

8 Noise and Vibration

This chapter considers the potential noise and vibration impacts of the proposed Scheme on noise sensitive receptors.

The study area was defined as 1km from existing routes that are being improved or bypassed and any proposed new routes, between the start and end points of the physical works associated with the proposed scheme. Within the 1km boundary a calculation area was defined as being the area that extends 600m from existing bypassed and/or improved routes and 600m from any affected routes within the 1km study area. Noise modelling was undertaken for all noise sensitive receptors within the defined 600m calculation area. As part of the assessment a baseline noise survey was undertaken at 27 identified noise sensitive receptors to gain an understanding of the existing noise climate within the vicinity of the proposed Scheme.

All potential impacts on noise sensitive receptors are discussed in full in this chapter. Appendix A8.3 (Predicted Noise Levels at Receptors) contains the predicted noise levels for all noise sensitive receptors, Appendix A8.4 (Wider Road Network Assessment) contains predicted noise levels on affected roads that are outwith the 1km study area, Appendix A8.5 (Noise Impacts on Committed Developments) contains the predicted noise impacts at all identified sensitive committed developments and Appendix A8.6 (Noise Impacts on Amenity Areas) contains the predicted noise impacts at all identified sensitive amenity areas.

In the short-term assessment with the proposed Scheme at ground floor level and without mitigation there are predicted to be 2,548 dwellings and 15 other noise sensitive receptors that would experience an increase in noise level of at least 1dB and 2,826 dwellings and 26 other noise sensitive receptors that would experience a decrease in noise level of at least 1dB.

In the long-term assessment with the proposed Scheme at ground floor level and without mitigation there are predicted to be 1,360 dwellings and 10 other noise sensitive receptors that would experience an increase in noise level of at least 3dB and 91 dwellings that would experience a decrease in noise level of at least 3dB.

The results indicated that there were 10 properties that may qualify for noise insulation at ground and first floor levels.

Proposed mitigation includes the use of low noise road surfacing, the inclusion of earthwork bunds and false cuttings in the proposed Scheme design and the use of receptor specific mitigation in the form of noise barriers for noise sensitive residential dwellings which met the mitigation criteria.

In the short-term assessment with the proposed Scheme at ground floor level and with receptor specific mitigation there are predicted to be 2,522 dwellings and 15 other noise sensitive receptors that would experience an increase in noise level of at least 1dB and 2,826 dwellings and 26 other noise sensitive receptors that would experience a decrease in noise level of at least 1dB.

In the long-term assessment with the proposed Scheme at ground floor level and with receptor specific mitigation there are predicted to be 1,323 dwellings and 10 other noise sensitive receptors that would experience an increase in noise level of at least 3dB and 91 dwellings that would experience a decrease in noise level of at least 3dB.

The results indicated that with receptor specific mitigation there were eight properties that may qualify for noise insulation at ground and first floor levels.

8.1 Introduction

8.1.1 This chapter presents an assessment of the potential significant effects that the proposed Scheme, as described in Chapter 4 (The Proposed Scheme), may have on noise and vibration sensitive receptors as a consequence of the construction and operation of the A96 Dualling Inverness to Nairn (including Nairn Bypass), hereafter referred to as the proposed Scheme. The chapter is supported by the following appendices, which are cross-referenced in the text where relevant:

- Appendix A8.1 (Noise and Vibration Terminology);
- Appendix A8.2 (Detailed Baseline Noise Survey Results and Notes);
- Appendix A8.3 (Predicted Noise Levels at Receptors);
- Appendix A8.4 (Wider Road Network Assessment);
- Appendix A8.5 (Noise Impacts on Committed Developments);
- Appendix A8.6 (Noise Impacts on Amenity Areas);
- Figure 8.1 (Noise and Vibration Study Area and Calculation Area);
- Figure 8.2 (Baseline Noise Monitoring Locations and Sample Receptors);
- Figure 8.3 (Noise Level Difference Contour Map (Ground Floor) Do-Min. Baseline Year Vs Do-Min. Future Assessment Year);

