noise impacts than the sample NSR assessment tables (Tables 17.11 to 17.15).

**Table 17.16: Summary – DM 2026 vs. DM 2041 – Daytime**

Change in Noise Level $L_{A10,18h}$ dB		Magnitude of Impact	Ground Floor		First Floor	
			No. of Dwellings	No. of Other Sensitive Receptors	No. of Dwellings	No. of Other Sensitive Receptors
Increase (Adverse) in Noise Level	0.1 – 2.9	Negligible	4	0	4	0
	3.0 – 4.9	Minor	0	0	0	0
	5.0 – 9.9	Moderate	0	0	0	0
	10.0+	Major	0	0	0	0
No Change	0	No Change	9	0	9	0
Decrease (Beneficial) in Noise Level	0.1 – 2.9	Negligible	275	37	276	37
	3.0 – 4.9	Minor	41	2	40	2
	5.0 – 9.9	Moderate	0	0	0	0
	10.0+	Major	0	0	0	0

17.4.25 Whilst the above table shows the magnitude of impacts in accordance with DMRB Noise and Vibration, the results show that during the daytime period at ground floor level without the proposed scheme, no NSR is predicted to experience a significance impact higher than Slight. In the long-term a Slight/Moderate Adverse significance of impact corresponds to a minor adverse magnitude of impact for high sensitivity receptors (all NSRs in this assessment). Accordingly, these are not considered to be significant. The beneficial impacts show that 43 NSR at ground floor and 42 NSR at first floor are predicted to experience an impact of Slight/Moderate Beneficial significance.

17.4.26 The corresponding summary tables for the DM 2026 scenario versus the DM 2041 scenario, for the night-time period at the ground and first floor levels are presented in Table 17.17 and Table 17.18. In addition, the tables provide information on:

- The number of dwellings with noise levels below 55dB  $L_{night, outside}$  in the DM 2026 scenario which increase to above 55dB  $L_{night, outside}$  in the DM 2041 scenario;
- the number of dwellings with noise levels above 55dB  $L_{night, outside}$  in both the DM 2026 and DM 2041 scenarios; and
- the number of dwellings with noise levels above 55dB  $L_{night, outside}$  in the DM 2026 scenario which reduce to below 55dB  $L_{night, outside}$  in the DM 2041 scenario.

17.4.27 It should be noted that n/a is reported when a condition cannot be met e.g., dwellings that have a night-time noise level less than 55dB in the DM 2026 scenario cannot have a decrease in noise level if the DM 2041 noise level is greater than or equal to 55dB.

**Table 17.17: Summary – Ground Floor DM 2026 vs. DM 2041 – Night**

Change in Noise Level $L_{\text{night, outside}}$ dB	Magnitude of Impact	No. of Dwellings	No. of Dwellings		No. of Dwellings	
			(DM 2026 < 55dB, DM 2041 ≥ 55dB)	(DM 2026 ≥ 55dB, DM 2041 ≥ 55dB)	(DM 2026 ≥ 55dB, DM 2041 < 55dB)	(DM 2026 < 55dB, DM 2041 < 55dB)
Increase (Adverse) in Noise Level	0.1 – 2.9	Negligible	4	0	0	n/a
	3.0 – 4.9	Minor	0	0	0	n/a
	5.0 – 9.9	Moderate	0	0	0	n/a
	10.0+	Major	0	0	0	n/a
No Change	0	No Change	10	0	0	0
Decrease (Beneficial) in Noise Level	0.1 – 2.9	Negligible	315	n/a	2	1
	3.0 – 4.9	Minor	0	n/a	0	0
	5.0 – 9.9	Moderate	0	n/a	0	0
	10.0+	Major	0	n/a	0	0

**Table 17.18: Summary – First Floor DM 2026 vs. DM 2041 – Night (without NSR Specific Mitigation)**

Change in Noise Level $L_{\text{night, outside}}$ dB	Magnitude of Impact	No. of Dwellings	No. of Dwellings		No. of Dwellings	
			(DM 2026 < 55dB, DM 2041 ≥ 55dB)	(DM 2026 ≥ 55dB, DM 2041 ≥ 55dB)	(DM 2026 ≥ 55dB, DM 2041 < 55dB)	(DM 2026 < 55dB, DM 2041 < 55dB)
Increase (Adverse) in Noise Level	0.1 – 2.9	Negligible	4	0	0	n/a
	3.0 – 4.9	Minor	0	0	0	n/a
	5.0 – 9.9	Moderate	0	0	0	n/a
	10.0+	Major	0	0	0	n/a
No Change	0	No Change	9	0	0	0
Decrease (Beneficial) in Noise Level	0.1 – 2.9	Negligible	316	n/a	2	2
	3.0 – 4.9	Minor	0	n/a	0	0
	5.0 – 9.9	Moderate	0	n/a	0	0
	10.0+	Major	0	n/a	0	0

17.4.28 As can be seen in Table 17.17 during the night-time period at ground floor level there are three NSR (The Bothy, Tomchitchen and The Old Reading Room) predicted to have noise levels in excess of 55dB  $L_{\text{night, outside}}$ . However, all these properties are predicted to have a decrease in noise levels between the Do-Minimum and Do-Something scenarios. Accordingly, the predicted night-time noise levels are not considered to be significant.

17.4.29 At first floor level during the night-time period there are four NSR (The Bothy, Tomchitchen, An-Cro and Drumbeg) predicted to have noise levels in excess of 55dB  $L_{\text{night, outside}}$ . However, all these properties are predicted to have a decrease in noise levels between the Do-minimum and Do-something scenarios. Accordingly, the predicted night-time noise levels are not considered to be significant.

*Do-Minimum Scenario in the Baseline Year vs. Do-Something Scenario in the Baseline Year (Short-term Assessment)*

17.4.30 In accordance with Table A1.1 of DMRB Noise and Vibration, a summary of the magnitude of noise impacts at all dwellings and other NSR within the 600m calculation area for the DM 2026 scenario versus the DS 2026 scenario, for the daytime period at ground and first floor are presented in Table 17.19. Note that in accordance with DMRB Noise and Vibration, assessment of night-time noise is not required for this ‘short-term’ assessment.

