# 17. Noise and Vibration

## 17.1. Introduction

17.1.1. The proposed dualling and junction improvements change the carriageway alignment and physical arrangement of the road network, and will alter vehicle flow characteristics. The scheme will cause changes in noise and vibration at sensitive receptors, this chapter considers the temporary impacts during construction and permanent impacts during operation.

17.1.2. The operation phase assessment considers the permanent impacts of the scheme and is based on the detailed assessment methodology of the Design Manual for Roads and Bridges Volume 11 Section 3 Part 7 HD 213/11 Revision 1[i] (HD 213/11).

17.1.3. The construction phase assessment considers the temporary impacts of the scheme and is primarily based on the guidance detailed in BS 5228-1[ii] and BS 5228-2[iii]. Further guidance has been taken from applicable local and national guidance documents.

17.1.4. The assessment builds upon the Strategic Environmental Assessment[iv] and the Stage 2 Environmental Assessment, and includes the following:

- Baseline conditions in the study area;
- Potential temporary and permanent, noise and vibration impacts from the Proposed Scheme;
- Rock blasting in the Slochd area;
- Due to the program length the rock cut works are treated the same as operational open quarry workings, therefore, guidance covering surface mineral workings has been considered in this assessment.
- Proposed mitigation during construction and operation.

17.1.5. This report is necessarily technical in nature, to assist the reader, a glossary of acoustic terminology is provided in Appendix 17.1.

### Study Area

#### *Operation Phase Noise*

17.1.6. The study area has been determined using the guidance contained within paragraph A1.11 of HD 213/11.

17.1.7. The noise study area requires calculations of noise impacts within 600 m of the Proposed Scheme, and within 600 m of any other affected routes within 1 km of the scheme. The scheme includes all new and improved routes; but does not contain bypassed routes.

17.1.8. HD 213/11 requires consideration of sensitive receptors beyond the area defined above. The wider road network will be assessed separately covering all schemes, from Perth to Inverness.

17.1.9. The operation phase noise study area for the Proposed Scheme is shown in Figure 17.1.

17.1.10. The study area is constrained by the start and end points of the Proposed Scheme and to the extent of the traffic model on the local road network.

17.1.11. Paragraph A1.11 of HD 213/11 details the methodology by which the affected routes are identified. An affected route is one where it is predicted to experience a change in noise of 1 dB(A) or more in the short-term (i.e. in the first full year of operation), or 3 dB(A) or more in the long-term (i.e. in the future assessment year).

#### *Operation Phase Vibration*

17.1.12. A vibration study area has been determined following the guidance contained within paragraph A1.35 of HD 213/11.

17.1.13. HD 213/11 requires calculations of vibration nuisance for all dwellings within 40 m of roads within the noise study area.

#### *Construction Phase Noise and Vibration*

17.1.14. The assessment of construction noise and vibration is based on calculating construction noise levels at sample receptors. Eighteen sample noise sensitive receptors have been selected based on the noise monitoring locations. The receptors are located at properties close to the A9 alignment and are spread over the length of the scheme. The assessment is considered indicative of the likely worst-case noise and vibration levels during the works.

## 17.2. Approach and Methods

### Assessment Methods

#### *Operational Noise*

The Design Manual for Road and Bridges, Volume 11, Section 3, Part 7, HD 213/11 - Revision 1, Noise and Vibration

17.2.1. The assessment of operational noise and vibration has broadly followed the HD 213/11 Detailed Assessment methodology. This document sets out procedures for undertaking the environmental assessment of new road schemes, including the assessment of noise impacts from road traffic. Where the adopted methodology deviates from HD 213/11 this has been identified.

17.2.2. In addition to HD 213/11 the assessment has followed established prediction and assessment methodologies that are governed or guided by the following key documents:

- Calculation of Road Traffic Noise (CRTN) 1988[v];
- Design Manual for Roads and Bridges HA205/08, Assessment and Management of Environmental Effects[vi]; and
- Technical Advice Note: Assessment of Noise[vii].

17.2.3. Cumulative effects are considered in Chapter 20.

17.2.4. The assessment examines the noise and vibration impacts with and without the Proposed Scheme in place, referred to as the Do-Something and Do-Minimum scenarios respectively.

17.2.5. The assessment considers impacts in the short and long-term. The short-term assessment is completed in the first full year of operation, 2026. The assessment considers the long-term, termed the future assessment year, and is the year between first full year of operation and the 15th year, where the highest impact would be expected to occur, which is 2041.

17.2.6. HD 213/11 requires that noise predictions are made for all identified sensitive receptors within the study area for the following scenarios:

- Do-Minimum scenario in the first full year of operation;
- Do-Minimum scenario in the future assessment year;
- Do-Something scenario in the first full year of operation; and
- Do-Something scenario in the future assessment year.

17.2.7. Permanent traffic noise impacts are assessed for the following scenarios:

- Do-Minimum scenario in the first full year of operation against Do-Minimum scenario in the future assessment year (long-term Do-Minimum);
- Do-Minimum scenario in the first full year of operation against Do-Something scenario in the first full year of operation (short-term scheme impacts);
- Do-Minimum scenario in the first full year of operation against Do-Something scenario in the future assessment year (long-term scheme impacts).

17.2.8. Night time impacts are considered in the long-term only, for dwelling receptors in the study area, where night time levels exceed the interim target value of 55 dB $L_{night,outside}$, defined in the WHO Night Noise Guidelines[viii] for Europe, published in 2009 and given in Table 17.1.

**Table 17.1: WHO Recommended Night Noise Guidelines Values**

| Target | $L_{night,outside}$ dB * |
|---|---|
| Interim target | 55 |
| Night noise guideline | 40 |

* The A-weighted long-term continuous equivalent free-field sound level as defined in ISO 1996-2:1987, determined over all the night periods of a year; in which the night is eight hours (23:00 - 07:00 hours).

17.2.9. Noise nuisance impacts are assessed for all dwellings in the study area. The highest nuisance experienced during the first 15 years after opening will normally be that in the 15th year, due to the growth in traffic flows.

17.2.10. Vibration nuisance impacts are assessed for all dwellings within 40 m of roads where noise levels predictions have been undertaken. The vibration assessment consists of two long-term comparisons, Do-Minimum scenario in the first full year of operation year against Do-Minimum scenario in the future assessment year; and Do-Minimum scenario in the first full year of operation against Do-Something in the future assessment year.

17.2.11. The least beneficial change (i.e. smallest decrease or largest increase) is reported for each sensitive receptor.

17.2.12. CRTN is the accepted method for the prediction of traffic noise in the UK and is uses Annual Average Weekday Traffic (AAWT) data. Noise levels are calculated in terms of the $L_{A10,18h}$ index. This represents the average of the 18 hourly values of the A-weighted noise level exceeded for 10% of the time over each hour between the hours of 06:00 and 00:00.

17.2.13. Noise levels in the study area have been predicted using commercially available software, NoiseMap Five, which applies all the calculation procedures detailed in CRTN and the additional calculation advice from HD 213/11.

17.2.14. In addition to traffic flow information, the traffic noise calculations are determined from digital mapping data detailing topographical and landscaping information including man-made features; positions of noise sensitive buildings; type of ground cover; and type of road surface used.

### *Construction Noise and Vibration*

17.2.15. The primary methodology for the noise and vibration impacts associated with the construction of the scheme have been assessed based on the guidance given BS 5228-1 and BS 5228-2.

17.2.16. Additional local and national guidance documents, and other British Standards have been used to inform the construction assessment, in particular, the assessment of the major rock cut areas at Slochd which require rock blasting. Relevant information from these documents is summarised below.

BS 5228:2009+A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites. Noise

17.2.17. BS 5228-1 sets out techniques to predict the likely noise impacts from construction and open site works, based on detailed information on the type and number of plant being used, their location and the length of time they are in operation.

17.2.18. The noise prediction method is used to establish likely noise levels in terms of the $L_{Aeq,T}$ over the core working day.

17.2.19. This standard contains a database of information, including measured sound pressure level data for a variety of different plant undertaking common activities.

17.2.20. Example criteria are presented for the assessment of the significance of noise impacts from construction and open sites.

17.2.21. The standard provides methods for determining the significance of construction noise levels considering the change in the existing noise level brought about by the construction work. This assessment is based on the ABC method.

17.2.22. The ABC Method is based upon threshold noise levels determined for both time of day and existing ambient noise level. The method requires the ambient pre-construction noise level to be measured and rounded to the nearest 5 dB. This ambient noise level is then compared to the construction noise level. If the construction noise level exceeds the appropriate category value then a potential significant impact is indicated. The assessment shall consider number of receptors affected, duration and character of noise; to determine significance. The ABC method is presented in Table 17.2 below.

**Table 17.2: Threshold of Potential Significant Construction Noise Impacts at Dwellings**

| Assessment Category and Threshold Value Period | Threshold Value, in Decibels (dB) ($L_{Aeq,T}$) | | |
|---|---|---|---|
| | Category A[A)] | Category B[B)] | Category C[C)] |
| Night-time (23.00-07.00) | 45 | 50 | 55 |

| Assessment Category and Threshold Value Period | Threshold Value, in Decibels (dB) ($L_{Aeq,T}$) | | |
|---|---|---|---|
| | Category A[A)] | Category B[B)] | Category C[C)] |
| Evenings (19.00-23.00) and weekends | 55 | 60 | 65 |
| Daytime (07.00-19.00) and Saturdays (07.00-13.00) | 65 | 70 | 75 |
| *NOTE 1 - A potential significant impact is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.*<br>*NOTE 2 - If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant impact is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.*<br>*NOTE 3 - Applied to residential receptors only.* | | | |
| [A)] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.<br>[B)] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.<br>[C)] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values. | | | |

Table Source: BS 5228-1 Table E.1

17.2.23. BS 5228-1 also states that in public open space, designated areas and pathways, the impact might be deemed to be significant if the total noise exceeds the ambient noise ($L_{Aeq,T}$) by 5 dB or more for a period of one month or more. However, the extent of the area impacted relative to the total available area also needs to be considered in determining whether the impact is significant.

17.2.24. It is not proposed to assess the construction noise impacts in public open spaces due to their transient use, the temporary nature of construction works, localised impact and the availability of alternative space.

<u>BS 5228:2009+A1:2014: Noise and Vibration Control on Construction and Open Sites. Vibration</u>

17.2.25. BS 5228-2 provides recommendations for basic methods of vibration control relating to construction and open sites. The legislative background to vibration control is described and guidance is provided concerning methods of measuring vibration and assessing its impacts on the environment.

17.2.26. BS 5228-2 presents guidance on the significance of vibration impacts in terms of human response, these are presented in Table 17.3. For assessment of construction vibration levels are given in terms of the Peak Particle Velocity (PPV).

**Table 17.3: Guidance on Impacts of Vibration Levels Perceptible to Humans**

| Vibration Level (PPV) | Impact |
|---|---|
| 0.14 mm/s | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration |
| 0.3 mm/s | Vibration might be just perceptible in residential environments |
| 1.0 mm/s | It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents |

| Vibration Level (PPV) | Impact |
|---|---|
| 10 mm/s | Vibration is likely to be intolerable for any more than a very brief exposure to this level |

Table Source: BS 5228-2 Table B.1

17.2.27. BS 5228-2 presents guidance on the significance of vibration impacts in terms of structural response, these are presented in Table 17.4 below.

**Table 17.4: Guidance on Impacts of Vibration Levels on Building Structures**

| Building Type | Peak Component Particle Velocity in Frequency Range of Predominant Pulse | |
|---|---|---|
| | 4 Hz to 15 Hz | 15 Hz and above |
| Reinforced or framed structures<br>Industrial and heavy commercial buildings | 50 mm/s at 4 Hz and above | 50 mm/s at 4 Hz and above |
| Unreinforced or light framed structures<br>Residential or light commercial buildings | 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |
| NOTE 1: Values referred to are at the base of the building.<br>NOTE 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded. | | |

Table Source: BS 5228-2 Table B.2

17.2.28. It should be noted that the values presented in Table 17.4 are applicable to cosmetic damage only. It is stated within BS 5228-2 that minor structural damage is possible at magnitudes which are greater than twice those given in Table 17.4.

17.2.29. It is not proposed to assess the construction vibration impacts in public open spaces due to their transient use, the temporary nature of construction works, localised impact and the availability of alternative spaces.

17.2.30. A calculation method for vibration levels resulting from blasting at different distances is presented. The method presented is based on analysis of the results of vibration measurements undertaken at the site in question. This method therefore relies upon a degree of blasting works being undertaken at the site, before accurate distance calculations can be undertaken. Once completed, the calculation method allows the resultant PPV vibration level to be determined at different distances for known charge weights.