- Figure 8.4 (Noise Level Difference Contour Map (First Floor) Do-Min. Baseline Year Vs Do-Min. Future Assessment Year);
- Figure 8.5 (Noise Level Difference Contour Map (Ground Floor) Do-Min. Baseline Year Vs Do-Something Baseline Year);
- Figure 8.6 (Noise Level Difference Contour Map (First Floor) Do-Min. Baseline Year Vs Do-Something Baseline Year);
- Figure 8.7 (Noise Level Difference Contour Map (Ground Floor) Do-Min. Baseline Year Vs Do-Something Future Assessment Year);
- Figure 8.8 (Noise Level Difference Contour Map (First Floor) Do-Min. Baseline Year Vs Do-Something Future Assessment Year);
- Figure 8.9 (Location of Receptor Specific Noise Mitigation);
- Figure 8.10 (Noise Level Difference Contour Map (Ground Floor) Do-Min. Baseline Year Vs Do-Something Baseline Year (with Mitigation));
- Figure 8.11 (Noise Level Difference Contour Map (First Floor) Do-Min. Baseline Year Vs Do-Something Baseline Year (with Mitigation));
- Figure 8.12 (Noise Level Difference Contour Map (Ground Floor) Do-Min. Baseline Year Vs Do-Something Future Assessment Year (with Mitigation));
- Figure 8.13 (Noise Level Difference Contour Map (First Floor) Do-Min. Baseline Year Vs Do-Something Future Assessment Year (with Mitigation));
- Figure 8.14 (Sample Receptor Predicted Daytime Noise Levels (Ground Floor));
- Figure 8.15 (Sample Receptor Predicted Daytime Noise Levels (First Floor));
- Figure 8.16 (Sample Receptor Predicted Daytime Noise Levels (Ground Floor) (with Mitigation));
- Figure 8.17 (Sample Receptor Predicted Daytime Noise Levels (First Floor) (with Mitigation));
- Figure 8.18 (Sample Receptor Predicted Night-time Noise Levels (Ground Floor));
- Figure 8.19 (Sample Receptor Predicted Night-time Noise Levels (First Floor));
- Figure 8.20 (Sample Receptor Predicted Night-time Noise Levels (Ground Floor) (with Mitigation)); and
- Figure 8.21 (Sample Receptor Predicted Night-time Noise Levels (First Floor) (with Mitigation)).

8.1.2 The assessment of noise and vibration impacts associated with the proposed Scheme has been undertaken in accordance with the Detailed Assessment Methodology of the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7, HD213/11 Revision 1 Noise and Vibration (Highways Agency, Transport Scotland, Welsh Government and The Department for Regional Development Northern Ireland 2011). Road traffic noise levels have been predicted in accordance with the guidance contained in the Department of Transport's and Welsh Office publication: Calculation of Road Traffic Noise (CRTN 1988) and supplemented with the additional guidance contained in Annex 4 of HD213/11.

8.1.3 To assist in the understanding of the noise assessment it is useful to consider the units of noise and how noise is described quantitatively.

8.1.4 The World Health Organisation (WHO 1999) defines noise as unwanted sound and sound is measured in terms of decibels (dB). The decibel is not an absolute unit of measurement; it is a ratio between a measured quantity and an agreed reference level. The measured quantity is the variation in atmospheric pressure and the reference level is taken as the lowest pressure to which a healthy ear is able to hear as sound, i.e. 2×10^{-5} Pascal's (20 μ Pa). It should be appreciated that whilst the audible range of hearing extends from 20 Hertz (Hz) to 20,000Hz, human hearing is not equally sensitive to sound across this range of frequencies and therefore corrections or "weightings" are applied to the measured linear levels to simulate the response of the ear. The

A-weighting is most often used to represent the response of the ear to environmental noise. When considering noise levels it may be of assistance to note that doubling or halving of the traffic flow is equivalent to a change of approximately 3dB, and a subjective impression of a doubling of loudness generally corresponds to a 10dB sound level increase. Given that noise is assessed as a logarithmic ratio of pressure levels it is often useful to consider the relationship between the subjective evaluations of objective noise levels as shown in Table 8.1.

Table 8.1: Typical Noise Levels and Subjective Evaluation

| A-weighted Noise Level L_A (dB) | Description |
|-----------------------------------|---|
| 120 | Threshold of pain |
| 100 | Diesel drop hammer at 10 meters (m) distance |
| 95 | Pneumatic drill at 7m distance |
| 85 | Heavy diesel lorry at 40 kilometres per hour (kph) at 7m distance |
| 85 | Jet aircraft take-off at 150m distance |
| 70 | Passenger car at 60kph at 7m distance |
| 65 | Train at 40kph at 25m distance |
| 60 | Busy general office |
| 55 | Communication starts becoming difficult |
| 40 | Quiet library |
| 35 | Typical bedroom |
| 20 | Leaves rustling lightly |
| 0 | Threshold of hearing |