**Table 17.19: Summary – DM 2026 vs. DS 2026 – Day (without NSR Specific Mitigation)**

Change in Noise Level $L_{A10, 18h}$ dB	Magnitude of Impact	Ground Floor		First Floor		
		No. of Dwellings	No. of Other Sensitive Receptors	No. of Dwellings	No. of Other Sensitive Receptors	
Increase	0.1 – 0.9	Negligible	130	5	128	5

Change in Noise Level L <sub>A10,18h</sub> dB		Magnitude of Impact	Ground Floor		First Floor	
			No. of Dwellings	No. of Other Sensitive Receptors	No. of Dwellings	No. of Other Sensitive Receptors
(Adverse) in Noise Level	1.0 – 2.9	Minor	55	10	43	8
	3.0 – 4.9	Moderate	1	0	1	0
	5.0+	Major	0	0	0	0
No Change	0	No Change	11	1	9	3
Decrease (Beneficial) in Noise Level	0.1 – 0.9	Negligible	111	23	129	23
	1.0 – 2.9	Minor	19	0	17	0
	3.0 – 4.9	Moderate	1	0	2	0
	5.0+	Major	1	0	0	0

17.4.31 Corresponding to a magnitude of impact of minor adverse and above in the short-term, the results show that at ground floor level there are 56 dwellings and ten other NSR with a potential impact of Slight/Moderate Adverse significance or higher in the short-term. Further analysis of the absolute noise levels at these NSR (which can be found in Appendix A17.3) show that of these, 11 NSR have predicted noise levels in excess of 59.5dB L<sub>A10,18h</sub> and are therefore are considered to be potentially significantly affected. The beneficial impacts of the proposed scheme indicate that 21 dwellings are predicted to have an impact of Slight/Moderate Beneficial significance or better. Significant impacts at all facades, not only the least beneficial façade are considered in Section 17.5 (Mitigation).

17.4.32 The 11 NSR where short-term potential impacts are considered to be significant at ground level are presented in Table 17.20.

**Table 17.20: NSR at Ground Floor Level Considered to be Significant (DM 2026 vs DS 2026 – Day (Without Mitigation))**

NSR ID	NSR Name	Predicted L <sub>A10,18h</sub> (dB) Noise Level (Façade) and Significance of Impact		
		DM 2026	DS 2041	Significance of Impact
R5.013	The Health Clinic	59.6	60.6	<b>Slight/ Moderate</b> Adverse
R5.084	Hillside	63.6	64.9	<b>Slight/ Moderate</b> Adverse
R5.103	Darroch Cottage	59.6	60.6	<b>Slight/ Moderate</b> Adverse
R5.104	The Shieling	62.5	63.6	<b>Slight/ Moderate</b> Adverse
R5.106	Laurelbank	62.9	64.0	<b>Slight/ Moderate</b> Adverse
R5.107	Garry View	62.8	63.9	<b>Slight/ Moderate</b> Adverse
R5.108	Old School House	64.3	65.4	<b>Slight/ Moderate</b> Adverse
R5.115	Corrie House	65.5	68.0	<b>Slight/ Moderate</b> Adverse
R5.119	Carnliath	65.2	67.1	<b>Slight/ Moderate</b> Adverse
R5.131	7 Blair Cottages	59.6	60.6	<b>Slight/ Moderate</b> Adverse
R5.368	Dalnacardoch Lodge	59.0	60.7	<b>Slight/ Moderate</b> Adverse

17.4.33 At first floor level there are 44 dwellings and eight other NSR with a potential impact of Slight/Moderate Adverse significance or higher in the short-term. The beneficial impacts of the proposed scheme indicate that 19 dwellings will have an impact of Slight/Moderate Beneficial significance or better.

*Do-Minimum Scenario in the Baseline Year vs. Do-Something Scenario in the Future Assessment Year (Long-term Assessment)*

17.4.34 In accordance with Table A1.2 of DMRB Noise and Vibration, summaries of the magnitude of noise impacts at all dwellings and other NSR within the 600m calculation area for the DM 2026 scenario versus the DS 2041 scenario, for the daytime period at ground and first floor are presented in Table 17.21.

**Table 17.21: Summary – DM 2026 vs. DS 2041 – Day (without NSR Specific Mitigation)**

Change in Noise Level $L_{A10,18h}$ dB		Magnitude of Impact	Ground Floor		First Floor	
			No. of Dwellings	No. of Other Sensitive Receptors	No. of Dwellings	No. of Other Sensitive Receptors
Increase (Adverse) in Noise Level	0.1 – 2.9	Negligible	173	14	151	15
	3.0 – 4.9	Minor	1	0	1	0
	5.0 – 9.9	Moderate	0	0	0	0
	10.0+	Major	0	0	0	0
No Change	0	No Change	13	2	27	1
Decrease (Beneficial) in Noise Level	0.1 – 2.9	Negligible	140	23	148	23
	3.0 – 4.9	Minor	2	0	2	0
	5.0 – 9.9	Moderate	0	0	0	0
	10.0+	Major	0	0	0	0

17.4.35 Where there is a resulting magnitude of impact of minor adverse and above in the long-term, the results show that at ground floor level there is a single dwelling with a potential impact of Slight/Moderate Adverse significance or higher in the long-term. Further analysis of the absolute noise levels at Clunes Cottage show that the predicted noise level is less than 59.5dB  $L_{A10,18h}$  and the potential impacts are therefore not considered to be significant. The beneficial impacts of the proposed scheme indicate that two NSR are predicted to have an impact of Slight/Moderate Beneficial significance.