17.2.31. Guidance is given regarding air overpressures resulting from blasting works. The majority of energy generated within the atmosphere from surface blasting is of a sub-audible nature (i.e. at frequencies below 20 Hz), although there is a component that is audible to the human ear and as such would be heard as noise. Audible noise and the sub-audible element (sensed as concussion) are together known as air overpressure.

17.2.32. Air overpressure may be sensed or felt by humans and can excite secondary vibrations at audible frequencies in buildings (e.g. rattling of windows and ornaments on shelves) that have been found to give rise to adverse comments from occupants of buildings affected by the blasting. However, the standard states that there is no known evidence

of structural damage to buildings/structures from excessive air overpressure levels from quarry blasting. It is stated that "*routine blasting can regularly generate air overpressure levels at adjacent premises of around 120 dB (lin). This level corresponds to an excess air pressure which is equivalent to that of a steady wind velocity of 5 m/s (Beaufort force 3, gentle breeze) and is likely to be above the threshold of perception*." Research is referenced that has identified that a poorly mounted window that is pre-stressed might crack at 150 dB (lin), with most windows cracking at around 170 dB (lin), whereas structural damage would not be expected at levels below 180 dB (lin).

17.2.33. It is stated that due to uncertainties with meteorological conditions, it is not possible to predict the location of maximum air overpressure, but a methodology for air overpressure measurement is presented within this standard, whilst it is stated that pressure variations in the atmosphere due to windy conditions can mask the blast generated air overpressure, and that for this reason, air overpressure prediction is not accepted practice.

## Legislation, Planning Policy and Other Guidance

17.2.34. Chapter 19 Policies and Plans provides an assessment of potential impacts associated with the Proposed Scheme in terms of the wider national and local planning policy.

### *The Noise Insulation (Scotland) Regulations 1975*

17.2.35. A key piece of legislation relating to noise and the operation of new or altered roads in Scotland is the Noise Insulation (Scotland) Regulations[ix] (the Regulations). A summary of the Regulations is presented below.

17.2.36. Under the circumstances specified in the Regulations, residential properties may qualify for an offer of noise insulation if:

- the use of any road causes, or is expected to cause, noise at a level not less than 68 dB $L_{A10,18h}$ at a position 1 m in front of a qualifying facade; and
- if the $L_{A10,18h}$ noise level at the property would experience noise levels exceeding the 'prevailing noise level' by at least 1 dB(A).

17.2.37. Noise levels should be calculated in accordance with the method given in the Memorandum of Advice and Instruction[x].

17.2.38. The relevant authority has a duty under the Regulations to offer insulation for residential properties with respect to a new road, or a road for which a new carriageway is proposed; and discretionary powers in relation to otherwise altered roads. The authority also has discretionary power to offer insulation against construction noise. The Regulations apply to living rooms or bedrooms having a qualifying door or qualifying window in an eligible building.

17.2.39. Some residential buildings are not eligible under the Regulations. These include any buildings liable to be acquired compulsorily or subject to a demolition order, and buildings first occupied after the "relevant date"; this being the date a new road was first opened to public traffic or an altered road was opened following completion of the alteration.

17.2.40. Furthermore, the following conditions are set out within the Memorandum of Advice and Instruction for testing the eligibility of a building. The building shall not be:

- more than 300 m from the nearest point on the carriageway of the new or altered road; or

- positioned such that there is no point on it from which a straight line can be drawn to a point on the new or altered road without passing through another building; or
- positioned such that it lies outside the triangular area at the terminal point of a new or altered road, the apexes of which are 50 m along the centre line of the existing road from the terminal points and the bases of which extend from points 300 m on either side of the road to the nearest point on the carriageway at right angles to the centre line of the carriageway.

### *Highland-wide Local Development Plan*[xi]

17.2.41. This document, published in 2012, outlines how The Highland Council will guide development and investment. Policy 72 - Pollution states:

- proposals that may result in significant pollution such as noise (including aircraft noise), air, water and light will only be approved where a detailed assessment report on the levels, character and transmission and receiving environment of the potential pollution is provided by the applicant to show how the pollution can be appropriately avoided and if necessary mitigated.
- where the Council applies conditions to any permission to deal with pollution matters these may include subsequent independent monitoring of pollution levels.
- Major Developments and developments that are subject of Environmental Impact Assessment will be expected to follow a robust project environmental management process, following the approach set out in the Council's Guidance Note 'Construction Environmental Management Process for Large Scale Projects' or a similar approach."

### *Planning Advice Note 1/2011: Planning and Noise*[xii]

17.2.42. This Planning Advice Note (PAN), published in 2011, sets out the policies of the Scottish Government on noise related planning issues. It provides guidance to Local Authorities in Scotland on the use of their planning powers to minimise the adverse impact of noise. Specifically, it:

- promotes the principles of good acoustic design and a sensitive approach to the location of new development;
- promotes the appropriate location of new potentially noisy development;
- promotes a pragmatic approach to the location of new development within the vicinity of existing noise generating uses;
- ensures that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.

17.2.43. The document provides advice on the role of the planning system in helping to prevent and limit the adverse impacts of noise. Information and advice on noise impact assessment methods is provided in the associated Technical Advice Note (TAN) Assessment of Noise. It includes details of the legislation, technical standards and codes of practice for specific noise issues.

Technical Advice Note: Assessment of Noise

17.2.44. This Technical Advice Note (TAN), published in 2011, provides guidance which may assist in the technical evaluation of noise assessment, and was prepared as a guide for noise professionals both in the public and private sectors.

17.2.45. In the TAN, reference is made to BS 5228 and PAN 50 with regards to noise from mineral workings, these are summarised below.

### *Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings*[xiii]

17.2.46. In PAN 50, paragraphs 39 to 42 identify the potential adverse impacts of noise which can arise beyond the site boundary of the extraction site, including annoyance, masking desirable 'noises' (e.g. conversation), prevention or disturbance of sleep and disturbance to animals and birds, and goes on to reference BS 5228, stating that content of this standard can be used to predict noise levels with reasonable accuracy.

17.2.47. It is stated that noise is often identified as one of the main problems associated with surface mineral workings, although research suggests that the actual problem of noise can be less intrusive than residents expect it to be.

17.2.48. Paragraphs 33 to 38 are concerned with blasting, including vibration and air overpressure. It confirms that vibration levels generated by mineral workings are well below those required to cause structural damage to properties, but that vibration and air overpressure may give rise to nuisance. It is also confirmed that the levels of air overpressure and noise can be significantly affected by meteorological conditions.

17.2.49. It is recommended that any planning conditions pertinent to blast induced vibration should look to set acceptable vibration level limits, but that this approach would be impractical for air overpressures, due to factors outside the control of the operator (e.g. meteorological effects). It is identified that the operator will always be concerned with maximising the effectiveness of the blast, and therefore minimising lost energy through air overpressure.

17.2.50. The document also presents a summary of good practice measures that are available in the control of surface mineral working operations, including blasting works.

Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings: Annex A: The control of Noise at Surface Mineral Workings[xiv]

17.2.51. The stated aim of PAN 50: Annex A is to provide advice on how the planning system can be used to keep noise emissions from surface mineral workings within environmentally acceptable limits without imposing unreasonable burdens on mineral operators, and that it:

- recommends the use of a model for the prediction of the likely level of noise emissions from a proposed mineral development;
- recommends a method for setting noise limits for mineral sites which can be incorporated into planning conditions. The method should take account of the environmental and operational features peculiar to each mineral site and should also be straightforward to monitor;
- provides advice on how the noise levels from surface mineral sites can be most effectively monitored and on remedial steps which should be taken, to ensure that local communities are not subjected to noise emissions above acceptable levels;
- discusses several noise control practices which can be made the subject of planning conditions and/or incorporated into good practice by the mineral operator.

17.2.52. The document does not specify noise level limits, it suggests that noise limits should be set on an individual site basis, having regard to the circumstances of the potential site and its surroundings. The factors which require consideration in the determination of such limits include the sensitivity of local receptors, the proposed periods of operation, the prevailing local noise environment, and the noise levels that are likely to be generated.

17.2.53. It is recommended that noise limits should be selected as a set of 'absolute values' adopting the $L_{Aeq,1hour}$ noise index, rather than variable limits which change based on the prevailing background level.

17.2.54. Definitions of daytime and night time may depend on local circumstances, but that these should normally be 07:00 to 19:00 (daytime) and 19:00 to 07:00 (night-time), whilst noting that 08:00 hours may be more appropriate than 07:00 in some areas. It is also suggested that in most instances, evening (typically 19:00 to 22:00) and/or dawn (06:00 to 07:00/08:00) can be defined.

17.2.55. The working week should normally be defined as Monday to Friday and Saturday mornings, but that variation on this can be appropriate subject to circumstances and agreements.

17.2.56. The following general limits are specified for dwellings during the working week:

- Daytime – 55 dB(A) $L_{Aeq,1hour}$ (free-field) during any working one-hour period; and
- Night-time – 42 dB(A) $L_{Aeq,1hour}$ (free-field) during any working one-hour period.

17.2.57. It is noted that these limits can be adjusted subject to local circumstances, with the following comments made:

- a lower nominal daytime limit may be appropriate in quieter rural areas, if a 55 dB(A) limit would exceed background noise levels by more than 10 dB(A). Where this is the case, the local planning authority will need to consider how the operational noise levels would relate to the background levels and the likelihood of complaints;
- in exceptionally quiet rural areas where the daytime background noise level is below 35 dB(A), a condition limiting the operational level to 10 dB over the existing background noise level is likely to be both difficult to achieve and unduly restrictive;
- it would not normally be appropriate to require a daytime limit below 45 dB(A) $L_{Aeq,1hour}$ as such a limit should prove tolerable to most rural areas;
- in the case of night-time workings, regard should be given to the needs of local people. Discussion with Local Environmental Health Officers may be appropriate as to whether the above night-time limit is reasonable;
- in some circumstances the setting of higher nominal limits is appropriate. For example, where large amounts of overburden and above ground heavy equipment operation is required, a daytime limit within 55 to 60 dB(A) $L_{Aeq,1hour}$ will normally be justified;
- in exceptional circumstances, lower noise level limits may be appropriate if it is known that mineral operation will include equipment which will make high pitched or whining tones;
- it will often be necessary to raise noise limits to allow temporary but exceptionally noisy phases in the mineral extraction operation which cannot meet the limits set for routine operations. An example of this is the construction of baffle mounds, soil stripping and the construction of new permanent landforms; and
- adjustments to the limits are suggested depending on receptor sensitivity. The examples provided are gardens and open spaces used by the public for relaxation, for which limits of 65 dB(A) $L_{Aeq,1hour}$ during the normal working day and 55 dB(A) $L_{Aeq,1hour}$ at other times are noted as being reasonable.

17.2.58. With respect to operational noise level predictions, the document states that "the likely future noise emissions arising from the new development should be predicted and the total amount of noise which would be emitted from the site determined". It is

recommended that BS 5228, Part 1 (1984) 'Noise Control on Construction and Open Sites' should form the basis for the noise prediction model, modified to take account of particular circumstances of mineral sites. The current version of the standard is BS 5228-1:2009+A1:2014 and a summary can be found above.

17.2.59. This document states that BS 5228 recognises that noise can be reduced by barriers and that BS 5228 presents a straight forward and effective approach to calculating the effect of barriers on noise emissions. If a noise source is partly visible from a measurement point, it is assumed that the noise level at this point should be reduced by 5 dB. If the noise source is completely screened, the noise source should be reduced by 10 dB, although it is acknowledged that more detailed barrier correction methodologies can be adopted.

### *Scottish Planning Policy (SPP)*[xv]

17.2.60. Published in June 2014, minerals extraction is referenced within the Promoting Responsible Extraction of Resources section of the SPP. The SPP also cross references to the use of PAN 50 and its annexes. The mineral extraction subsection states that when deciding planning applications for extraction, planning authorities should consider, amongst other points:

17.2.61. "Disturbance and disruption from noise, blasting and vibration, and potential pollution of land, air and water" and that;

17.2.62. "Operators should provide sufficient information to enable a full assessment to be made of the likely effects of development together with proposals for appropriate control, mitigation and monitoring measures".

## Assessment of Impacts

17.2.63. The Scottish Government's TAN: Assessment of Noise provides a framework for determining the level of significance relating the magnitude of noise impacts with the sensitivity of the receptor and has been used in this assessment.