Road Traffic Noise

- 8.1.5 In terms of road traffic noise, it is useful to understand the causes of noise associated with a flow of road traffic vehicles.
- 8.1.6 Road traffic noise can be separated into two main components. The first is generated by the engine, exhaust system and transmission, and is the dominant noise source when traffic is not freely flowing. This is particularly apparent from heavy good vehicles (HGV), when accelerating, braking or changing of gears and this contributes a significant proportion of low frequency noise. The second noise source component is generated from the interaction of tyres with the road surface and is the dominant noise source under free flow traffic conditions at moderate to high road speeds and contributes a significant proportion of higher frequency noise.
- 8.1.7 The noise from a stream of traffic at a receptor point is an aggregation of noise from each of a number of vehicles at various distances. There are several factors that influence the noise level experienced at a receptor point and these can be separated into two categories. Firstly there are factors that affect the noise emissions at source, such as volume and speed of traffic, the composition of the traffic (i.e. the percentage of HGV), and the gradient and surface characteristics of the carriageway. Secondly there are those factors affecting the propagation characteristics, such as the distance of the receptor from the source, the topography and characteristics of the ground between the source and receptor, the presence of any screening or barrier effects and the wind strength and direction.

Measurement of Road Traffic Noise

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

Road Traffic Vibration

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

Legislative and Policy Background

- 8.1.12 The assessment of potential noise and vibration impacts has been carried out with reference to the following documents:
- DMRB Volume 11 Section 3 Part 7, HD213/11 – Revision 1 Noise and Vibration (Highways Agency, Transport Scotland, Welsh Government and The Department for Regional Development Northern Ireland 2011);
 - Calculation of Road Traffic Noise (CRTN) (The Department of Transport Welsh Office 1988);
 - The Noise Insulation (Scotland) Regulations (NISR) (HMSO 1975);
 - Memorandum on the Noise Insulation (Scotland) Regulations (Memorandum) (HMSO 1975);
 - The Environmental Noise (Scotland) Regulations (HMSO 2006);
 - Control of Pollution Act 1974 (HMSO 1974);
 - PAN 1/2011 Planning Advice Note – Planning and Noise (The Scottish Government 2011);
 - TAN: Technical Advice Note – Assessment of Noise (The Scottish Government 2011);
 - BS 5228:2009+A1:2014 "*Code of practice for noise and vibration control on construction and open sites*" Part 1 - Noise and Part 2 – Vibration (BSI 2014);
 - World Health Organisation (WHO) Guidelines for Community Noise (WHO 1999); and
 - WHO Night Noise Guidelines (NNG) for Europe (WHO 2009).
- 8.1.13 In addition, a review of relevant national, regional and local planning policies and guidance relevant to noise and vibration are identified below.

National Planning Policy and Guidance

- 8.1.14 National planning policy on a variety of themes is contained within Scottish Planning Policy (SPP) (The Scottish Government 2014). In terms of the impact of proposals on noise and vibration, SPP is focused on:
- supporting development that will contribute to sustainable economic growth and to high quality sustainable places; and

- supporting healthier living by improving the quality of the built environment and by addressing environmental problems affecting communities.

Regional and Local Planning Policy and Guidance

8.1.15 The Highland-wide Local Development Plan (HwLDP 2012) is the land use Plan which will guide the development and investment in the region over the next 20 years. The relevant policies in relation to noise and vibration include:

- Policy 28: Sustainable Design; and
- Policy 72: Pollution.

8.1.16 **Policy 28: Sustainable Design** states that:

'The Council will support developments which promote and enhance the social, economic and environmental wellbeing of the people of Highland. Proposed developments will be assessed on the extent to which they: [...] impact on individual and community residential amenity. Developments which are judged to be significantly detrimental in terms of the above criteria will not accord with this Local Development Plan. All development proposals must demonstrate compatibility with the Sustainable Design Guide: Supplementary Guidance, which requires that all developments should: conserve and enhance the character of the Highland area; use resources efficiently; minimise the environmental impact of development and enhance the viability of Highland communities'.

8.1.17 **Policy 72: Pollution** states that:

'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'.

8.1.18 Appendix A18.1 (Planning Policy Context for Environmental Assessment) describes the planning policies and guidance from national to local level which are relevant to noise and vibration. An assessment of the compliance of the proposed Scheme against all development plan policies relevant to this environmental topic report is reported in Appendix A18.2 (Assessment of Development Plan Policy Compliance) and a summary overview is provided in Section 18.4 (Assessment of Compliance) in Chapter 18 (Policies and Plans).