17.4.36 The corresponding summary tables for the DM 2026 scenario versus the DS 2041 scenario, for the night-time period at the ground and first floor are presented in Table 17.22 and Table 17.23, respectively. These tables provide the magnitude of impacts for all dwellings within the 600m calculation area. In addition, the tables provide information on:

- The number of dwellings with noise levels below 55dB  $L_{night, outside}$  in the DM 2026 scenario which increase to above 55dB  $L_{night, outside}$  in the DS 2041 scenario;
- the number of dwellings with noise levels above 55dB  $L_{night, outside}$  in both the DM 2026 and DS 2041 scenarios; and
- the number of dwellings with noise levels above  $L_{night, outside}$  55dB in the DM 2026 scenario which reduce to below 55dB  $L_{night, outside}$  in the DS 2041 scenario.

**Table 17.22: Summary – Ground Floor DM 2026 vs. DS 2041 – Night (without NSR Specific Mitigation)**

Change in Noise Level $L_{night, outside}$ dB		Magnitude of Impact	No. of Dwellings	No. of Dwellings (DM 2026 < 55dB, DS 2041 ≥ 55dB)	No. of Dwellings (DM 2026 ≥ 55dB, DS 2041 ≥ 55dB)	No. of Dwellings (DM 2026 ≥ 55dB, DS 2041 < 55dB)
Increase (Adverse) in Noise Level	0.1 – 2.9	Negligible	173	1	1	N/A
	3.0 – 4.9	Minor	1	0	0	N/A
	5.0 – 9.9	Moderate	0	0	0	N/A
	10.0+	Major	0	0	0	N/A
No Change	0	No Change	16	0	0	0
Decrease (Beneficial) in Noise Level	0.1 – 2.9	Negligible	137	N/A	0	0
	3.0 – 4.9	Minor	2	N/A	0	0
	5.0 – 9.9	Moderate	0	N/A	0	0
	10.0+	Major	0	N/A	0	0

**Table 17.23: Summary – First Floor DM 2026 vs. DS 2041 – Night (without NSR Specific Mitigation)**

Change in Noise Level $L_{\text{night, outside}}$ dB	Magnitude of Impact	No. of Dwellings	No. of Dwellings (DM 2026 < 55dB, DS 2041 ≥ 55dB)	No. of Dwellings (DM 2026 ≥ 55dB, DS 2041 ≥ 55dB)	No of Dwellings (DM 2026 ≥ 55dB, DS 2041 < 55dB)	
Increase (Adverse) in Noise Level	0.1 – 2.9	Negligible	146	1	0	N/A
	3.0 – 4.9	Minor	1	0	0	N/A
	5.0 – 9.9	Moderate	0	0	0	N/A
	10.0+	Major	0	0	0	N/A
No Change	0	No Change	33	0	0	0
Decrease (Beneficial) in Noise Level	0.1 – 2.9	Negligible	147	N/A	0	0
	3.0 – 4.9	Minor	2	N/A	0	0
	5.0 – 9.9	Moderate	0	N/A	0	0
	10.0+	Major	0	N/A	0	0

- 17.4.37 As can be seen in the above tables, during the night-time period at ground floor level, there are two NSR (2 Essengal Cottages and Corrie House) which have a noise level greater than or equal to 55dB  $L_{\text{night, outside}}$ . However, these NSR are predicted to experience an impact of less than Slight/Moderate Adverse, which is not deemed significant.
- 17.4.38 At first floor level there is a single NSR (Corrie House) which has a noise level greater than or equal to 55dB  $L_{\text{night, outside}}$ . However, this NSR is predicted to experience an impact of less than Slight/Moderate Adverse, which is not deemed significant.

Health and Educational Establishments

- 17.4.39 With regard to other NSR the impacts on identified health and education buildings have also been reported separately within this chapter. Figure 17.2 presents the location of identified health and educational establishments located within the 600m calculation area. For each of the buildings, the daytime noise levels at ground and first floor for the DM 2026 scenario and the DM 2041 scenario, with associated significance of impacts is presented in Table 17.24. The DM 2026 scenario and DS 2026 scenario and associated significance of impacts are presented in Table 17.25. Whilst the DM 2026 scenario and the DS 2041 scenario and associated significance of impacts are presented in Table 17.26.
- 17.4.40 It is noted that Struan Primary School is currently not operational and has been mothballed. However, as there is the potential for the school to become operational again in the future it has been included as a NSR.

**Table 17.24: Health and Educational Establishments – DM 2026 vs DM 2041 – Day**

ID	Address	Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DM 2041	Significance of Impact	DM 2026	DM 2041	Significance of Impact
R5.012	Blair Atholl Primary School, St Adamnan Road, PH18 5TB	37.1	34.7	Slight Beneficial	40.2	37.7	Slight Beneficial
R5.013	The Health Clinic, Main Road, Blair Atholl, PH18 5SG	56.5	56.2	Slight Beneficial	59.6	59.2	Slight Beneficial
R5.014	Struan Primary School, Calvine, PH18 5UA	64.0	60.9	Slight/Moderate Beneficial	65.5	62.5	Slight/Moderate Beneficial

**Table 17.25: Health and Educational Establishments – DM 2026 vs DS 2026 – Day (without NSR Specific Mitigation)**

ID	Address	Predicted L <sub>A10,18h</sub> (dB) Noise Level (Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DS 2026	Significance of Impact	DM 2026	DS 2026	Significance of Impact
R5.012	Blair Atholl Primary School	41.1	40.7	Slight Beneficial	39.7	39.2	Slight Beneficial
R5.013	The Health Clinic	59.6	60.6	Slight/Moderate Adverse	59.8	60.6	Slight Adverse
R5.014	Struan Primary School	51.7	51.7	Neutral	53.4	53.4	Neutral

**Table 17.26: Health and Educational Establishments – DM 2026 vs DS 2041 – Day (without NSR Specific Mitigation)**

ID	Address	Predicted L <sub>A10,18h</sub> (dB) Noise Level (Façade) and Significance of Impact					
		Ground Floor			First Floor		
		DM 2026	DS 2041	Significance of Impact	DM 2026	DS 2041	Significance of Impact
R5.012	Blair Atholl Primary School	41.1	40.8	Slight Beneficial	43.7	43.3	Slight Beneficial
R5.013	The Health Clinic	59.6	60.2	Slight Adverse	60.3	60.7	Slight Adverse
R5.014	Struan Primary School	51.7	52.0	Slight Adverse	53.4	53.7	Slight Adverse

- 17.4.41 In the long-term, without the proposed scheme in place (DM 2026 v DM 2041) at ground and first floor levels all of the identified health and education buildings are predicted to experience an impact of Slight Beneficial significance or better.
- 17.4.42 In the short-term, with the proposed scheme in place (DM 2026 v DS 2026) at ground floor level the Health Clinic in Blair Atholl is predicted to have a potential impact of Slight/Moderate Adverse significance or higher and is predicted to have a potential noise level in excess of 59.5dB L<sub>A10,18h</sub> which is considered to be significant.
- 17.4.43 In the long-term, with the proposed scheme in place (DM 2026 v DS 2041) at ground floor level none of the identified health and education buildings are predicted to experience an impact of Slight/Moderate Adverse significance or higher.