### *Value/Sensitivity*

17.2.64. The level of sensitivity associated with each type of noise sensitive receptor is defined within the TAN and is shown in Table 17.5.

**Table 17.5: Level of Sensitivity Associated with Various Examples of Sensitive Receptors**

| Sensitivity | Description | Examples of NSR |
|---|---|---|
| High | Receptors where people or operations are particularly susceptible to noise | • Residential, including private gardens<br>• Quiet outdoor areas used for recreation<br>• Conference facilities<br>• Theatres/Auditoria/Studios<br>• Schools during the daytime<br>• Hospitals/residential care homes<br>• Places of worship |
| Medium | Receptors moderately sensitive to noise, where it may cause some distraction | • Offices<br>• Bars/Cafes/Restaurants where external noise may be intrusive |

| Sensitivity | Description | Examples of NSR |
|---|---|---|
| | | • Sports grounds when spectator noise is a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls) |
| Low | Receptors where distraction or disturbance from noise is minimal | • Building not occupied during working hours<br>• Factories and working environments with existing high noise levels<br>• Sports grounds when spectator noise is a normal part of the event<br>• Night Clubs |

Table Source: TAN Table 2.1

17.2.65. The properties and locations that could potentially be affected by noise during the operation of the development have been identified.

17.2.66. The study area contains 1122 dwelling receptors and 133 other sensitive receptors.

17.2.67. A new touring caravan park, on land west of Shunem Cottage, Granish is due to open in 2018. An additional free-field receiver is included in the model, the results are included in the other sensitive receptors category.

17.2.68. The study area contains open area and pathway noise sensitive receptors, including Cairngorms National Park and Cairngorms SAC and SPA; Kinveachy Forest SAC, SPA and SSSI; Loch Vaa SPA and SSSI; River Spey SAC and SSSI; Slochd SAC; Alvie SSSI; Craigellachie SSSI and National Nature Reserve; North Rothiemurchus Pinewood SSSI; Scheduled Monuments; Public Rights of Way and Core Paths.

17.2.69. Free-field receiver points representing ecological sites have been modelled at 58 locations within the study area and are included in the other sensitive receptors category.

17.2.70. There are two consented residential developments in Aviemore, named Horse Field and Allt Mor. Where development planning is granted but construction is yet to start, these buildings are considered separately. Note, for the Horse Field development, some dwellings are complete and occupied and these buildings are included in the main assessment.

### *Magnitude of Impact*

17.2.71. As advised by the TAN, the classification of the magnitude of noise impact is in line with HD 213/11, these are presented in Table 17.6 and Table 17.7 respectively. The magnitude of impact is considered different in the short-term and long-term.

17.2.72. HD 213/11 states that a change in road traffic noise of 1 dB $L_{A10,18h}$ in the short-term (i.e. on scheme opening) is the smallest that is considered perceptible. In the long-term (typically 15 years after project opening), a 3 dB $L_{A10,18h}$ change is considered perceptible.

**Table 17.6: Classification of Magnitude of Noise Impacts in the Short-Term**

| Noise change, $L_{A10,18h}$ | Magnitude of impact |
|---|---|
| 0.0 | No change |
| 0.1 – 0.9 | Negligible |

| Noise change, $L_{A10,18h}$ | Magnitude of impact |
|---|---|
| 1.0 – 2.9 | Minor |
| 3.0 – 4.9 | Moderate |
| 5.0+ | Major |

Table Source: HD 213/11 Table 3.1

**Table 17.7: Classification Magnitude of Noise Impacts in the Long-Term**

| Noise change, $L_{A10,18h}$ | 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 |

Table Source: HD 213/11 Table 3.2

### *Impact Significance Criteria*

17.2.73. The framework for determining the level of significance relating the magnitude of the impact with the sensitivity of the receptor is defined within the TAN and is shown in Table 17.8.

**Table 17.8: Significance of Impacts**

| Magnitude of Impact | Level of Significance Relative to Sensitivity of Receptor | | |
|---|---|---|---|
| | Low | Medium | High |
| Major | Slight/Moderate | Moderate/Large | Large/Very Large |
| Moderate | Slight | Moderate | Moderate/Large |
| Minor | Neutral/Slight | Slight | Slight/Moderate |
| Negligible | Neutral/Slight | Neutral/Slight | Slight |
| No Change | Neutral | Neutral | Neutral |

Table Source: TAN Table 2.6

17.2.74. The level of significance and its relevance to the decision-making process is detailed in the TAN, as follows:

- Very Large: these impacts represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.
- Large: these impacts are likely to be important considerations in the decision-making process, but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.
- Moderate: these impacts, if adverse, while important, are not likely to be key factors in the decision-making process.
- Slight: these impacts may be raised but are unlikely to be of importance in the decision-making process.

- Neutral: No impact, not significant, noise need not be considered as a determining factor in the decision-making process.

### *Threshold for Noise Mitigation*

17.2.75. Under HD 213/11, adverse noise impacts above the threshold values should be mitigated if possible. In this assessment the threshold for consideration of mitigation takes into account the magnitude of impact and the community response to the noise.

17.2.76. Community response to noise is described in the World Health Organisation (WHO) Guidelines for Community Noise[xvi]. Two different guidelines are given:

- To protect the majority of people from being 'seriously annoyed' during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB $L_{Aeq,16h}$ 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 50 dB $L_{Aeq,16h}$.

17.2.77. To use these values for this assessment, it is necessary to convert the daytime $L_{Aeq,16h}$ index into the $L_{A10,18h}$ index calculated for the assessment. There are two factors to consider:

- The index is different – the commonly used method of transposing from an $L_{Aeq,16h}$ to an $L_{A10,18h}$ is to add 2 dB. This factor is taken from the DfT Transport Analysis Guidance, unit A3[xvii].
- The WHO guidelines refer to noise levels in free-field positions whereas the road traffic assessment uses levels assessed 1 m from the property façade. Calculation of Road Traffic noise advises that façade noise levels are 2.5 dB higher than free-field levels.

17.2.78. Therefore, the WHO guidelines can be re-stated in terms of the façade $L_{A10,18h}$ levels reported by the noise assessment:

- To protect the majority of people from being 'seriously annoyed' during the daytime, the outdoor sound level from steady, continuous noise should not exceed 59.5 dB $L_{A10,18h}$ 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 54.5 dB $L_{A10,18h}$.

17.2.79. Mitigation is considered where both magnitude of impact exceeds adverse negligible and the noise level is above the WHO threshold for serious annoyance, as detailed in Table 17.9.

**Table 17.9: Threshold for Mitigation**

| Timeframe | Magnitude of impact threshold | Noise level threshold $L_{A10, 18h}$ |
|---|---|---|
| Short-Term | 1 dB(A) | 59.5 dB |
| Long-term | 3 dB(A) | 59.5 dB |

17.2.80. Impacts below these thresholds are not considered to be significant and mitigation is therefore not investigated or proposed.

## Data Sources, Limitations and Assumptions

17.2.81. The following data sources have been used:

- Ordnance Survey (OS) MasterMap;
- OS AddressBase Plus;
- OS Digital Terrain Model (DTM) 5 m resolution;
- Three-dimensional topographical survey data for details of cuttings, embankments and existing and proposed road heights;
- Type of intervening ground between each road segment and each receiver;
- Annual average weekday traffic flow (AAWT);
- Percentage of heavy duty vehicles (HDV);
- Average traffic speed; and,
- Nature of the road surface.

17.2.82. Annual average weekday traffic data have been provided for the modelled first full year of operation (2026) and future assessment year (2041) for the Do-Minimum scenario and Do-Something scenarios. The accuracy of the noise predictions performed is directly related to the accuracy of the data provided. It is considered that all data inputs for this assessment are of an adequate level to support a Detailed Assessment as defined in HD 213/11.

17.2.83. In the scheme corridor, the Do-Minimum ground contours are taken from an OS dataset (5 m resolution); the Do-Something ground contours are taken from the Proposed Scheme 3D engineering drawings. Beyond the scheme corridor the OS dataset is used in both the Do-Minimum and Do-Something scenarios. A buffer is used between datasets to ensure any height differences that may exist have a smooth transition.

17.2.84. Building footprint data taken from OS MasterMap is cross-referenced with OS AddressBase Plus to identify sensitive receptors. Several instances were found where either building footprints do not contain address point data, or where address point data does not sit within a building footprint. Additional sensitive building receptors in Aviemore have been inserted into the model following a review of OS data, satellite imagery and local information.

17.2.85. All buildings are given a height of 8 m; equivalent to the height of a typical two storey building. The exception to this are the MacDonald Highlands Hotel buildings, the building height is based on the number of storeys, as taken from site photos.

17.2.86. Buildings with a total area less than 25 $m^2$ are deemed to be small buildings, for example, sheds, garages and lockups. These small buildings are not included in the noise model.

17.2.87. Façade noise levels are calculated for buildings at a height of 1.5 m and 4.0 m above ground. For MacDonald Highlands Hotel buildings with three or more storeys, the façade noise level is also calculated at each additional building storey. The receivers are calculated at +2.5 m for each additional storey, e.g. three storey building, façade receivers are calculated at 1.5 m; 4.0 m and 6.5 m.

17.2.88. Free-field noise levels are calculated for ecological sites at a height of 1.5 m above ground.

17.2.89. The night-time noise levels have been derived using Method 3 of the TRL report[xviii].

17.2.90. The A9 carriageway and junction road surfaces are modelled as follows:

- DM2026 – Standard Hot Rolled Asphalt (HRA) with a texture depth 2 mm;
- DM2041 – Low Noise Road Surface (LNRS);
- DS2026 – LNRS; and
- DS2041 – LNRS.

17.2.91. The existing road surface is a patchwork of many types of surface, for consistency across the A9 Dualling Programme the existing road network is assumed to be HRA.

17.2.92. The exception to the above are the dualled sections of the A9 Kincraig to Dalraddy in the DM scenarios which are modelled as LNRS.

17.2.93. For LNRS a correction of -3.5 dB(A) is applied, as compared against HRA, where the mean average speed is ≥75 km/h.

17.2.94. All local roads are modelled as Standard HRA in both the Do-Minimum and Do-Something scenarios.

17.2.95. CRTN states that calculations of noise level for traffic flows below 1,000 vehicles (18-hour AAWT) are unreliable. Road links in the traffic model below 1,000 vehicles are excluded from the model.

17.2.96. The modelled traffic data was screened and no instances were found where link flows were greater than 1000 vehicles in one scenario and less than 1000 vehicles in another.

17.2.97. Soft ground is assumed between road and receptors.

17.2.98. All receptors are identified as high sensitivity.

## 17.3. Baseline Conditions

17.3.1. The baseline conditions are defined as the situation expected to exist just before the Proposed Scheme opens, this is in the absence of any noise from construction operations. Baseline traffic noise levels have been predicted using the Do-Minimum scenario in the first full year of operation.

17.3.2. A noise measurement survey has also been undertaken to gather information about the existing noise sources and noise levels in the study area. A noise survey is useful to identify the non-road related noise sources which are not accounted for in the noise modelling; such as aircraft, industrial/commercial and other human activities.

17.3.3. The existing A9 between Dalraddy and Slochd is a single carriageway section running in a predominantly south to north direction for approximately 25 km. The Highland Mainline (HML) railway also runs through the area, broadly following the alignment of the A9, with stations located in Aviemore and Carrbridge.

17.3.4. The study area includes the town of Aviemore and the village of Carrbridge, away from these settlements the area is largely rural and sparsely populated.

17.3.5. The study area runs through part of the Cairngorms National Park, as well as several other designated areas.

17.3.6. No Candidate Noise Management Areas (CNMA) have been proposed within the study area.

## Noise Measurement Survey

17.3.7. Noise measurements have been completed along the A9 between Dalraddy and Slochd. This has revealed a relatively stable noise environment in the vicinity, dominated by traffic noise but with other sources influencing measured levels, such as military aircraft training manoeuvres.

17.3.8. Noise measurements were undertaken at eighteen locations between 29 October 2014 and 11 November 2014. The locations are representative of noise sensitive receptors along the A9 between Dalraddy and Slochd. Surveys were either unattended 24-hour or attended 3-hour measurements. The attended measurements were based on the shortened procedure given in CRTN.

17.3.9. Consultation was undertaken with the Environmental Health Officer for The Highland Council to agree the noise survey locations.

17.3.10. During all attended measurements, the A9 was freely flowing. For the unattended surveys this cannot be verified, but on setup and collection it was noted that the A9 was freely flowing. It was noted that average speed cameras were installed and understood to be operating during all measurements.