8.2 Methodology

Scope of Assessment (Study Area)

8.2.1 The assessment study area has been determined in accordance with paragraph A1.11 of DMRB, 'Noise and Vibration' which sets out the procedure for defining the 'study area' and 'calculation area'. The main study area extends 1 kilometre (km) from existing routes that are being improved or bypassed and any proposed new routes, between the start and end points of the physical works associated with the proposed Scheme. Within the 1km boundary the calculation area is then defined as being the area that extends:

- 600m from existing and bypassed and/or improved routes or new routes; and
- 600m from any affected routes within the 1km study area.

8.2.2 An affected route is defined as a road where there is a possibility of a $L_{A10,18h}$ 1dB or more change in noise levels as a consequence of the proposed Scheme in the short-term or a $L_{A10,18h}$ 3dB or more in the long-term. Roads where a change of at least 1dB is predicted to occur can be

determined by considering changes in traffic flow; where a 25% increase equates to an increase in noise of 1dB and a 20% decrease in the traffic flow equates to a 1dB decrease in noise level, assuming other factors remain unchanged. Similarly, a change in noise level of $L_{A10,18h}$ 3dB would be equivalent to an increase in traffic flows of 100% or a decrease of 50%, assuming other factors such as speed, road surface, gradient and % of HGV remain unchanged.

8.2.3 Noise levels are calculated at all identified noise sensitive receptors (NSRs) within the 600m calculation area, within the main 1km study area boundary. Outside the 1km boundary, the study area also includes land within a 50m boundary around any additional affected routes. Within these 50m boundaries, an assessment of noise impacts at NSRs is undertaken by simply considering the change in road traffic noise using the CRTN Basic Noise Level prediction methodology.

8.2.4 Figure 8.1 details both the study area and calculation areas used for the noise and vibration impact of the proposed Scheme.

Requirements of DMRB 'Noise and Vibration' Detailed Assessment

8.2.5 The DMRB 'Noise and Vibration' Detailed Assessment methodology requires consideration of permanent impacts including traffic noise, traffic nuisance and traffic induced vibration, together with temporary and cumulative impacts of the proposed Scheme.

8.2.6 In order to assess the potential permanent noise and vibration impacts for the DMRB 'Noise and Vibration' Detailed Assessment it is necessary to make comparisons of noise levels in the 'short-term' (i.e. in the baseline year which for this proposed Scheme is 2021) and 'long-term' (typically 15 years after project opening, which for this proposed Scheme is 2036), as follows:

- Do Minimum scenario in the Baseline Year (DM 2021) versus Do-Minimum scenario in the Future Assessment Year (DM 2036);
- Do-Minimum scenario in the Baseline Year (DM 2021) versus the Do-Something scenario in the Baseline Year (DS 2021); and
- Do-Minimum scenario in the Baseline Year (DM 2021) versus the Do-Something scenario in the Future Assessment Year (DS 2036).

Methods of Impact Assessment

8.2.7 It should be noted that whilst DMRB 'Noise and Vibration' provides guidance for the magnitude of noise level changes it does not provide any guidance on assessing the significance of noise effects. Accordingly the reported noise impacts have been assessed using the significance of noise impact scale provided in the Scottish Government's Technical Advice Note (TAN) (The Scottish Government 2011) which accompanies PAN 1/2011 (The Scottish Government 2011). The significance of impact matrix is based on the predicted noise levels, the magnitude of noise level change between each scenario (based on the magnitude of impact tables and the sensitivity of noise receptors (presented in the TAN)).

Sensitivity of Noise Sensitive Receptors

8.2.8 The sensitivity of NSRs to road traffic noise has been determined based on the criteria provided in Table 8.2 (reproduced from TAN Table 2.1).

Table 8.2: Criteria Used to Define Noise Sensitive Receptors

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

Magnitude of Noise Impacts

8.2.9 When considering two sounds with similar acoustic properties, i.e. similar spectral and temporal characteristics, a change of more than 3dB is regarded as being just perceptible to the human ear. It is generally accepted that changes in road traffic noise levels of up to 3dB are not widely perceptible, confirmed in the Department for Transport document Transport Appraisal Guidance Unit 3.3.2 (The Department for Transport 2014):

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

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

8.2.11 Section 3 of DMRB ‘Noise and Vibration’ provides guidance on the magnitude of impacts for road traffic noise. The magnitude of impacts is considered for both the short-term and long-term. A change in $L_{A10,18h}$ road traffic noise of 1dB in the short-term, for example, when a project is opened, is the smallest that is considered perceptible. In the long-term, a change in $L_{A10,18h}$ road traffic noise levels of 3dB is considered perceptible. The classification of noise impacts is detailed in Table 8.3 and Table 8.4, below (reproduced from DMRB ‘Noise and Vibration’ Tables 3.1 and 3.2).