Noise Nuisance

- 17.4.44 Table 17.27 summarises the comparison of noise nuisance, between two scenarios: DM 2026 scenario versus the DM 2041 scenario and the DM 2026 scenario versus the DS 2041 scenario, which illustrates the potential noise nuisance impacts at all dwellings.

**Table 17.27: Summary of Traffic Noise Nuisance (without NSR Specific Mitigation)**

Change in Traffic Induced Noise Nuisance		Number of Dwellings			
		Ground Floor		First Floor	
		DM2026 vs DM2041	DM2026 vs DS2041	DM2026 vs DM2041	DM2026 vs DS2041
Increase (Adverse) in Noise Nuisance	< 10%	4	18	4	29
	10 < 20%	0	110	0	96
	20 < 30%	0	62	0	52
	30 < 40%	0	1	0	1
	> 40%	0	0	0	0
No Change	0%	80	50	40	46
Decrease (Beneficial) in	< 10%	245	88	285	105
	10 < 20%	0	0	0	0

Change in Traffic Induced Noise Nuisance		Number of Dwellings			
		Ground Floor		First Floor	
		DM2026 vs DM2041	DM2026 vs DS2041	DM2026 vs DM2041	DM2026 vs DS2041
Noise Nuisance	20 < 30%	0	0	0	0
	30 < 40%	0	0	0	0
	> 40%	0	0	0	0

17.4.45 Table 17.27 shows that there is an increase in the noise nuisance with the proposed scheme compared to without the proposed scheme.

17.4.46 Without the proposed scheme at ground floor level there are four dwellings with an adverse change in noise nuisance, 80 dwellings with no change in noise nuisance and 245 dwellings with a beneficial change in noise nuisance. With the proposed scheme 191 dwellings are predicted to have a potential increase in noise nuisance with the majority experiencing an increase in noise nuisance at the 10-20% noise nuisance band. Fifty dwellings are predicted to experience no change in noise nuisance and 88 dwellings are predicted to have a beneficial change in noise nuisance. Similar impacts are predicted to occur at the first floor of these dwellings.

#### Vibration Nuisance

17.4.47 When determining vibration nuisance, Figures A6.1 and A6.2 of DMRB Noise and Vibration have been used to determine the percentage of people bothered by traffic vibration. This is based on the predicted noise levels and the percentage of people bothered (very much or quite a lot) by vibration nuisance for the DM 2026 scenario versus the DM 2041 scenario, and the DM 2026 scenario versus the DS 2041 scenario. These scenarios have been determined and summarised in Table 17.28 for all dwellings that are within 40m of all modelled roads with a predicted noise level greater than 58.0dB LA10,18h.

**Table 17.28: Summary of Traffic Induced Airborne Vibration Nuisance (without NSR Specific Mitigation)**

Change in Airborne Traffic Induced Vibration Nuisance		Number of Dwellings			
		Ground Floor		First Floor	
		DM2026 vs DM2041	DM2026 vs Ds2041	DM2026 vs DM2041	DM2026 vs Ds2041
Increase (Adverse) in Vibration Nuisance	< 10%	3	2	4	3
	10 < 20%	0	27	0	28
	20 < 30%	0	14	0	14
	30 < 40%	0	0	0	0
	> 40%	0	0	0	0
No Change	0%	66	26	62	22
Decrease (Beneficial) in Vibration Nuisance	< 10%	1	1	4	3
	10 < 20%	0	0	0	0
	20 < 30%	0	0	0	0
	30 < 40%	0	0	0	0
	> 40%	0	0	0	0

17.4.48 With regard to airborne traffic induced vibration, there is a predicted potential increase in the vibration nuisance with the proposed scheme compared to without the proposed scheme.

17.4.49 Without the proposed scheme at ground floor level there are three dwellings with an adverse change in vibration nuisance, 66 dwellings with no change in vibration nuisance and a single dwelling with a beneficial change in airborne vibration nuisance. With the proposed scheme 43 dwellings are predicted to have a potential increase in airborne vibration nuisance, with the majority experiencing an increase in the 10-20% and 20-30% vibration nuisance bands. Twenty-six dwellings are predicted to experience no change in airborne vibration nuisance and a single dwelling is predicted to experience a decrease in vibration nuisance. Similar impacts are predicted to occur at the first floor of these dwellings.

#### Noise Insulation

- 17.4.50 As noted in Paragraph 17.2.50, Regulation 3 of the NISR confers a duty on the roads authorities, in certain instances, to offer insulation to eligible residential properties affected by noise. The results of the noise assessment indicate that there are no NSR which are likely to be deemed eligible for noise insulation according to the eligibility requirements in Noise Insulation (Scotland) Regulations 1975 (HMSO, 1975b).

#### Qualitative Assessment (for NSR between 600m – 1km)

- 17.4.51 In both the short-term and long-term assessment, NSR that are located outwith the 600m calculation area but within the 1km study area the majority of these would be predicted to experience an impact of Slight Beneficial significance. Whilst there may be some NSR which would experience an increase in noise level these would be no higher than of Slight Adverse significance. Furthermore, given these NSR are at least 600m from the proposed scheme then absolute noise level as a consequence of the proposed scheme is predicted to be low.