17.3.11. Full details of the noise survey are contained in Northern Scheme Baseline Noise Measurement Report[xix].

17.3.12. Long-term measurements were completed over a 24-hour period. Measurements of this kind allow for averaging over a longer period as well as obtaining levels for night time noise. The $L_{A10,18h}$ is the arithmetic mean of the dB(A) noise levels exceeded for 10% of the time in each of the eighteen, one-hour periods between 06:00 and 00:00.

17.3.13. Short-term measurements were completed over three consecutive hours between 10:00 and 17:00. The $L_{A10}$ measurements are arithmetically averaged for each location, then 1 dB is subtracted to give an estimated $L_{A10,18h}$. This method is in line with the CRTN procedure and is applied to the three-hour measurements in Table 17.12.

### *Measurement Locations*

17.3.14. Table 17.10 details each monitoring position and gives the location in British National Grid (BNG) X/Y coordinates. The monitoring locations are mapped in Figure 17.2.

**Table 17.10: Noise Monitoring Locations**

| Receptor ID | Receptor address | X | Y |
|---|---|---|---|
| 1 | Druim-Mhor, Loch Alvie, PH22 1QB | 287158 | 810198 |
| 2 | Lywilg Farm House, Kinakyle, PH22 1PZ | 287935 | 810424 |
| 3 | Lywilg, Kinakyle, PH22 1PZ | 288141 | 810682 |
| 4 | Upper Kinakyle, Aviemore, PH22 1PZ | 289029 | 811047 |
| 5 | Kinmundy, Kinakyle, Aviemore, PH22 1PZ | 289121 | 811491 |
| 6 | High Range House, Grampian Road, Aviemore | 289176 | 811603 |
| 7 | Aviemore Highland Resort, Aviemore, PH22 1PM | 289287 | 811947 |
| 8 | Iona, Morlich Place, Aviemore, PH22 1TH | 289409 | 813360 |
| 9 | Adj. to Lochnagar Lodge, High Burnside, Aviemore | 289349 | 814122 |
| 10 | Scottish Natural Heritage, Achantoul, Aviemore, PH22 1QD | 289668 | 814295 |

| Receptor ID | Receptor address | X | Y |
|---|---|---|---|
| 11 | Birch Cottage, Avielochan, Aviemore, PH21 1QD | 290349 | 816543 |
| 12 | The Knoll, Kinveachy, Boat of Garten, PH24 3BT | 291158 | 818331 |
| 13 | Keepers Cottage, Kinveachy, Boat of Garten, PH24 3BT | 291007 | 818840 |
| 14 | Dunelm Cottage, Station Road, Carrbridge | 289654 | 822473 |
| 15 | Dalrachney Beag, Carrbridge, PH23 3AX | 289221 | 822646 |
| 16 | Holiday Property, Carrbridge, PH23 3AX | 289671 | 822891 |
| 17 | Slochd Mhor Lodge, Carrbridge, PH23 3AY | 284776 | 823825 |
| 18 | Rynaclarsach, Slochd, Carrbridge PH23 3AY | 284514 | 824209 |

17.3.15. Table 17.11 summarises the measured noise levels at each location. Short-term measurements have a duration of 3 hours, long-term measurements have a duration of 24 hours.

**Table 17.11: Summary of Measured Noise Levels**

| Receptor ID | Receptor name | Duration | $L_{Aeq,T}$ Day* | $L_{A10,T}$ Day* | $L_{Aeq,T}$ Night** | $L_{A10,T}$ Night** |
|---|---|---|---|---|---|---|
| 1 | Druim-Mhor | 3 Hr | 49.0 | 53.3 | - | - |
| 2 | Lywilg Farm House | 3 Hr | 60.8 | 65.7 | - | - |
| 3 | Lywilg, Kinakyle | 3 Hr | 51.8 | 55.5 | - | - |
| 4 | Upper Kinakyle | 24 Hr | 60.6 | 62.1 | 52.4 | 53.5 |
| 5 | Kinmundy, Kinakyle | 3 Hr | 62.9 | 68.1 | - | - |
| 6 | High Range House | 3 Hr | 63.0 | 67.3 | - | - |
| 7 | Aviemore Resort | 24 Hr | 56.4 | 59.4 | 52.1 | 55.8 |
| 8 | Iona, Morlich Place | 3 Hr | 53.5 | 55.9 | - | - |
| 9 | Lochnagar Lodge | 3 Hr | 59.2 | 63.2 | - | - |
| 10 | SNH, Achantoul | 24 Hr | 54.1 | 54.8 | 48.1 | 49.1 |
| 11 | Birch Cottage | 3 Hr | 50.1 | 53.8 | - | - |
| 12 | The Knoll | 24 Hr | 54.1 | 57.2 | 46.3 | 48.4 |
| 13 | Keepers Cottage | 3 Hr | 52.2 | 55.9 | - | - |
| 14 | Dunelm Cottage | 3 Hr | 58.3 | 62.8 | - | - |
| 15 | Dalrachney Beag | 3 Hr | 53.8 | 58.0 | - | - |
| 16 | Holiday property | 24 Hr | 50.3 | 50.8 | 49.8 | 51.0 |
| 17 | Slochd Mhor Lodge | 24 Hr | 45.3 | 46.5 | 40.7 | 42.3 |
| 18 | Rynaclarsach, Slochd | 3 Hr | 59.5 | 61.2 | - | - |

* During the day the time index, T, is 3 hours for short-term 3-hour measurements and 18 hours (06:00-00:00) for long-term 24-hour measurements

** During the night the time index, T, is 6 hours (00:00-06:00) for the long-term 24-hour measurements

17.3.16. Table 17.12 reports the measured and where required, corrected $L_{A10,18h}$ noise levels for each location.

**Table 17.12: Measured and Corrected $L_{A10,18h}$ Noise Levels**

| Receptor ID | Receptor name | Duration | Meas. $L_{A10,18h}$ | Corrected $L_{A10,18h}$ |
|---|---|---|---|---|
| 1 | Druim-Mhor | 3 Hr | 53.3 | 52.3 |
| 2 | Lywilg Farm House | 3 Hr | 65.7 | 64.7 |
| 3 | Lywilg, Kinakyle | 3 Hr | 55.5 | 54.5 |
| 4 | Upper Kinakyle | 24 Hr | 62.1 | 62.1 |
| 5 | Kinmundy, Kinakyle | 3 Hr | 68.1 | 67.1 |
| 6 | High Range House | 3 Hr | 67.3 | 66.3 |
| 7 | Aviemore Resort | 24 Hr | 59.4 | 59.4 |
| 8 | Iona, Morlich Place | 3 Hr | 55.9 | 54.9 |
| 9 | Lochnagar Lodge | 3 Hr | 63.2 | 62.2 |
| 10 | SNH, Achantoul | 24 Hr | 54.8 | 54.8 |
| 11 | Birch Cottage | 3 Hr | 53.8 | 52.8 |
| 12 | The Knoll | 24 Hr | 57.2 | 57.2 |
| 13 | Keepers Cottage | 3 Hr | 55.9 | 54.9 |
| 14 | Dunelm Cottage | 3 Hr | 62.8 | 61.8 |
| 15 | Dalrachney Beag | 3 Hr | 58.0 | 57.0 |
| 16 | Holiday property | 24 Hr | 50.8 | 50.8 |
| 17 | Slochd Mhor Lodge | 24 Hr | 46.5 | 46.5 |
| 18 | Rynaclarsach, Slochd | 3 Hr | 61.2 | 60.2 |

# 17.4. Potential Impacts

## Operational Phase Impacts

### *Operational Phase Impacts: Noise*

17.4.1. Predicted noise levels, with mitigation in place, at all sensitive receptors used in the assessment are listed in Appendix 17.2.

17.4.2. Table 17.13 below, gives the categorised short-term predicted Do-Something changes in traffic noise for dwellings and other noise sensitive receptors. The short-term Do-Something daytime noise level change contour is given in Figure 17.3.

17.4.3. A total of eight dwellings receive a perceptible (equal to or greater than 1 dB change in the short-term) increase in noise due to the scheme, this represents less than 1% of all dwellings in the study area. All eight dwellings experience a Minor perceptible increase.

17.4.4. Of the perceptible increases, six are considered significant as these dwellings experience noise levels above the 59.5 $L_{A10,18h}$ dB threshold:

- Two are located near the proposed new Aviemore South junction, Railway Cottages are adjoining semi-detached bungalows adjacent to the B9152. A combination of factors results in an overall increase in noise at this property, the Proposed Scheme moves the A9 carriageway closer to the dwelling, and there is increase in the traffic flows and vehicle speed on the A9.

- March Cottage is located to the west of the A9, south of Aviemore, approximately 30 m. A combination of factors results in an overall increase in noise at this property, the Proposed Scheme moves the A9 carriageway closer to the dwelling, and there is increase in the traffic flows and vehicle speed on the A9.
- Three dwellings are in Carrbridge, Cherry Bank and the adjoining semi-detached 7 Bogroy are adjacent to the A938 in Carrbridge, between 5 m and 8 m from the local road carriageway. The increase in noise at these dwellings is due to increases in traffic flows on the A938.

17.4.5. A total of 39 dwellings experience a perceptible decrease in noise due to the scheme, this represents 4% of all dwellings in the study area. All 39 are Minor decreases.

17.4.6. The remaining 1075 dwellings have either no change or a below perception change, this represents 96% of all dwellings in the study area.

17.4.7. Three other sensitive receptors receive a perceptible increase in noise due to the scheme.

17.4.8. Of the perceptible increases two are considered significant. The two significant increases are at designated ecological sites and are predicted to experience a Minor increase. Note, the impacts within this chapter pertain to use of the designated areas by humans. Noise impacts on flora and fauna are considered within the ecology chapter, where relevant:

- The first receptor is located south of Aviemore, to the west of the northbound A9 carriageway and is on the eastern edge of Craigellachie SSSI/NNR and within the Cairngorms National Park;
- The second receptor is located near the proposed new Aviemore South junction, adjacent to the B9152 and is on the northern edge of Alvie SSSI and within the Cairngorms National Park.

17.4.9. A total of 48 other sensitive receptor types experience a perceptible decrease in noise due to the scheme, this represents 36% of all non-dwelling sensitive receptors in the study area. Of these, 43 receive a Minor decrease, two are Moderate decreases and three are Major decreases.

17.4.10. The remaining 82 other sensitive receptors have either a below perception or no change, this represents 62% of all non-dwelling sensitive receptors in the study area.

17.4.11. Based on the short-term HD 213/11 results, an indicative assessment of dwellings that may qualify for an offer of noise insulation under the Regulations, identifies one dwelling with façade noise levels above 68 dB $L_{A10,18h}$; and equal to or greater than 1 dB(A) increase in noise level; and within 300 m of the Proposed Scheme:

- March Cottage, Grampian Road, Aviemore, PH22 1PZ.

17.4.12. The above assessment is indicative only because the methodologies of HD 213/11 and the Regulations are not the same.

**Table 17.13: Short-Term Changes in Traffic Noise**

| Change in Noise Level | | Number of Dwellings | Number of Other Sensitive Receptors |
|---|---|---|---|
| Increase in noise levels, | 0.1 – 0.9 Negligible | 234 | 22 |

| Change in Noise Level | | Number of Dwellings | Number of Other Sensitive Receptors |
|---|---|---|---|
| $L_{A10,18h}$ | 1.0 – 2.9 Minor | 8 | 3 |
| | 3.0 – 4.9 Moderate | 0 | 0 |
| | 5.0 + Major | 0 | 0 |
| No change | 0.0 No change | 96 | 5 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 – 0.9 Negligible | 745 | 55 |
| | 1.0 – 2.9 Minor | 39 | 43 |
| | 3.0 – 4.9 Moderate | 0 | 2 |
| | 5.0 + Major | 0 | 3 |

17.4.13. Table 17.14 below, displays the categorised long-term predicted Do-Minimum changes in traffic noise for dwellings, other noise sensitive receptors and night-time dwellings. The long-term Do-Minimum noise level change contour for the day is given in Figure 17.4, and for the night in Figure 17.5.

17.4.14. In the daytime, eight dwellings receive a perceptible (equal to or greater than 3 dB change in the long-term) decrease in noise due to the scheme; all eight dwellings experience a Minor perceptible decrease.

17.4.15. In the day, the remaining 1114 dwellings have a below perception or no change.

17.4.16. In the daytime, 16 non-residential receptors receive a perceptible decrease in noise due to the scheme; the reduction for all these receptors is classified as a Minor perceptible decrease.

17.4.17. In the day, the remaining 117 non-residential receptors experience either a below perception change or no change.