Table 8.3: Short Term Road Traffic Noise Level Magnitude of Impacts

| Noise Level Change (Rounded to 0.1dB) $L_{A10,18h}$ | Magnitude of Impact |
|---|---------------------|
| 0.0 | no change |
| 0.1 – 0.9 | negligible |
| 1.0 – 2.9 | minor |
| 3.0 – 4.9 | moderate |
| 5.0+ | major |

Table 8.4: Long Term Road Traffic Noise Level Magnitude of Impacts

| Noise Level Change (Rounded to 0.1dB) $L_{A10,18h}/L_{night,outside}$ | 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 |

Significance of Noise Impacts

8.2.12 The significance of operational road traffic noise impacts will then be determined according to the relationship between magnitude and sensitivity, as shown in Table 8.5 (reproduced from TAN Table 2.6).

Table 8.5: Significance of Noise Impacts

| Magnitude | Sensitivity | | |
|------------|-----------------|----------------|------------------|
| | low | medium | high |
| Major | Slight/Moderate | Moderate/Large | Large/Very Large |
| Moderate | Slight | Moderate | Moderate/Large |
| Minor | Neutral/Slight | Slight | Slight/Moderate |
| Negligible | Neutral/Slight | Neutral/Slight | Slight |
| no change | Neutral | Neutral | Neutral |

Predicting Noise Levels – Noise Modelling

8.2.13 All road traffic noise levels have been calculated using the CadnaA® noise modelling software, which predicts the $L_{A10,18h}$ traffic noise level at dwellings and other receptor locations in accordance with CRTN. CadnaA® models have been predicted for the Baseline Year and the Future Assessment Year for the Do-Minimum and Do-Something Scenarios as described in paragraph 8.2.16 below. In accordance with DMRB ‘Noise and Vibration’, where noise levels are predicted at different façades of dwellings and other buildings, the summary of assessment results report the least beneficial change in noise level.

8.2.14 All calculations are based on predicted traffic flows and associated variables in the form of 18 Hour Annual Average Weekday Traffic (AAWT) for the Base, Opening and Future Years. Traffic data taken from the Moray Firth Transport Model (MFTM) for the following scenarios have been used:

- Base Year (BY 2014);
- Do-Minimum Opening Year (DM 2021);
- Do-Something Opening Year (DS 2021);
- Do-Minimum Design Year (DM 2036); and
- Do-Something Design Year (DS 2036).

8.2.15 It should be noted that the terminology used when referring to the MFTM is different from the terminology used in DMRB ‘Noise and Vibration’. Accordingly, where the MFTM refers to an Opening Year this is equivalent to the term Baseline Year in DMRB ‘Noise and Vibration’ and where the MFTM refers to a Design Year this is the equivalent of the Future Assessment Year in DMRB ‘Noise and Vibration’.

8.2.16 Additional CadnaA® noise model input data includes;

- road speeds in kilometres per hour (kph);

- HGV percentages;
- existing topography for the calculation area comprised of survey data undertaken for the proposed Scheme and supplemented with a 3D digital terrain model (DTM) 5m resolution height data;
- proposed topography (3D DTM data taken from the MX road design model);
- existing road surface types: all assumed to be impervious bitumen, such as hot rolled asphalt (HRA), with 2 millimetre (mm) texture depth;
- All new roads constructed on the dual carriageway and slip roads (with the exception of the slip roads at Brackley Junction and the eastbound off slip at Nairn West Junction) of the proposed Scheme will be low noise surfacing such as stone mastic asphalt (SMA);
- All new local roads constructed for the proposed scheme are assumed to be impervious bitumen, such as hot rolled asphalt (HRA), with 2 millimetre (mm) texture depth;
- Ground Absorption Factor: for open land and grassed areas (G=1); surfaces within residential areas (G=0.5) and roads and water (G=0);
- Existing building heights are assumed to be 8m high; and
- Small buildings are assumed to be 3m high. Small buildings have been identified where the ratio of the building perimeter and building area is less than 1.2.