#### Committed Development

- 17.4.52 Committed developments are extant planning applications that have been received or determined by the local planning authority in the last three years.
- 17.4.53 With regards to committed developments, the potential noise impact on seven noise sensitive committed developments have been assessed. Full details of the potential noise impacts are provided in Appendix A17.4 (Noise Impacts on Committed Developments). This appendix provides tables reporting the percentage of the committed development area subject to a change in free-field noise level.
- 17.4.54 In the long-term without the proposed scheme all committed developments are predicted to experience a decrease in noise level.
- 17.4.55 With the proposed scheme a single committed development (Clan Donnachaidh Museum; planning application number 17/00362/FLL), is predicted to experience a potential increase in noise level change of between 1 and 3dB across 41.4% of the development site in the short-term. All other committed developments are predicted to experience a potential increase in noise level change of less than 1dB in the short-term and less than 3dB in the long-term.

#### Amenity Areas

- 17.4.56 There are 32 amenity areas (e.g. SSSIs, SAC) and 58 amenity lines (e.g. Core Paths, Rights of Way) which have been identified within the calculation area. Details of the potential noise impacts are provided in Appendix A17.5 (Noise Impacts on Amenity Areas).
- 17.4.57 As with the committed developments, Appendix A17.5 (Noise Impacts on Amenity Areas) provides a summary table reporting the percentage area/length of each amenity area/line subject to a change in free-field noise level.
- 17.4.58 In the long-term without the proposed scheme no amenity areas or amenity lines are predicted to be exposed to a noise level increase of greater than or equal to 3dB.
- 17.4.59 The noise impacts on amenity areas in the short-term, with the proposed scheme, are summarised in Table 17.29. It should be noted that this table highlights the least beneficial impacts of the proposed scheme, as the change in noise level over the total area/length will vary. Therefore, this table should be read in conjunction with the tables in Appendix A17.5 (Noise Impacts on Amenity Areas) to gain a full understanding of the potential noise impacts.

**Table 17.29: Summary of Noise Impacts on Amenity Areas in the Short-term with the Proposed Scheme (with Mitigation)**

Amenity Area Noise Impact Assessment	Number of Amenity Areas/Lines								
	Increase in Noise Level				No Change	Decrease in Noise Levels			
	$x \geq 5\text{dB}$	$3 \leq x < 5\text{dB}$	$1 \leq x < 3\text{dB}$	$0 < x < 1\text{dB}$	$X = 0\text{dB}$	$-1 < x < 0\text{dB}$	$-3 < x \leq -1\text{dB}$	$-5 < x \leq -3\text{dB}$	$X \leq -5\text{dB}$
Amenity Areas	3	1	9	7	0	8	4	0	0
Amenity Lines	9	7	14	8	1	16	3	0	0

- 17.4.60 For the three amenity areas predicted to be exposed to a noise level increase of greater than 5dB in the short-term, these impacts would be across no greater than 2% of these amenity areas. These three areas are Cairngorms National Park, Glen Garry SSSI and Blair Castle Gardens and Designed Landscape.
- 17.4.61 For the nine amenity lines predicted to be exposed to a noise level increase of greater than 5dB in the short-term, these impacts would be across no greater than 48% of these amenity lines exposed to this noise level increase.
- 17.4.62 The potential noise impacts on amenity areas in the long-term, with the proposed scheme, are summarised in Table 17.30. As with Table 17.29, it should be noted that this table highlights the least beneficial impacts of the proposed scheme as the change in noise level over the total area/length will vary. Therefore, this table should be read in conjunction with the tables in Appendix A17.5 (Noise Impacts on Amenity Areas) to gain a full understanding of the potential noise impacts.

**Table 17.30: Summary of Noise Impacts on Amenity Areas in the Long-term with the Proposed Scheme (with Mitigation)**

Amenity Area Noise Impact Assessment	Number of Amenity Areas/Lines								
	Increase in Noise Level				No Change	Decrease in Noise Levels			
	$x \geq 10\text{dB}$	$5 \leq x < 10\text{dB}$	$3 \leq x < 10\text{dB}$	$0 < x < 3\text{dB}$	$X = 0\text{dB}$	$-3 < x < 0\text{dB}$	$-5 < x \leq -3\text{dB}$	$-10 < x \leq -5\text{dB}$	$X \leq -10\text{dB}$
Amenity Areas	1	2	3	13	1	12	0	0	0
Amenity Lines	2	7	6	20	4	19	0	0	0

- 17.4.63 A single amenity area, Cairngorms National Park, is predicted to be exposed to a noise level increase of greater than 10dB in the long-term. However, this impact would be across 0.2% of this amenity area.
- 17.4.64 For the two amenity lines predicted to be exposed to a noise level increase of greater than 10dB in the long-term, these impacts would be across no greater than 41% of these amenity lines exposed to this noise level increase.

## 17.5 Mitigation

- 17.5.1 Mitigation measures for the proposed scheme in relation to noise and vibration are detailed below and take into account best practice, legislation, guidance and professional experience. This chapter makes reference to overarching standard measures applicable across A9 dualling projects ('SMC' mitigation item references), and also to project-specific measures ('P05' mitigation item references). Those that specifically relate to noise and vibration are assigned an 'NV' reference.

### Embedded Mitigation

- 17.5.2 The proposed scheme requires the construction of cuttings and embankments (collectively referred to as 'earthworks'). Earthworks of the proposed scheme have been included within the 3D noise model. Although no earthworks were included within the design specifically to provide mitigation to NSR, the proposed earthworks in some locations will offer a greater degree of noise attenuation than if they were not included.

- 17.5.3 In addition, as part of the proposed scheme, all mainline and slip roads will be surfaced with a low noise road surfacing material. According to DMRB Noise and Vibration this can reduce noise levels by approximately 3.5dB  $L_{A10,18h}$  when compared with conventional HRA surfacing of 2mm texture depth, although this is only valid for sections of the proposed scheme with traffic speeds of at least 75km/h. For sections of the proposed scheme with traffic speeds below 75km/h, for example some sections of slip roads, noise levels would only be reduced by approximately 1dB  $L_{A10,18h}$ .