17.4.18. In the night, where $L_{night,outside}$ is greater than 55 dB, all dwellings experience either a below perception change or no change.

**Table 17.14: Long-Term Do-Minimum Changes in Traffic Noise**

| Change in noise level | | Number of dwellings | Number of other sensitive receptors | Number of night-time dwellings |
|---|---|---|---|---|
| Increase in noise levels, $L_{A10,18h}$ | 0.1 – 2.9 Negligible | 105 | 6 | 25 |
| | 3.0 – 4.9 Minor | 0 | 0 | 0 |
| | 5.0 – 9.9 Moderate | 0 | 0 | 0 |
| | 10.0 + Major | 0 | 0 | 0 |

| Change in noise level | | Number of dwellings | Number of other sensitive receptors | Number of night-time dwellings |
|---|---|---|---|---|
| No change | 0.0 No change | 73 | 5 | 8 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 – 2.9 Negligible | 936 | 106 | 12 |
| | 3.0 – 4.9 Minor | 8 | 16 | 0 |
| | 5.0 – 9.9 Moderate | 0 | 0 | 0 |
| | 10.0 + Major | 0 | 0 | 0 |

17.4.19. Table 17.15 below, displays the categorised long-term predicted Do-Something changes in traffic noise for dwellings, other noise sensitive receptors and night-time dwellings. The long-term Do-Something noise level change contour for the day is given in Figure 17.6, and for the night in Figure 17.7.

17.4.20. No receptors receive a perceptible increase in noise due to the Proposed Scheme in the long-term.

17.4.21. In the daytime, no dwellings receive a perceptible (equal to or greater than 3 dB change in the long-term) increase or decrease in noise due to the scheme.

17.4.22. Two other sensitive receptors experience a perceptible decrease in noise, one Minor and one Moderate decrease.

17.4.23. The remaining 131 other sensitive receptors receive a below perception or no change.

17.4.24. In the night, there are a total of 45 dwellings where the predicted noise level, $L_{night,outside}$, is greater than 55 dB in any scenario.

17.4.25. In the night, no dwellings experience a perceptible increase in noise due to the Proposed Scheme.

17.4.26. In the night, six dwellings experience a perceptible decrease in noise due to the Proposed Scheme. Of these, four are categorised as Minor and two are Moderate decreases.

17.4.27. In the night, the remaining 39 dwellings have either below perception or no change.

17.4.28. Based on the long-term HD 213/11 results, an indicative assessment of dwellings that may qualify for an offer of noise insulation under the Regulations, identifies four dwellings with façade noise levels above 68 dB $L_{A10,18h}$; an equal to or greater than 1 dB(A) increase in noise level; and are within 300 m of the Proposed Scheme:

- March Cottage, Grampian Road, Aviemore, PH22 1PZ;
- Birch View, Kinveachy, Boat of Garten, PH24 3BT;
- Underwood, Kinveachy, Boat of Garten, PH24 3BT; and
- Meikle House, Kinveachy, Boat of Garten, PH24 3BT.

**Table 17.15: Long-term Do-Something Changes in Traffic Noise**

| Change in noise level | | Number of dwellings | Number of other sensitive receptors | Number of night-time dwellings |
|---|---|---|---|---|
| Increase in noise levels, $L_{A10,18h}$ | 0.1 – 2.9 Negligible | 411 | 44 | 33 |
| | 3.0 – 4.9 Minor | 0 | 0 | 0 |
| | 5.0 – 9.9 Moderate | 0 | 0 | 0 |
| | 10.0 + Major | 0 | 0 | 0 |
| No change | 0.0 No change | 118 | 6 | 2 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 – 2.9 Negligible | 593 | 81 | 4 |
| | 3.0 – 4.9 Minor | 0 | 1 | 4 |
| | 5.0 – 9.9 Moderate | 0 | 1 | 2 |
| | 10.0 + Major | 0 | 0 | 0 |

## *Operational Phase Impacts: Noise Nuisance*

17.4.29. Table 17.16 below, displays the categorised traffic noise nuisance impacts for dwellings.

17.4.30. In the Do-Minimum, the majority (1061) of dwellings receive a decrease in noise nuisance of less than 10%. There are 24 dwellings with no change, and 37 dwellings which receive an increase in noise nuisance of less than 10%.

17.4.31. In the Do-Something, the majority (587) of dwellings receive a decrease in noise nuisance of less than 10%. There are 225 dwellings with no change. The remaining 310 dwelling receive an increase in noise nuisance. With 171 dwellings receiving a less than 10% increase, 115 receiving a 10-20% increase, and 24 receiving a 20-30% increase.

17.4.32. A 1 dB increase in noise is equal to a 21% increase in noise nuisance. All nuisance increases up to 20% represent a less than 1 dB increase in noise level.

**Table 17.16: Traffic Noise Nuisance Impacts**

| Change in nuisance level | | Do-Minimum Number of dwellings | Do-Something Number of dwellings |
|---|---|---|---|
| Increase in nuisance | <10% | 37 | 171 |
| | 10 < 20% | 0 | 115 |
| | 20 < 30% | 0 | 24 |
| | 30 < 40% | 0 | 0 |
| | >40% | 0 | 0 |

| Change in nuisance level | | Do-Minimum Number of dwellings | Do-Something Number of dwellings |
|---|---|---|---|
| No change | 0% | 24 | 225 |
| Decrease in nuisance | <10% | 1061 | 587 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | >40% | 0 | 0 |

### *Operational Phase Impacts: Vibration Nuisance*

17.4.33. Operational vibration is not anticipated to be an issue associated with the A9 carriageway or associated junctions, as the Proposed Scheme road surface will be smooth and ground borne vibrations from traffic are only generally perceptible where the road surface is uneven.

17.4.34. Table 17.17 below, displays the categorised traffic vibration nuisance impacts for dwellings. There are 193 dwellings within the vibration study area.

17.4.35. In the Do-Minimum, the majority (143) of dwellings receive a decrease in vibration nuisance of less than 10%. There are 39 dwellings with no change. The remaining 11 dwellings receive an increase in vibration nuisance below 10%.

17.4.36. In the Do-Something, the majority (165) of dwellings have no change in vibration nuisance. Of the remaining 28 dwellings, all receive an increase in vibration nuisance of less than 10%.

**Table 17.17: Traffic Vibration Nuisance Impacts**

| Change in nuisance level | | Do-Minimum Number of dwellings | Do-Something Number of dwellings |
|---|---|---|---|
| Increase in nuisance | <10% | 11 | 28 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | >40% | 0 | 0 |
| No change | 0% | 39 | 165 |
| Decrease in nuisance | <10% | 143 | 0 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |

### *Operational Phase Impacts: Consented Development*

17.4.37. There are two consented developments in Aviemore, Horse Field and Allt Mor, where planning approval has been granted but construction is yet to commence (in relation to part or all the development, respectively), these buildings are considered separately.

17.4.38. A total of 91 building receptors are considered in the consented development assessment. Potential impacts have been calculated for the short and long-term, therefore, the consented buildings are assessed as if they are completed by the first full year of operation of the scheme.

17.4.39. Table 17.18 below, displays the categorised short-term predicted Do-Something changes in traffic noise for consented dwellings.

17.4.40. A total of 24 buildings experience a perceptible Minor decrease in noise due to the scheme.

17.4.41. The remaining 67 buildings have either no change or a below perception change.

**Table 17.18: Consented Development Short-Term Changes in Traffic Noise**

| Change in noise level | | Number of dwellings |
|---|---|---|
| Increase in noise levels, $L_{A10,18h}$ | 0.1 – 0.9 Negligible | 6 |
| | 1.0 – 2.9 Minor | 0 |
| | 3.0 – 4.9 Moderate | 0 |
| | 5.0 + Major | 0 |
| No change | 0.0 No change | 2 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 – 0.9 Negligible | 59 |
| | 1.0 – 2.9 Minor | 24 |
| | 3.0 – 4.9 Moderate | 0 |
| | 5.0 + Major | 0 |

17.4.42. Table 17.19 below, displays the categorised long-term predicted Do-Something changes in traffic noise for consented dwellings.

17.4.43. In the long-term all consented dwellings experience a below perception or no change in noise level.

17.4.44. In the night, all consented dwellings are predicted to be below the assessment threshold of 55 dB $L_{night,outside}$.

**Table 17.19: Consented Development Long-term Do-Something Changes in Traffic Noise**

| Change in noise level | | Number of dwellings | Number of night-time dwellings |
|---|---|---|---|
| Increase in noise levels, $L_{A10,18h}$ | 0.1 – 2.9 Negligible | 19 | 0 |
| | 3.0 – 4.9 Minor | 0 | 0 |

| Change in noise level | | Number of dwellings | Number of night-time dwellings |
|---|---|---|---|
| | 5.0 – 9.9 Moderate | 0 | 0 |
| | 10.0 + Major | 0 | 0 |
| No change | 0.0 No change | 3 | 0 |
| Decrease in noise level, $L_{A10,18h}$ | 0.1 – 2.9 Negligible | 69 | 0 |
| | 3.0 – 4.9 Minor | 0 | 0 |
| | 5.0 – 9.9 Moderate | 0 | 0 |
| | 10.0 + Major | 0 | 0 |

## Construction Phase Impacts

17.4.45. The assessment of potential construction phase impacts is used to define appropriate mitigation measures that should be implemented through a Construction Environment Management Plan (CEMP), which are commensurate to the scale and duration of the activities. If appropriate, the Contractor may request prior consent under Section 61 of the Control of Pollution Act 1974 (CoPA). This consent would include details of the works and the method; and proposed noise and vibration mitigation.

17.4.46. In considering the impact of construction noise and vibration on nearby receptors, of importance is the exact nature of the activities, plant and equipment types, distance between receivers and activities, and the hours of working.

17.4.47. Full details of the plant and activities associated with the works are not yet known. Anticipated phases and main noise generating plant likely to be employed are based on input from the design team in conjunction with road project experience.

17.4.48. Due to the specific and localised nature of the works, rock blasting at the three major rock cut locations in the Slochd area is considered separately.

### *Construction Phase Impacts: Noise*

17.4.49. The assessment of construction related noise associated with working areas has involved:

- Identification of construction stages and working areas;
- Description of likely construction activities and associated equipment;
- Identification of noise sensitive receptors;
- Calculation of noise levels at sample noise sensitive receptors and extrapolation to include the entire scheme corridor; and
- Evaluation of the significance of noise impact at sample noise sensitive receptors.

17.4.50. The assumed construction phases are site clearance, site preparation and earthworks, drainage, road construction, bridge construction, rock cutting (excluding rock blasting)

and signage. Appendix 17.3 details the anticipated equipment, noise levels and utilisation during each phase. Table 17.20 provides a summary of the combined noise levels for each construction phase. The construction phases are assumed to take place non-concurrently.

**Table 17.20: Construction Stage Noise Levels**

| Construction Stage | Noise Level, $L_{Aeq,T}$ dB at 10 m |
|---|---|
| Site Clearance | 80 |
| Site Preparation and Earthworks | 81 |
| Drainage | 79 |
| Road Construction / Laying | 80 |
| Bridge Construction | 80 |
| Rock Cutting | 90 |
| Signage | 79 |

17.4.51. To represent the worst-case scenarios, the calculations are based on all plant operating simultaneously at the nearest point of the works area to each receptor.

17.4.52. In practice, the plant items identified for each stage will move around the site, operating at different times, for different durations and at different locations on any one day for the duration of the works. Consequently, noise levels at any receptor may vary considerably day-on-day. Hence, it is necessary to rationalise the geographic and temporal spread of activities to obtain a meaningful prediction (and subsequent assessment) and to this end, various assumptions have necessarily been made.

17.4.53. With respect to the geographical location of the plant, the full complement of plant for each phase, as identified in Appendix 17.3 is assumed to operate together at a single point at the boundary of the closest working area. The assumed single point operating distances between construction works and noise sensitive receptor is summarised in Table 17.21.