Night-time Noise Assessment

- 8.2.17 Historically, the fact that there is much less traffic at night has meant that night-time noise assessments have not been undertaken as part of the DMRB 'Noise and Vibration' assessment process. However, due to the increasing use of the strategic road network by long distance goods traffic during night-time hours and the associated potential to increase the level of noise and the potential for disturbance at night, a night-time noise impact assessment is now to be considered as part of the DMRB 'Noise and Vibration' assessment process where an $L_{\text{night, outside}}$ noise level is greater than 55dB in any scenario. The $L_{\text{night, outside}}$ noise metric is the A-weighted average sound level over the eight hour night-time period of 23:00 – 07:00 hours.
- 8.2.18 The Transport Research Laboratory (TRL) report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (Abbott & Nelson 2002) has been used to derive the night-time noise levels for each scenario using Method 3 of the TRL report which converts the predicted daytime noise levels ($L_{A10,18h}$) to equivalent $L_{\text{night, outside}}$.

Noise Nuisance Assessment

- 8.2.19 The term 'nuisance' in DMRB 'Noise and Vibration' means the percentage of people bothered by traffic noise (i.e. those who say they are 'very much' or 'quite a lot' bothered on a four point worded scale). The response to noise by individuals varies widely. However, average or community response is deemed to be relatively stable, with community average degree of annoyance, associated with long-term average exposure. Consequently, change in average noise emission levels between assessed scenarios, together with estimates of population density, based on residential property counts and assumptions on the numbers of residents per property, enable changes in estimated populations annoyed to be determined.
- 8.2.20 DMRB 'Noise and Vibration' states the following noise nuisance assessments should be undertaken:
- Do-Minimum scenario in the Baseline Year against Do-Minimum scenario in the Future Assessment Year; and
 - Do-Minimum scenario in the Baseline Year against Do-Something scenario in the Future Assessment Year.
- 8.2.21 DMRB 'Noise and Vibration' states that the change in DMRB 'Noise and Vibration' defined noise nuisance should be carried out for each property where noise calculations have been undertaken.

Due to variability in individual responses, DMRB 'Noise and Vibration' recommends that community annoyance ratings are used for each noise level. It is therefore important to note that the results of the DMRB 'Noise and Vibration' nuisance assessment should not be related to individual annoyance responses.

- 8.2.22 The DMRB 'Noise and Vibration' method of assessing traffic noise and vibration nuisance is outlined in Annex 6 DMRB 'Noise and Vibration'.

Noise Insulation Assessment

- 8.2.23 There is consideration of the number of properties that are likely to be eligible for statutory insulation. The Noise Insulation (Scotland) Regulations 1975 (NISR) provide for acoustic insulation to be offered for residential properties. The qualifying criteria are detailed within the Regulations and within the Memorandum on the Noise Insulation (Scotland) Regulations 1975 (NISR Memorandum), Regulations 3 and 6. The qualifying criteria area as follows:

- the properties are situated within 300m of the proposed Scheme;
- the properties lie within the triangular area at the terminal point of the new dual carriageway, the apexes of which are 50m along the centreline of the existing A96 from the terminal point of the bases of which extend from points 300m on either side of the proposed Scheme to the nearest point on the dual carriageway, at right angles to the centreline of the dual carriageway;
- a straight line can be drawn from any point of the property to a point on the dual carriageway without passing another building;
- the use of the road causes, or is expected to cause, noise at a level not less than $L_{A10,18h}$ 68dB; and
- the property will experience noise levels exceeding the 'prevailing noise level' by at least 1.0dB.

Noise Mitigation Threshold Criteria

- 8.2.24 Potential mitigation measures have been considered during this assessment and take into account best practice, legislation, guidance and professional experience.

- 8.2.25 As described in Chapter 1 (Introduction) and Chapter 5 (Overview of Assessment) the mitigation commitments and monitoring frameworks are identified in the Strategic Environmental Assessments (SEAs) for the Strategic Transport Projects Review (STPR) (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 2008) and A96 Dualling Programme (CH2M 2015 and 2016) have also been taken into consideration in relation to the mitigation proposals.

- 8.2.26 The mitigation commitments relevant to this assessment of noise and vibration detailed within the STPR SEA include:

- Noise reduction mitigation should include road surfaces which generate lower levels of traffic noise and / or noise barriers, where adjacent properties could be affected; and
- The routing of construction traffic should be detailed in a transport management plan before construction begins to reduce effects on sensitive receptors.

- 8.2.27 The mitigation commitments relevant to this assessment of noise and vibration detailed within the A96 Dualling Programme SEA include:

- Route choice to take account of proximity of operational road traffic effects on receptors in populated areas to reduce potential noise and other adverse amenity effects (including community severance); and
- Use of noise barriers and other acoustic screening as appropriate to be considered in locations where road traffic could increase noise impacts at nearby properties.