### Standard Mitigation

- 17.5.4 A Construction Environmental Management Plan (CEMP) will be prepared by the Contractor (**Mitigation Item SMC-S1**). The CEMP will set out how the Contractor intends to operate the construction site, including construction-related mitigation measures. The relevant section(s) of the CEMP will be in place prior to the start of construction work and will cover a range of aspects including noise and vibration.
- 17.5.5 Prior to construction a suitably qualified Environmental Clerk of Works (EnvCoW) will be appointed by the Contractor (**Mitigation Item SMC-S2**). The EnvCoW(s) will report to the Environmental Coordinator and be present on site, as required, during the construction period to monitor the implementation of the mitigation measures identified and ensure that activities are carried out in such a manner to prevent or reduce impacts on the environment. This would involve the EnvCoW(s) ensuring the contractor is adhering to the mitigation measures set out in **Mitigation Item SMC-NV2**.
- 17.5.6 As previously stated, at this stage of the proposed scheme, detailed methods and programming of work and type of plant to be employed during the construction phase is not known. A scheme of noise and vibration monitoring will therefore be agreed with the relevant Environmental Health Department, and noise and vibration limits will be contained within the CEMP (refer to Mitigation Item SMC-S1). 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 (**Mitigation Item SMC-NV1**).
- 17.5.7 The following mitigation measures, as recommended in BS 5228:2009+A1:2014, will be employed to minimise the noise impacts during the construction phase:

### Community Relations

- 17.5.8 In accordance with (Table 1, Chapter 21: Schedule of Environmental Commitments) throughout the construction period the Contractor will contribute towards the overall communications strategy for the A9 Dualling Programme (**Mitigation Item SMC-S3**), which will assist in mitigation of noise and vibration, for example by providing forewarning of impending noisy activities and a feedback mechanism for any concerns to be raised. As part of the communications strategy the Contractor will appoint a community liaison officer supported by a liaison team as necessary who will:
- liaise with the following: relevant local authorities; other statutory bodies and regulatory authorities; community councils and relevant community groups; and businesses and residents in local communities affected by the construction works;
  - notify occupiers of nearby properties a minimum of two weeks in advance of the nature and anticipated duration of planned construction works that may affect them;
  - support the production of project communications such as the project website and newsletters; and
  - establish a dedicated freephone telephone helpline together with a dedicated email address and postal address for enquiries and complaints during the construction phase. The relevant contact numbers, email and postal addresses will as a minimum be displayed on signs around the construction site and will be published on the project website. Enquiries and complaints will be logged in a register and appropriate action will be taken in response to any complaints.

### Training of Employees

- 17.5.9 The Contractor will ensure that all site workers receive adequate environmental training relevant to their role prior to working on the construction site, including specific environmental project inductions

and 'toolbox talks' on best practice construction methods as appropriate (**Mitigation Item SMC-S4**), which would be anticipated to include those relating to noise and vibration control, by employing techniques to keep site noise to a minimum, and would be effectively supervised to ensure that best working practice in respect of noise reduction is followed.

#### Execution of Works

- 17.5.10 Best Practicable Means will be used to limit the level of noise to which operators and others in the vicinity of site operations will be exposed (**Mitigation Item SMC-NV2**). This includes the following:
- the hours of working would 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 will be agreed 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 would 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, efficient working order;
  - where appropriate, inherently quiet plant will be selected. All major compressors would 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 would 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.
- 17.5.11 In addition, PKC will be consulted regarding any proposed working out-with normal working hours.

#### **Specific Mitigation**

- 17.5.12 As stated in Paragraph 17.2.44 mitigation will be implemented, where reasonably practicable, where the potential impact is of Slight/Moderate Adverse significance or higher and the predicted façade noise level exceeds 59.5dB  $L_{A10,18h}$  at ground floor level during the daytime period, and/or 55.0dB  $L_{night,outside}$  during the night-time period, at ground and/or first floor level. Tables 17.31, 17.32 and 17.33, below show the number of residential buildings that may qualify for mitigation.

- 17.5.13 It should be noted that the DMRB Noise and Vibration assessment reports a single value noise level at the least beneficial façade of a property. However, mitigation is considered at all receptor points where an exceedance of the noise mitigation threshold criteria occurs.

Table 17.31: Mitigation Criteria Qualification (Short-term Day)

Number of Residential Buildings		
DS 2026 – DM 2026 Noise Level Change $\geq$ 1dB(A)	DS 2026 Noise Level > 59.5dB ( $L_{A10,18h}$ )	Meets Mitigation Threshold Criteria
53	48	12

Table 17.32: Mitigation Criteria Qualification (Long-term Day)

Number of Residential Buildings		
DS 2041 – DM 2026 Noise Level Change $\geq$ 3dB(A)	DS 2041 Noise Level > 59.5dB ( $L_{A10,18h}$ )	Meets Mitigation Threshold Criteria
1	49	0

Table 17.33: Mitigation Criteria Qualification (Long-term Night)

Number of Residential Buildings		
Ground Floor		
DS 2041 – DM 2026 Noise Level Change $\geq$ 3dB(A)	DS 2041 Noise Level > 55.0dB ( $L_{night,outside}$ )	Meets Mitigation Threshold Criteria
1	4	0
First Floor		
DS 2041 – DM 2026 Noise Level Change $\geq$ 3dB(A)	DS 2041 Noise Level > 55.0dB ( $L_{night,outside}$ )	Meets Mitigation Threshold Criteria
1	4	0