**Table 17.21: Distances between Construction Works and Noise Sensitive Receptors**

| Receptor ID | Receptor name | Distance to Carriageway (m) | Distance to Scheme Boundary (m) | Distance to Bridge Works (m) | Distance to Rock Cutting Works (m) |
|---|---|---|---|---|---|
| 1 | Druim-Mhor | 75 | 70 | 260 | 1560 |
| 2 | Lywilg Farm House | 35 | 27 | 140 | 700 |
| 3 | Lywilg, Kinakyle | 185 | 180 | 230 | 450 |
| 4 | Upper Kinakyle | 12 | 4 | 425 | 4 |
| 5 | Kinmundy, Kinakyle | 30 | 9 | 25 | 125 |
| 6 | High Range House | 12 | 17 | 170 | 310 |

| Receptor ID | Receptor name | Distance to Carriageway (m) | Distance to Scheme Boundary (m) | Distance to Bridge Works (m) | Distance to Rock Cutting Works (m) |
|---|---|---|---|---|---|
| 7 | Aviemore Resort | 90 | 80 | 85 | 650 |
| 8 | Iona, Morlich Place | 180 | 165 | 300 | 165 |
| 9 | Lochnagar Lodge | 75 | 60 | 75 | 250 |
| 10 | SNH, Achantoul | 180 | 175 | 375 | 175 |
| 11 | Birch Cottage | 75 | 68 | 175 | 2140 |
| 12 | The Knoll | 145 | 130 | 840 | 2000 |
| 13 | Keepers Cottage | 65 | 60 | 1300 | 1480 |
| 14 | Dunelm Cottage | 50 | 48 | 45 | 2200 |
| 15 | Dalrachney Beag | 230 | 225 | 475 | 2580 |
| 16 | Holiday property | 240 | 200 | 400 | 2600 |
| 17 | Slochd Mhor Lodge | 150 | 145 | 315 | 185 |
| 18 | Rynaclarsach, Slochd | 30 | 25 | 650 | 50 |

17.4.54. Other assumptions/limitations with respect to the construction noise predictions are:

- Hours of working are 08:00-18:00 Monday to Friday and 08:00-13:00 Saturday.
- No temporary or permanent noise barriers have been included;
- No screening between sources and receivers;
- Acoustically soft ground cover is assumed between the noise source and noise sensitive receptor. For distances less than 25 m soft ground attenuation does not apply. At distances over 300 m noise predictions are treated with caution, because meteorological effects become increasingly important;
- No atmospheric absorption has been included;
- Predicted levels are quoted as equivalent free-field levels at the location of the noise sensitive receptor façade to allow direct comparison with measured levels;
- Sources and receptors have both been taken to be 1.5 metres high; and
- Meteorological effects are not included.

17.4.55. On the basis described above, construction noise levels have been determined at eighteen noise sensitive receptors, equivalent to the noise monitoring locations. These sample receptors are considered representative of all sensitive receptors.

17.4.56. A summary of predicted noise levels during each construction phase is given in Table 17.22.

**Table 17.22: Predicted Construction Noise Levels at Existing Noise Sensitive Receptors**

| Receptor ID | Receptor Name | Construction Phase Noise Levels $L_{Aeq}$ dB | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Site Clearance | Site Preparation and Earthworks | Drainage | Road Construction | Bridge Construction | Rock cutting | Signage |
| 1 | Lywilg, Kinakyle | 61 | 62 | 60 | 61 | 47 | 38 | 60 |
| 2 | Upper Kinakyle | 71 | 72 | 70 | 71 | 54 | 46 | 70 |
| 3 | Kinmundy, Kinakyle | 51 | 52 | 50 | 50 | 48 | 51 | 50 |
| 4 | High Range House | 88 | 89 | 87 | 88 | 42 | 98 | 87 |
| 5 | Aviemore Resort | 81 | 82 | 80 | 81 | 73 | 65 | 80 |
| 6 | Iona, Morlich Place | 75 | 76 | 74 | 75 | 52 | 55 | 74 |
| 7 | Lochnagar Lodge | 59 | 60 | 58 | 59 | 59 | 47 | 58 |
| 8 | SNH, Achantoul | 52 | 53 | 51 | 51 | 46 | 62 | 51 |
| 9 | Birch Cottage | 63 | 64 | 62 | 62 | 61 | 57 | 62 |
| 10 | The Knoll | 51 | 52 | 50 | 51 | 43 | 61 | 50 |
| 11 | Keepers Cottage | 61 | 62 | 60 | 61 | 51 | 34 | 60 |
| 12 | Dunelm Cottage | 54 | 55 | 53 | 54 | 34 | 35 | 53 |
| 13 | Dalrachney Beag | 63 | 64 | 62 | 62 | 30 | 38 | 62 |
| 14 | Holiday property | 66 | 67 | 65 | 66 | 66 | 34 | 65 |
| 15 | Slochd Mhor Lodge | 48 | 49 | 47 | 48 | 41 | 32 | 47 |
| 16 | Rynaclarsach, Slochd | 50 | 51 | 49 | 49 | 42 | 32 | 49 |
| 17 | Lywilg, Kinakyle | 53 | 54 | 52 | 53 | 45 | 61 | 52 |
| 18 | Upper Kinakyle | 72 | 73 | 71 | 72 | 37 | 75 | 71 |

17.4.57. The assessment results are presented in Table 17.23. Where construction noise is predicted to exceed BS 5228-1 threshold value then a potential significant impact is indicated.

**Table 17.23: Predicted Daytime Construction Noise Impact Significance at Existing Noise Sensitive Receptors**

| Receptor ID | Receptor name | Ambient measured noise level (dB) | Ambient value (rounded to nearest 5 dB) | BS 5228 category, threshold value (ABC method) | Range of Predicted construction noise levels dB $L_{Aeq,1\ h}$ | Noise exceedance over BS 5228 category threshold value dB | Potential significant impact |
|---|---|---|---|---|---|---|---|
| 1 | Druim-Mhor | 49.0 | 50 | 65 | 38 - 62 | -3 | - |
| 2 | Lywilg Farm House | 60.8 | 60 | 65 | 46 - 72 | 7 | Yes |
| 3 | Lywilg, Kinakyle | 51.8 | 50 | 65 | 48 - 52 | -13 | - |
| 4 | Upper Kinakyle | 60.6 | 60 | 65 | 42 - 98 | 33 | Yes |
| 5 | Kinmundy, Kinakyle | 62.9 | 65 | 70 | 65 - 82 | 12 | Yes |
| 6 | High Range House | 63.0 | 65 | 70 | 52 - 76 | 6 | Yes |
| 7 | Aviemore Resort | 56.4 | 55 | 65 | 47 - 60 | -5 | - |
| 8 | Iona, Morlich Place | 53.5 | 55 | 65 | 46 - 62 | -3 | - |
| 9 | Lochnagar Lodge | 59.2 | 60 | 65 | 57 - 64 | -2 | - |
| 10 | SNH, Achantoul | 54.1 | 55 | 65 | 43 - 61 | -4 | - |
| 11 | Birch Cottage | 50.1 | 50 | 65 | 34 - 62 | -3 | - |
| 12 | The Knoll | 54.1 | 55 | 65 | 34 - 55 | -10 | - |
| 13 | Keepers Cottage | 52.2 | 50 | 65 | 30 - 64 | -2 | - |
| 14 | Dunelm Cottage | 58.3 | 60 | 65 | 34 - 67 | 2 | Yes |
| 15 | Dalrachney Beag | 53.8 | 55 | 65 | 32 - 49 | -16 | - |

| Receptor ID | Receptor name | Ambient measured noise level (dB) | Ambient value (rounded to nearest 5 dB) | BS 5228 category, threshold value (ABC method) | Range of Predicted construction noise levels dB $L_{Aeq,1\ h}$ | Noise exceedance over BS 5228 category threshold value dB | Potential significant impact |
|---|---|---|---|---|---|---|---|
| 16 | Holiday property | 50.3 | 50 | 65 | 32 - 51 | -15 | - |
| 17 | Slochd Mhor Lodge | 45.3 | 45 | 65 | 45 - 61 | -4 | - |
| 18 | Rynaclarsach, Slochd | 59.5 | 60 | 65 | 37 - 75 | 10 | Yes |

17.4.58. Potential significant impacts are indicated at six of the sample receptors. Extrapolating from sample receptor calculations, a potential significant impact is predicted at receptors within 60 m of construction works, excluding rock cutting. A count of sensitive receptor buildings within 60 m of construction stages is given in Table 17.24.

**Table 17.24: Count of Sensitive Buildings Within 60 m of Construction Works**

| Construction stage | Count of sensitive receptor buildings within 60 m |
|---|---|
| Site Clearance | 53 |
| Site Preparation and Earthworks | 53 |
| Drainage | 53 |
| Road Construction / Laying | 38 |
| Bridge Construction | 6 |
| Signage | 53 |

17.4.59. For rock cutting, excluding rock blasting, a potential significant impact is predicted at receptors within 130 m. A count of sensitive receptor building within 130 m of rock cutting works has identified twelve sensitive receptors.

17.4.60. Due to proximity to the works, large scale exceedances, greater than 5 dB over threshold value, are predicted at five sample receptors:

- Lywilg Farm House, Kinakyle, +7 dB exceedance;
- Upper Kinakyle, Aviemore, +33 dB exceedance;
- Kinmundy, Kinakyle, Aviemore, +12 dB exceedance;
- High Range House, Grampian Road, +6 dB exceedance;
- Rynaclarsach, Slochd, +10 dB exceedance.

17.4.61. Predictions of the likely noise impacts from anticipated construction activities have been made and an assessment of significant impacts, they are considered to be sufficiently indicative of the likely worst-case noise levels during the works and represent a robust assessment.

17.4.62. It is inevitable with any major development that there will be some disturbance caused to those nearby during the construction works. However, due to the linear nature of road construction, impacts will be temporary, generally localised and relatively short in duration.

### *Construction Phase Impacts: Vibration*

17.4.63. The assessment of construction related vibration associated with working areas has involved:

- Identification of areas where piling, ground stabilisation or extended periods of breaking out of hard ground may be required, excluding rock blasting;
- Identification of the closest noise sensitive receptors to the identified areas;
- Evaluation of the significance of vibration impact at the closest noise sensitive receptors; and
- Identification of mitigation as appropriate.

17.4.64. Groundborne vibration levels are predicted for typical activities during construction based on the empirical procedures presented within:

- BS 5228-2;
- TRL report 246[xx], applicable to HGV induced vibration; and
- TRL report 429[xxi], applicable to vibratory rollers.

17.4.65. Predictions have been performed to determine the distances at which vibration may be experienced. In this regard, groundborne vibration levels and associated distances have been identified for a sample of typical vibration sources, as shown in Table 17.25.

17.4.66. Vibration generating activities are assumed to occur during road construction, bridge construction and rock cutting construction stages.

17.4.67. The predictions have assumed that the piling equipment will operate for some time at a point closest to the nearest vibration sensitive receptors.

**Table 17.25: Predicted Groundborne Vibration Levels Applicable to Typical Vibration Generating Construction Activities**

| Activity | Distance (m) | PPV ($mm^{-1}$) |
|---|---|---|
| Contiguous or secant bored piling | 48 | 0.3 |
| | 19 | 1.0 |
| | 3.3 | 10.0 |
| Rotary bored piling - auguring | 20 | 0.3 |
| | 6 | 1.0 |
| | 0.6 | 10.0 |
| Rotary bored piling – driving casing | 75 | 0.3 |
| | 23 | 1.0 |
| | 2.3 | 10.0 |
| Vibratory rollers – start & end[1] | 60 | 0.3 |
| | 23 | 1.0 |
| Vibratory rollers – steady state | 3.3 | 10.0 |
| HGVs[2] | 50 | 0.3 |
| | 17 | 1.0 |
| | 2.5 | 10.0 |
| [1] Assumes two rollers, 0.4 mm amplitude, drum width of 1.3 m, e.g. heavy-duty ride on roller.<br>[2] Assumes max height / depth of surface defect of 50 mm, max speed of 30 km/h, and that surface defect occurs at both wheels. | | |

17.4.68. The data presented within Table 17.25 is general and not site specific. Furthermore, there may be a variety of different potential vibration generating activities employed other than those listed. However, the vibration levels and associated distances can be used to determine the typical distances at which specific impacts could be registered.

17.4.69. Table 17.25 indicates that vibration generating activities are likely to exceed 1.0 $mm^{-1}$ PPV at distances less than 23 m.

17.4.70. A potential significant impact is deemed to occur if vibration levels exceed 1.0 $mm^{-1}$ PPV. This level equates to the onset of complaints in residential environments, but can be tolerated if prior warning and explanation has been given to residents.

17.4.71. There are six sensitive receptors within 23 m of vibration generating construction works:

- Upper Kinakyle, Aviemore, PH22 1PZ;
- Birchview, Kinakyle, Aviemore, PH22 1PZ;
- March Cottage, Kinakyle, Aviemore, PH22 1PZ;
- High Range House, Grampian Road, Aviemore, PH22 1PT;
- The MacDonald Highland Hotel, Grampian Road, Aviemore, PH22 1PN; and
- Dunelm, Station Road, Dalnahaitnach, Carrbridge, PH23 3AP.