- 8.2.28 The specific mitigation measures in relation to the proposed Scheme are discussed further in Section 8.6 (Mitigation).

- 8.2.29 For guidance on the effects of noise, reference can be made to the current World Health Organisation (WHO) document entitled 'Community Noise' (WHO 1999). This document does not contain recommendations, but provides guideline values based on the precautionary principle. The WHO document states that *'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development'*. For the purposes of this noise impact assessment it is considered that mitigation would be considered where the noise level exceeds $L_{Aeq,T}$ 55dB in order to protect the majority of people from being seriously annoyed.
- 8.2.30 The WHO refers to a daytime time base of 16 hours ($L_{Aeq,16h}$), and CRTN predictions are in terms of $L_{A10,18h}$. To convert the WHO $L_{Aeq,16h}$ to $L_{A10,18h}$ a correction of approximately +2dB is required, with a further +2.5dB necessary to translate into façade levels. When this conversion is applied to 55dB $L_{Aeq,16h}$, this results in an equivalent threshold façade level of 59.5dB $L_{A10,18h}$.
- 8.2.31 Ideally, mitigation would be implemented, where practicable, where the significance of impact is 'Slight/Moderate adverse' or worse at ground floor for both short and long-term impacts. This is an onerous target as mitigation is therefore considered where there is an increase of greater than 1dB in the short-term (in recognition of the sudden change effects as reported within DMRB 'Noise and Vibration'), or 3dB in the long-term, irrespective of the absolute noise level, and must be applied with caution in rural areas where there are at present low levels of road traffic noise.
- 8.2.32 In addition, it is necessary that in all cases where it is considered, mitigation should comply with acceptable standards in terms of traffic, safety, environmental and economic issues (DMRB Volume 11, Section 3, Part 7, HD213/11 Noise and Vibration Chapter 4 – Design and Mitigation, paragraph 4.10 (Highways Agency, Transport Scotland, Welsh Government and The Department for Regional Development Northern Ireland 2011)). Examples which could preclude the use of mitigation are disproportionate cost and unacceptable visual impact.
- 8.2.33 In summary, taking into account the above WHO and DMRB guidance, mitigation is considered where the significance of impact at a receptor has been assessed as Slight/Moderate adverse or worse, and where the predicted ground floor façade level exceeds 59.5dB $L_{A10,18h}$. In addition, mitigation taking cognisance of the WHO Night Noise Guidelines publication has also been considered during the night-time period in the long-term where the significance of impact at a receptor has been assessed as Slight/Moderate adverse or worse, and where the predicted noise level exceeds 55dB $L_{night,outside}$.
- 8.2.34 In general, mitigation will be considered in terms of incorporated mitigation that is included as part of the proposed Scheme such as road alignment and lower noise road surfacing, and receptor specific mitigation for the properties identified as per the mitigation strategy. Receptor specific mitigation measures could comprise acoustic screens of various forms and/or revised earthworks. This can be summarised as shown in Table 8.6.

Table 8.6: Summary of General Aim of Measures Employed to Address Potential Noise Impacts

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

Vibration

- 8.2.35 The DMRB 'Noise and Vibration' Detailed Assessment requires an assessment of traffic induced vibration, including an assessment of the numbers of people bothered by airborne vibration. It should be appreciated that the vibration assessments are for comparison only and, as such, are

not indicative of an individual's responses. Also, only properties within approximately 40m of the centre line which have predicted or measured road traffic noise levels greater than 58dB $L_{A10,18h}$ will be included. This is because the DMRB 'Noise and Vibration', vibration-bothered relationship is only validated up to a distance of 40m.

- 8.2.36 DMRB 'Noise and Vibration' requires that the following vibration assessments should be undertaken:
- Do-Minimum scenario in the Baseline Year against the Do-Minimum scenario in the Future Assessment Year; and
 - Do-Minimum scenario in the Baseline Year against the Do-Something scenario in the Future Assessment Year.
- 8.2.37 With regard to ground-borne vibration, this should be assessed if considered to be a potential issue adjacent to existing roads. TRL report 246 (Watts, G.R. 1990) indicates that ground-borne vibration should not be significant for residents located adjacent to smooth and well maintained road surfaces free of discontinuities and potholes. In the future, should ground-borne vibration complaints arise, it is likely that following suitable dual carriageway repairs these would cease. Hence, road traffic induced ground-borne vibration is not considered to be an issue for the proposed Scheme.