- 17.5.14 Where a NSR meets the mitigation criteria, even with the embedded mitigation outlined above, then additional NSR specific mitigation has been proposed or considered.
- 17.5.15 **Mitigation Item P05-NV3** provides for 300m of LNRS to be applied to a section of existing A9 that is already dualled, as shown in Figure 17.9, to mitigate potential significant noise impacts on Dalnacardoch Lodge. The exceedance of the noise mitigation criteria at Dalnacardoch Lodge (as shown in Figure 17.9) occurs in the short-term only, and is due to the traffic flow increasing on the A9. However, as it is beyond the end of the proposed scheme this NSR does not benefit from the introduction of LNRS that a NSR adjacent to the proposed scheme would benefit from. Providing LNRS at this location will avoid exceedances in the short-term. As it is proposed that LNRS would be placed on existing sections of the A9 by 2041 as part of ongoing road maintenance/upgrade even without the proposed scheme then these exceedances do not occur in the long-term.
- 17.5.16 With the additional NSR specific mitigation (**Mitigation Item P05-NV3**), there remain 11 residential buildings and a health centre that have exceedances of the mitigation threshold criteria in the short-term when considering all receptor points. These include:
- Two NSR on Ford Road/Main Road in Blair Atholl (7 Blair Cottages and The Health Clinic (occupying a single building));
  - Seven NSR on the B8079 to the south of the proposed scheme (Darroch Cottage, The Sheiling, Laurelbank, Garry View, Old School House, Hillside and Oakwood House); and
  - Three NSR on the B8079 to the north of the proposed scheme (Carnliath, Lude East Lodge and Corrie House).
- 17.5.17 Analysis of the predicted noise levels at these NSR shows that the exceedances are occurring in the short-term only and are being caused by strategic traffic flow changes (including traffic flow volume, speed and percentage of HGVs) on the side roads (Ford Road and the B8079). For example, the seven NSR on the B8079 to the south of the proposed scheme experience exceedances of the

mitigation threshold criteria on the facades which face away from the proposed scheme and face towards the B8079. The noise level contribution from the side roads at the 12 NSR that have exceedances of the mitigation threshold criteria is more than 10dB above that from the proposed scheme, and therefore any reduction in noise from the proposed scheme would have a negligible effect on the absolute noise levels experienced in the short-term at these significantly affected NSR. This is due to the logarithmic relationship of decibels and how noise levels from different noise sources combine to give a resulting total noise level at a receptor.

- 17.5.18 Consideration was given to providing noise mitigation, in the form of a noise barrier, a drystone wall and/or an earthworks bund at the garden boundaries of these NSR where noise exceedances were occurring:
- At the two NSR on Ford Road/Main Road there is no space available between the building and Ford Road and therefore mitigation was deemed to be impracticable;
  - At the seven NSR on the B8079 to the south of the proposed scheme and the three NSR on the B8079 to the north of the proposed scheme, consideration was given to providing mitigation along the garden boundaries facing on to the B8079, which are comprised of hedgerows and stone walls. However, as the driveways of these properties also share this boundary any additional mitigation would be ineffective due to the gaps required to accommodate driveways. Accordingly, mitigation is not proposed at these properties.
- 17.5.19 No mitigation has been proposed for the committed development at Clan Donnachadh Museum which is predicted to experience a change in noise level of between 1 and 3dB across 41.4% of the development site in the short-term. This is because in general it is not possible to provide mitigation for committed developments as the final site layout is unknown. However, it should be noted that this particular committed development results in a change of use of a museum to staff accommodation. The museum has been considered in the assessment as an 'other sensitive receptor' (high sensitivity) and is reported in Appendix A17.3 (Predicted Noise Levels at Receptors) Receptor ID R5.313. The results show that as a result of the proposed scheme the predicted significance of impact is Slight Adverse in both the short and long-term assessments at ground floor level.

## **17.6 Residual Impacts**

### **Construction**

- 17.6.1 Assuming that the appropriate noise mitigation measures (**Mitigation Items SMC-S1 to SMC-S4, SMC-NV1, SMC-NV2 and P05-NV3**) are employed, it is anticipated that any potentially significant adverse impacts associated with construction of the proposed scheme are unlikely to arise and any that do would be short-term in nature.

### **Operation**

- 17.6.2 DMRB Noise and Vibration requires that a full assessment be undertaken of the residual operational noise impacts where noise mitigation is included. Accordingly, Appendix A17.6 (Operational Residual Noise Impacts) contains the predicted noise levels at sample NSR locations and Health & Education buildings which have been predicted to experience a change in noise level due to the additional NSR specific mitigation. The appendix also includes the residual DMRB Noise and Vibration summary tables for all NSR within the 600m calculation area, noise nuisance tables, vibration nuisance tables and noise insulation assessment.

#### Residual Noise Impacts at Dalnacardoch Lodge

- 17.6.3 As a result of **Mitigation Item P05-NV3** the predicted noise levels at Dalnacardoch Lodge will be reduced in the short-term. Table 17.34 provides the difference in the predicted noise levels at ground floor level. As has been stated previously DMRB requires that the least beneficial change in noise level is reported and it therefore should be appreciated that mitigated and unmitigated noise levels are not necessarily for the same receptor point around Dalnacardoch Lodge. Accordingly, for the purposes of comparison the mitigated noise levels at the receptor point corresponding to the unmitigated receptor point has been included as has the mitigated receptor point with the least beneficial change in noise level.

**Table 17.34: Comparison of Mitigated and Unmitigated Noise Levels at Dalnacardoch Lodge in the Short-term (Ground Floor)**

Scenario	Receptor ID	DM 2026 $L_{A10,18h}$ Noise Level (dB)	DS 2026 $L_{A10,18h}$ Noise Level (dB)	Significance of Impact
DM 2026 Vs DS 2026 (Unmitigated)	21404	59.0	60.7	<b>Slight/Moderate Adverse</b>
DM 2026 Vs DS 2026 (Mitigated)	21404	59.0	57.4	Slight/Moderate Beneficial
DM 2026 Vs DS 2026 (Mitigated)	21410	51.0	50.9	Slight Beneficial

Residual Noise Impacts at all Sample Receptors

*Do-Minimum Scenario in the Baseline Year vs. Do-Something Scenario in the Baseline Year (Short-term Assessment)*

- 17.6.4 With the mitigation proposed in Section 17.5 (Mitigation) the DMRB (i.e. least beneficial change in noise level) predicted daytime noise levels at ground floor level for the short-term assessment indicate that there are ten NSR which are considered to have a residual significant noise impact. These are:
- Two NSR on Ford Road/Main Road in Blair Atholl (7 Blair Cottages and The Health Clinic (Occupying a single building));
  - Six NSR on the B8079 to the south of the proposed scheme (Darroch Cottage, The Sheiling, Laurelbank, Garry View, Old School House and Hillside) and
  - Two NSR on the B8079 to the north of the proposed scheme (Carnliath and Corrie House).
- 17.6.5 As previously stated in Paragraph 17.5.17 and 17.5.18 the exceedances of the noise mitigation criteria are predicted to occur in the short-term only and are being caused by traffic flow changes on the Ford Road and the B8079 side roads. At these properties there is either no space for noise mitigation or it would be ineffective due to the gaps required to accommodate driveways. Accordingly, no further mitigation is proposed at these properties.