### *Construction Phase Impacts: Rock Blasting*

17.4.72. This section considers the air overpressure and vibration impacts that could arise from rock blasting works. Noise and vibration from rock blasting works are a special case and are therefore considered separately.

17.4.73. Three major rock cuts are required in the Slochd area to engineer space for the Proposed Scheme. At each rock cut the tonnage of material required to be excavated is equivalent to that produced by a medium sized commercial quarry.

17.4.74. The impacts of blasting can be heard and felt, this is because both audible and sub-audible noise, as well groundborne vibration is generated. Blasting can cause concern or alarm; impacts will be mitigated through the adoption of good blasting practices, and these are detailed in the next section.

17.4.75. A summary of the major rock cut locations is given in Table 17.26 below.

**Table 17.26: Summary of Major Rock Cut Locations**

| Major rock cut location | Excavated material approx. tonnage | Estimated number of blasts | Construction blasting duration |
|---|---|---|---|
| Slochd Summit | 150,000 | 30 | 2 years |
| Slochd Mor | 100,000 | 20 | |
| Slochd Beag | 150,000 | 30 | |
| Total | 400,000 | 80 | |

17.4.76. The estimated two-year blasting program equates to less than one blast per week across all three sites. Due to the program length the rock cut works are treated the same as operational open quarry workings, therefore, guidance covering surface mineral workings has been considered in this assessment.

17.4.77. At each site there are different constraints at varying distances, including:

- Human receptors;
- Designated species receptors;
- Network Rail assets;
- Transport Scotland assets;
- Geological conservation site

17.4.78. The closest sensitive receptors to the rock blasting works are identified in the table below. No non-residential buildings are identified in the vicinity these works.

**Table 17.27: Dwellings Located Closest to Rock Cut Areas**

| Rock cutting area | Nearby Dwellings | Appox. grid reference | Distance between | Dwelling count |
|---|---|---|---|---|
| Slochd Summit | Blackmount, Slochd Road | NH 84529 24204 | 1.4 km | 2 |
| Slochd Mor | Blackmount, Slochd Road | NH 84529 24204 | 500 m | 2 |
| Slochd Beag | Slochd Railway Cottages | NH 84799 23797 | 215 m | 3* |
| * This location also includes Slochd Mhor Lodge and Slochd Cottage holiday let accommodation | | | | |

17.4.79. The vibration threshold for blast events, as recommended in BS 6472-2[xxii] for dwellings and BS 7385-2[xxiii] for structures, are detailed in Table 17.28 and Table 17.29, below.

**Table 17.28: Maximum Satisfactory Magnitudes of Vibration With Respect to Human Response or Up to Three Blast Vibration Events per Day**

| Place | Time | Satisfactory magnitude, ppv mm/s |
|---|---|---|
| Residential | Day* | 6 - 10 *** |
| | Night** | 2 |
| | Other times | 4.5 |
| Note 1 This table recommends magnitudes of vibration below which the probability of adverse comment is low (noise caused by any structural vibration is not considered).<br>NOTE 2 Doubling the suggested vibration magnitudes could result in adverse comment and this will increase significantly if the magnitudes are quadrupled. | | |
| * Daytime is Monday to Friday (08:00 - 18:00) and Saturdays (08:00 - 13:00). Blasting should be avoided on Sundays and Public Holidays<br>** Night is 23:00 - 07:00<br>*** Within residential properties people exhibit a wide variation of tolerance to vibration. Specific values are dependent upon social and cultural factors, psychological attitudes and the expected degree of intrusion. In practice the lower satisfactory magnitude should be used with the higher magnitude being justified on a case-by-case basis. | | |

Table Source: Based on BS 6472-2:2008 Table 1

**Table 17.29: Transient Vibration Guide Values for Cosmetic Damage**

| Type of Building | Time | Peak Component Particle Velocity in Frequency Range of Predominant Pulse | |
|---|---|---|---|
| | | 4 Hz to 15 Hz | 15 Hz and above |
| Reinforced or framed structures | All | 50 mm/s at 4 Hz and above | |
| Unreinforced or light framed structures | All | 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |
| Note 1 Values referred to are at the base of the building. | | | |

| Type of Building | Time | Peak Component Particle Velocity in Frequency Range of Predominant Pulse | |
|---|---|---|---|
| | | 4 Hz to 15 Hz | 15 Hz and above |
| Note 2 In unreinforced or light framed structures, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded | | | |

Table Source: Based on BS 7385-2:1993 Table 1

17.4.80. The values in Table 17.28 are considered to be overly restrictive in terms of viable blast charge weights, especially so, should night time working be required.

17.4.81. A series of groundborne vibration measurements will be made during a trial blasting period. These measurements will enable accurate prediction of distance propagation through the ground strata. After the completion of trial blasting, vibration thresholds will be set to minimise impacts at sensitive receptors and to ensure blasting is viable. The vibration thresholds will then be used to calculation maximum allowable charge weight at each site.

17.4.82. PAN 50 states that vibration levels generated by mineral workings are well below those required to cause structural damage to properties, but that vibration and air overpressure may give rise to nuisance. In addition, the guidance states that once the threshold of perception is exceeded, the likelihood of complaints is largely independent of vibration magnitude but greatly influenced by the relationship between an operator and the local community.

## 17.5. Mitigation

### Mitigation During Operational Phase

17.5.1. Low-noise-surfacing is included in the design in all Do-Something modelled scenarios for the A9 carriageway and junctions. For LNRS a correction of -3.5 dB(A) is applied, as compared against HRA, where the mean average speed is ≥75 km/h.

17.5.2. Mitigation is considered where the threshold of mitigation is exceeded in either the short or long term, detailed in Table 17.9.

17.5.3. Mitigation investigation was triggered at six dwelling receptors in the short-term, there are no significant impacts in the long-term. The dwellings are identified in Table 17.30.

**Table 17.30: Dwellings Receiving Significant Road Traffic Noise Increases**

| Receptor ID | Receptor address | X | Y |
|---|---|---|---|
| BLD1 | Railway Cottages, Lynwilg, Aviemore, PH22 1PZ* | 288044 | 810153 |
| BLD2 | Railway Cottages, Lynwilg, Aviemore, PH22 1PZ* | 288048 | 810158 |
| BLD3 | March Cottage, Grampian Road, Aviemore, PH22 1PZ | 289096 | 811340 |
| BLD4 | Cherry Bank, Bogroy, Dalrachney Road, Carrbridge, PH23 3BX | 290032 | 823149 |
| BLD5 | 7 Bogroy, Dalrachney Road, Carrbridge, PH23 3BX* | 290116 | 823142 |
| BLD6 | 7 Bogroy, Dalrachney Road, Carrbridge, PH23 3BX* | 290128 | 823142 |
| * Address data missing or incomplete. The mapping information identifies these buildings as semi-detached pairs, they have been modelled as unique dwellings. | | | |

17.5.4. Table 17.31 details the noise level change and noise at dwellings predicted to experience a significant impact. The dwellings are identified in Figure 17.2.

**Table 17.31: Dwellings Receiving Significant Road Traffic Noise Increases - Noise Change and Noise Level**

| Receptor ID | Receptor name | Short-Term Noise | | Long-Term Noise | |
|---|---|---|---|---|---|
| | | Change, dB(A)* | Level, $L_{A10,18h}$** | Change, dB(A)* | Level, $L_{A10,18h}$** |
| BLD1 | Railway Cottages | 2.0 | 63.0 | 2.3 | 63.3 |
| BLD2 | Railway Cottages | 2.4 | 62.2 | 2.6 | 62.4 |
| BLD3 | March Cottage | 2.2 | 69.4 | 2.7 | 70.2 |
| BLD4 | Cherry Bank | 1.0 | 65.0 | 1.7 | 65.7 |
| BLD5 | 7 Bogroy | 1.6 | 69.5 | 2.2 | 70.1 |
| BLD6 | 7 Bogroy | 1.4 | 71.6 | 2.0 | 72.2 |
| * Building receiver exhibiting the least beneficial noise change, $L_{A10,18h}$.<br>** Noise level for the building receiver exhibiting the least beneficial change in noise level. | | | | | |

17.5.5. Railway Cottages (BLD1 and BLD2) are adjoining semi-detached bungalows adjacent to the B9152. The impacts are due to an increase traffic numbers on the existing B9152 and because junction improvements shift this local road closer to the dwellings.

17.5.6. March Cottage (BLD3) is located to the west of the A9, south of Aviemore, approximately 30 m from the carriageway. The noise impact is primarily due to an increase in the number of vehicles and an increase in traffic speed on the A9; and because the Proposed Scheme road alignment moves west, making it nearer to the dwelling. The low-noise-surface, which is designed into all Do-Something scenarios for the A9 carriageway already provides some mitigation.

17.5.7. Cherry Bank (BLD4) and the adjoining semi-detached 7 Bogroy (BLD5 and BLD6) are adjacent to the A938 in Carrbridge, between 5 m and 8 m from the local road carriageway. The noise impacts are due to an increase traffic numbers on the existing A938. The Proposed Scheme attracts more vehicles to use the A9 and surrounding network traffic, and local junction improvements draws more vehicles into Carrbridge along the A938. Impacts are not altered by the Proposed Scheme.

17.5.8. An indicative scheme of noise mitigation has been proposed, the design criteria for the noise barriers is to reduce noise levels to below significant impact.

17.5.9. Specification of noise barriers shall be at least B3, as classified under BS 1793-2[xxiv]. The environmental barriers will be designed in conjunction with specialists in the design team. Proposed mitigation does not consider factors which may constrain a barrier, such as cost/benefit analysis, construction feasibility, ecological impacts, visibility for road users, land ownership, maintenance and visual impact.

17.5.10. Provisional noise barriers have been built into the 3D noise model and the results are given below and included in Chapter 21 as P11-NV5. Three separate noise barriers are proposed, outline details are given in Table 17.32 and are mapped in Figure 17.8.

**Table 17.32: Proposed Noise Barrier Mitigation**

| Noise Barrier | Length | Height (m) | Start X | Start Y |
|---|---|---|---|---|
| EB1 | 53 | 1.4 | 288002 | 810150 |

| Noise Barrier | Length | Height (m) | Start X | Start Y |
|---|---|---|---|---|
| EB2 | 45 | 1.4 | 288051 | 810196 |
| EB3 | 93 | 2.3 | 289123 | 811354 |

17.5.11. The effect of installing the proposed noise barriers is shown in Table 17.33 and Table 17.34 for the short and long-term scenarios respectively.

**Table 17.33: Noise Barrier Attenuation, Short-Term**

| Receptor ID | Receptor name | Effective noise barrier | Without barrier mitigation short-term change, dB(A)* | With barrier mitigation short-term change, dB(A)* |
|---|---|---|---|---|
| BLD1 | Railway Cottages | EB1 & EB2 | 2.0 | 0.2 |
| BLD2 | Railway Cottages | EB1 & EB2 | 2.4 | 0.3 |
| BLD3 | March Cottage | EB3 | 2.2 | 0.9 |
| * Building receiver exhibiting the least beneficial noise change, $L_{A10,18h}$. | | | | |

**Table 17.34: Noise Barrier Attenuation, Long-Term**

| Receptor ID | Receptor name | Effective noise barrier | Without barrier mitigation long-term change, dB(A)* | With barrier mitigation long-term change, dB(A)* |
|---|---|---|---|---|
| BLD1 | Railway Cottages | EB1 & EB2 | 2.3 | 0.4 |
| BLD2 | Railway Cottages | EB1 & EB2 | 2.6 | 0.6 |
| BLD3 | March Cottage | EB3 | 2.7 | 1.6 |
| * Building receiver exhibiting the least beneficial noise change, $L_{A10,18h}$. | | | | |

17.5.12. With proposed barrier mitigation in place, noise impacts at Railway Cottages (BLD1 and BLD2) and March Cottage (BLD3) are not significant.

17.5.13. In Carrbridge, Cherry Bank (BLD4) and 7 Bogroy (BLD5 and BLD6) are more than 600 m from the A9 carriageway but are impacted due to changes in traffic on existing roads (although it is noted that without mitigation, impacts are negligible in the long term, i.e. not significant). Noise barriers may be effective for some dwellings but the constraints in this particular location make it impractical to provide effective noise mitigation, with the associated impacts outweighing any benefits it would provide.

17.5.14. Mitigation investigation was triggered, in the short-term only, at two ecological receptors, Craigellachie SSSI/NNR and Alvie SSSI. Mitigation is not proposed at either location, this is due to their transient use, localised impact, the availability of alternative space, and because the receptors are located at the closest point to the A9. Note, the impacts within this chapter pertain to use of the designated areas by humans. Noise impacts on flora and fauna are considered within the ecology chapter, where relevant.

## Mitigation During Construction Phase

17.5.15. Legislative safeguards are available to reduce the impacts of noise during the construction of a development such as the proposed scheme. These include:

- EC Directives and UK Statutory Instruments that limit noise emissions of a variety of construction plant;
- Guidance set out in BS 5228-1 and BS 5228-2;
- Guidance on good practice for noise and blasting presented in PAN 50, including Annex A and Annex D; and
- Sections 60 and 61 of the CoPA.

17.5.16. The mitigation measures to minimise construction impacts are detailed in Table 17.35.

## Committed Mitigation

17.5.17. Table 17.35 details mitigation measures, these are also set out in Chapter 21 Schedule of Environmental Commitments and comprise both A9 Dualling standard mitigation and measures specifically applicable to the proposed scheme.

**Table 17.35: Noise and Vibration Mitigation**

| Mitigation Item | Description |
|---|---|
| SMC-S3 | Throughout the construction period the Contractor will, as required, contribute towards the overall communications strategy for the A9 Dualling Programme.<br>As part of this the Contractor will appoint a Community Liaison Officer supported by a liaison team as necessary who will:<br>• 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;<br>• 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;<br>• support the production of project communications such as the project website and newsletters; and<br>• 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. |
| SMC-NV1 | A scheme of noise and vibration monitoring will be agreed with the Environmental Health Officer of Highland Council, and noise and vibration limits will be contained within the Construction Environmental Management Plan (CEMP).<br>The CEMP will be prepared by the appointed contractor, and will include the following:<br>• Arrangements for communicating construction details, and likely noisy activities, with local communities and residents, including points of contact;<br>• Detailed methodologies for each construction activity;<br>• Detailed programmes for each phase of construction; |

| Mitigation Item | Description |
|---|---|
| | • Identification of the construction activities likely to generate the highest levels of noise, based on working areas;<br>• Prediction of noise levels from these activities following methods given in BS 5228-1;<br>• Identification, in consultation with The Highland Council, of appropriate hours of working and construction noise limits;<br>• An assessment of predicted impacts against the agreed construction noise limits;<br>• Identification of appropriate noise mitigation measures; and<br>• Noise monitoring and reporting procedures. |
| SMC-NV2 | The adoption of Best Practicable Means (BPM), as defined in the Control of Pollution Act 1974, and the guidance on good practice presented in PAN 50, will be used to control noise and vibration from construction activities, and will include the following:<br>• Maintaining good public relations with local residents that may be affected by noise from the construction works. Effective communication should be established, keeping local residents informed of the type and timing of works involved. Effective methods of keeping local residents informed include leaflet drops, posters, public meetings, exhibitions and guided site visits;<br>• Provision of contact details for a site representative so that noise and vibration complaints arising from construction works are dealt with pro-actively and that subsequent resolutions are communicated to the complainant;<br>• All site staff would receive appropriate periodic environmental training throughout the construction period;<br>• Night-time working would be avoided where possible;<br>• Careful planning of construction activities and selection of plant to reduce noise emissions;<br>• The use of temporary acoustic barriers where appropriate;<br>• Locating static noisy plant in use as far away from sensitive receptors as is feasible for the particular activity;<br>• Using suitable equipment and ensuring such equipment is properly maintained and operated by trained staff;<br>• Using silenced equipment where possible, in particular silenced power generators if night-time power generation is required for site security or lighting;<br>• Vehicles and plant to be properly maintained and operated according to manufacturers' recommendations, in such a manner as to avoid causing excessive noise<br>• Engine compartments should be closed when equipment is in use and the resonance of body panels and cover plates reduced through the addition of suitable dampening materials;<br>• Where practicable, rubber linings would be used on chutes and dumper trucks, etc.;<br>• Ensuring plant machinery is turned off when not in use;<br>• Speed limits on access roads or tracks for HGVs;<br>• Care to be taken regarding the needs for reversing alarms, where possible, install non-tonal alarms;<br>• The gradient of any temporary haul road or track connecting work areas to the road network to be kept to a minimum;<br>• Deliveries would be programmed to arrive during daytime hours only;<br>• Drop heights would be minimised when loading/unloading vehicles;<br>• Ensuring that vehicles do not park or queue for long periods outside sensitive receptors with engines running unnecessarily; |

| Mitigation Item | Description |
|---|---|
| | • The timing of vehicle movements to and from site; where possible these should be limited to less-sensitive times of day;<br>• The routing of vehicle movements to and from site; where possible these should prioritise routes with fewer (or more distant) noise-sensitive receptors;<br>• The provision of alternative routes to spread impacts across multiple routes;<br>• The application of traffic management, including speed limits for construction traffic in the most sensitive areas;<br>• Generators and water pumps required for 24-hour operation should be silenced and/or screened as appropriate;<br>• Where possible, the use of mains electricity rather than generators.<br>In addition, noisy construction activities are to be reduced as far as is reasonably practicable between the hours of 13.00 to 19.00 on Saturdays. Where works are required outside standard hours, the use of silenced equipment and plant is suggested, or temporary barriers installed in order to reduce noise at sensitive receptors to below BS 5228-1 threshold values where practicable.<br>If appropriate, the Contractor may request prior consent under Section 61 of CoPA. This consent would include details of the works and the method; and proposed noise and vibration mitigation. |
| P11-NV3 | In order to manage potential impacts from blasting works the following mitigation measures would be employed to mitigate vibration and air overpressure levels:<br>• The affected local community shall be notified of the proposed blasting times;<br>• During blasting site sentries at key locations to warn people in advance and maintain a suitable safe distance;<br>• Installed blast signs around the rock cut areas on publicly accessible routes;<br>• Use pre-blast warning sirens to warn both human and non-human receptors;<br>• Care would be taken with the development of faces, and with trial blasts, as anomalous vibration levels might be produced when there is no free face to relieve the energy produced;<br>• Appropriate burden would be ensured to avoid over or under confinement of the charge;<br>• Accurate drilling and setting out would be undertaken;<br>• Charge levels would be appropriate;<br>• Stemming with appropriate material such as sized gravel or stone chippings would be undertaken;<br>• Decking charges/in hole delays/delay detonation would be used to ensure smaller Maximum Instantaneous Charges (MICs);<br>• A series of groundborne vibration measurements and air overpressure measurements would be undertaken to determine compliance with appropriate criteria (adopted from BS 5228-2). These measurements would initially be undertaken for a series of smaller charge weights, which would only be increased following analysis of the measured vibration levels and determination of likely compliance with applicable limits for higher charge weights;<br>• Each charge would be individually designed to maximise efficiency and reduce energy loss through vibration and air overpressure;<br>• The use of surface detonating cords and secondary blasting would be avoided where possible;<br>• The areas of heave and the total charges would be minimised;<br>• Blasting in adverse weather conditions would be avoided where possible, i.e. wind in the direction of sensitive receptors;<br>• All blasting would be undertaken in accordance with the blast plan. This is updated following a blast, if required. |

| Mitigation Item | Description |
|---|---|
| P11-NV4 | Specific mitigation may be required for locations where potentially significant effects are indicated. This mitigation would be confirmed when the final selection of plant and equipment is known and the impacts reassessed. Mitigation may take the form of solid site hoardings. Depending on the scheduling of works there may be a need to consider specific arrangements to manage night-time construction impacts for residents. Such arrangements will be agreed between the Contractor and residents. |
| P11-NV5 | An indicative scheme of noise mitigation has been proposed, the design criteria for the noise barriers is to reduce operational noise levels to below significant impact.<br>Specification of noise barriers shall be at least B3, as classified under BS 1793-2. Three permanent noise barriers are specified, outline details are given in Table 17.32 and are mapped in Figure 17.8.<br>• EB1 noise barrier is 53 m long, 1.4 m high, is located adjacent to the B9152 and limits operational noise impact at Railway Cottages, adjoining semi-detached bungalows;<br>• EB2 noise barrier is 45 m long, 1.4 m high, is located adjacent to the B9152 and limits operational noise impact at Railway Cottages, adjoining semi-detached bungalows; and<br>• EB3 noise barrier is 93 m long, 2.3 m high, is located adjacent to the A9 and limits operational noise impact at March Cottage. |

## 17.6. Residual Impacts

### Residual Operation Phase Impacts

17.6.1. With the proposed mitigation in place, significant operation phase impacts remain at three dwellings and two ecological receptors, in the short-term only.

17.6.2. In Carrbridge, Cherry Bank (BLD4) and 7 Bogroy (BLD5 and BLD6) are more than 600m from the A9 carriageway but are impacted due to changes in traffic on existing roads. However, the constraints in this particular location make it impractical to provide effective noise mitigation, with the associated impacts to the properties outweighing any benefits it would provide.

17.6.3. At the two ecological receptors (Craigellachie SSSI/NNR and Alvie SSSI), mitigation has not been considered because of the transient use, localised impact, the availability of alternative space, and because the receptors are located at the closest point to the A9.

17.6.4. With noise barrier mitigation in place, an indicative assessment identifies four dwellings that may qualify for an offer of noise insulation under the Regulations:

- March Cottage, Grampian Road, Aviemore, PH22 1PZ;
- Birch View, Kinveachy, Boat of Garten, PH24 3BT;
- Underwood, Kinveachy, Boat of Garten, PH24 3BT; and
- Meikle House, Kinveachy, Boat of Garten, PH24 3BT.

### Residual Construction Phase Impacts

17.6.5. The potential significant impacts are considered to be adequately mitigated through the implementation of BPM and a CEMP.

17.6.6. Road projects are linear and construction activities progress along the scheme corridor, therefore disruption is generally localised and temporary in nature.

17.6.7. Rock blasting noise, vibration and air overpressure may give rise to nuisance. Impacts will be reduced and minimised by the application of mitigation measures.

---

[i] The Highways Agency, Scottish Government, Welsh Assembly Government and the Department for Regional Development Northern Ireland (2011), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, HD 213/11 revision 1. Noise and Vibration

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

[iii] The British Standards Institution (2014), BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration

[iv] Transport Scotland (2014), A9 Dualling Programme, Strategic Environmental Assessment (SEA)

[v] Department of Transport and Welsh Office (1988), *Calculation of Road Traffic Noise*

[vi] The Highways Agency, Scottish Government, Welsh Assembly Government, The Department for Regional Development Northern Ireland (2008). Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5, HA205/08. Assessment and Management of Environmental Effects

[vii] The Scottish Government (2011), *Technical Advice Note (TAN): Assessment of Noise*

[viii] World Health Organisation (2009), *Night Noise Guidelines for Europe*

[ix] Statutory Instrument, 1975, No. 460 (S.60). Building and Buildings. The Noise Insulation (Scotland) Regulations 1975

[x] Memorandum of Advice and Instruction (Noise Insulation (Scotland) Regulations 1975) No. 1/74

[xi] The Highland Council (2012), *Highland-wide Local Development Plan*

[xii] Scottish Government (2011), *Planning Advice Note (PAN) 1/2011, Planning and Noise*

[xiii] Scottish Government (1996), *Planning Advice Note (PAN) 50, Controlling the Environmental Effects of Surface Mineral Workings*

[xiv] Scottish Government (2006), *Planning Advice Note (PAN) 50, Annex A, The Control of Noise at Surface Mineral Workings*

[xv] Scottish Government (2014), *Scottish Planning Policy*

[xvi] World Health Organisation (2009), *Guidelines for Community Noise*

[xvii] Department for Transport, Transport Analysis Guidance Unit A3, December 2015

[xviii] Abbott P. G. and Nelson P. M., TRL Limited (2002), Project Report PR/SE/451/02 *Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping*

[xix] Northern Scheme Baseline Noise Measurement Report (2015)

[xx] Watts G. R., Transport and Road Research Laboratory. Department of Transport (1990). Research Report 246 *Traffic induced vibration in buildings*

[xxi] Hiller D. M. and Crabb G. I., Transport Research Laboratory (2000), TRL Report 429 *Groundborne vibration caused by mechanised construction works*

[xxii] The British Standards Institution (2008), BS 6472-2:2008 Guide to evaluation of human exposure to vibration in buildings. Part 2: Blast-induced vibration

[xxiii] The British Standards Institution (1993), BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Part 2: Guide to damage levels from groundborne vibration

[xxiv] The British Standards Institution (2012), BS 1793-2: 2012 Road traffic noise reducing devices. Test method for determining the acoustic performance. Intrinsic characteristics of airborne sound insulation under diffuse sound field conditions