*Do-Minimum Scenario in the Baseline Year vs. Do-Something Scenario in the Future Assessment Year (Long-Term Assessment)*

- 17.6.6 The daytime noise levels at ground floor level in the long-term assessment indicate that there are no NSR which are predicted to experience a significant residual noise impact.
- 17.6.7 The long-term night-time assessment indicates that at both the ground and first floor levels no NSR is predicted to have a significant residual noise impact.

**17.7 Statement of Significance**

- 17.7.1 With the proposed scheme in place, and taking into account mitigation measures as described in Section 17.5 (Mitigation) there are a total of ten NSR in the short-term assessment, at ground floor level which are considered to have a significant residual noise impact, when considering the least beneficial change in noise level. However, when considering all receptor points around the NSRs there is a total of 12 NSR which are considered to have a significant residual impact.
- 17.7.2 These NSR and associated noise levels and significance of residual impact are presented in Table 17.35. As has been previously stated, the reason for a significant impact being identified for these NSR is due to road traffic flow changes on the side roads.

**Table 17.35: NSR with a Significant Effect after Mitigation**

NSR ID	NSR Name	Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) and Significance of Impact		
		Ground Floor		
		DM 2026	DS 2026	Significance of Impact
R5.013	The Health Clinic	59.6	60.6	<b>Slight/Moderate</b> Adverse
R5.084	Hillside	63.6	64.9	<b>Slight/Moderate</b> Adverse
R5.089	Oakwood House*	58.4	60.0	<b>Slight/Moderate</b> Adverse
R5.103	Darroch Cottage	59.6	60.6	<b>Slight/Moderate</b> Adverse
R5.104	The Shieling	62.5	63.6	<b>Slight/Moderate</b> Adverse
R5.106	Laurelbank	62.9	64.0	<b>Slight/Moderate</b> Adverse
R5.107	Garry View	62.8	63.9	<b>Slight/Moderate</b> Adverse
R5.108	Old School House	64.3	65.4	<b>Slight/Moderate</b> Adverse
R5.115	Corrie House	65.5	68.0	<b>Slight/Moderate</b> Adverse
R5.118	Lude East Lodge*	63.1	65.4	<b>Slight/Moderate</b> Adverse
R5.119	Carnliath	65.2	67.1	<b>Slight/Moderate</b> Adverse
R5.131	7 Blair Cottages	59.6	60.6	<b>Slight/Moderate</b> Adverse

\* These NSR are considered to have a significant impact when considering all receptor points around the NSR. However, when considering the least beneficial change in noise level they would not be considered significant. The least beneficial change in noise levels at these NSR are presented in Appendix A17.3 (Predicted Noise Levels at Receptors).

17.7.3 There are no other impacts considered to be significant in the context of the EIA Regulations.

## 17.8 References

- Abbot, P G and Nelson, P M. (2002). Converting the UK Traffic Noise Index LA10,18h to EU Noise Indices for Noise Mapping. Transport Research Laboratory (TRL)
- Baughan, C J and Martin, D J. (1981). TRRL Report LR 1020 - Vibration Nuisance from Road Traffic at Fourteen Residential Sites. Cited in Design Manual for Roads and Bridges (DMRB). Crowthorne, Transport and Road Research Laboratory
- British Standards Institution (2014). BS 5228:2009+A1:2004 'Code of practice for noise and vibration control on construction and open sites – Part 1 Noise'. London: BSI
- British Standards Institution (2014). BS 5228:2009+A1:2004 'Code of practice for noise and vibration control on construction and open sites – Part 2 Vibration'. London: BSI
- Highways Agency, Transport Scotland, Welsh Government and The Department for Regional Development Northern Ireland (2011)/Design Manual for Roads and Bridges (DMRB 2011) Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques Part 7 HD 213/11 – Revision 1 Noise and Vibration.
- HMSO (1974) Control of Pollution Act 1975. London: HMSO.
- HMSO (1975a). The Noise Insulation (Scotland) Regulations (NISR). London: HMSO
- HMSO (1975b). Memorandum on the Noise Insulation (Scotland) Regulations (Memorandum). London: HMSO
- HMSO (2006). The Environmental Noise (Scotland) Regulations. London: HMSO
- The Department of Transport (1988). Calculation of Road Traffic Noise. London: HMSO.
- The Department of Transport (2014/2015) Transport Analysis Guidance (TAG) Unit A3 Environmental Impact Appraisal. London: HMSO
- The Scottish Government. (2011a). PAN 1/2011 Planning Advice Note – Planning and Noise.

Edinburgh: The Scottish Government.

The Scottish Government. (2011b). TAN: Technical Advice Note – Assessment of Noise. Edinburgh: The Scottish Government.

Watts, G R. (1984). TRRL Report LR 1119 - Vibration Nuisance from Road Traffic – Results of a 50 Site Survey. Crowthorne: Transport and Roads Research Laboratory.

Watts, G R (1990). TRRL Report 246 – Traffic Induced Vibrations in Buildings. Crowthorne: Transport and Roads Research Laboratory

World Health Organization (1999). Guidelines for Community Noise. Geneva: World Health Organization

World Health Organization (2009). Night Noise Guidelines for Europe. Geneva: World Health Organization