Methodology for the Assessment of Construction and Vibration Impacts

- 8.2.38 Guidance on the approach to control construction noise is contained within British Standard BS 5228: Part 1:1997 and Part 4:1992 Noise and Vibration Control on Construction and Open Sites¹. BS 5228 states that '*Good relations with people living and working in the vicinity of site operations are of paramount importance*'. It suggests that the early establishment and maintenance of these relations throughout the contract would go some way to allaying people's fears.
- 8.2.39 The standard also advises that it is not possible to provide detailed guidance for determining whether or not noise from a site would constitute a problem in a particular situation as a number of factors would affect the acceptability of the site noise and vibration. These factors are:
- site location;
 - existing ambient noise and vibration levels;
 - duration of site operations;
 - hours of work;
 - attitude to site operator; and
 - noise and vibration characteristics.
- 8.2.40 The level of noise experienced by inhabitants in the vicinity would vary according to the following factors:
- sound power outputs of processes and plant;
 - periods of operation of processes and plant;
 - distance from source(s) to receiver(s);
 - presence of screening by barriers;
 - reflection of sound associated with topographical features;
 - phasing/programming of demolition works;

¹ It should be noted that a newer version of BS 5228 came into force on 1 January 2009, which was subsequently amended in February 2014. At present the previous 1997 version is still officially approved under Section 71 of the Control of Pollution Act 1974 via The Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002. Therefore BS 5228: Part 1:1997 and Part 4:1992 are still referred to in this context. However, it is recommended that the most up to date versions of BS 5228 be followed when assessing potential noise and vibration impacts from the proposed Scheme.

- soft ground attenuation; and
- meteorological factors.

Control of Pollution Act 1974

- 8.2.41 To facilitate accurate prediction of noise levels it is necessary to know working methods, timing and phasing of the works and the number and type of plant likely to be used. At this stage such information is not available.
- 8.2.42 However, should the proposed Scheme proceed and a Contractor be appointed an assessment would be required. Whilst residents may accept that it is inevitable that, as with any major infrastructure development, there would be some disturbance caused to those living nearby during the construction phase and that the provisions of Sections 60 and 61 of the Control of Pollution Act 1974 offers some protection to them. Section 60 enables a local authority to serve a notice specifying its noise control requirements covering:
- plant or machinery that is or is not be used;
 - hours of working; and
 - levels of noise or vibration that can be emitted.
- 8.2.43 Section 61 relates to prior consent, and is for situations where a contractor or developer takes the initiative and approaches the local authority before work starts to obtain approval for the methods to be used and any noise and vibration control techniques that may be required. In response to the DMRB Stage 3: A96 Screening and Scoping Report (Jacobs 2015), The Highland Council have stated that *'If there is a risk of serious disturbance, it may be advisable to apply for a consent under Section 61 of the above Act'*. In addition it is stated *'It is expected that the developer/contractor will employ the best practicable means to reduce the impact of noise from construction activities'*.
- 8.2.44 With regard to construction noise impacts BS 5228-1:2009+A1:2014 Annex E provides examples of criteria for the assessment of the potential significance of noise effects and the adoption of any of these examples should be fully justified.
- 8.2.45 BS 5228-2:2009+A1:2014 provides recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry specific guidance. With consideration to the nature and size of the proposed Scheme as well as the likely construction processes, it is considered that any required blasting, piling or heavy earthmoving processes are the key on site activities that have the potential to give rise to significant vibration impacts outside of the proposed Scheme boundary.

Consultation

- 8.2.46 The Highland Council's Environmental Health Department was consulted regarding the baseline noise survey and the assessment methodology. Both noise monitoring locations and the noise measurement periods were agreed with an Environmental Health Officer from The Highland Council via telephone and email during the week ending 16 October 2015.

Limitations

- 8.2.47 The prediction method detailed within the NISR Memorandum for considering requirements for statutory noise insulation has been updated for use in England and Wales since its publication. However, this update has not yet been incorporated into the NISR or NISR Memorandum. Whilst DMRB 'Noise and Vibration' does require the use of the method detailed within the NISR Memorandum for determination of NISR eligibility in Scotland, the prediction methodology employed in this assessment uses the more detailed and accurate predictive methods set out in CRTN. However, to facilitate compliance with NISR this indicative assessment of eligibility uses a proxy CRTN predicted level of $L_{A10,18h}$ 65dB as a preliminary indicator of the need to utilise the full NISR Memorandum methodology in assessment of eligibility, where all other qualifying criteria are met.

8.3 Baseline Description and Evaluation

8.3.1 A baseline noise survey was undertaken to establish the existing ambient noise within the study area. Ambient noise monitoring allows existing road traffic noise sources in addition to other sources of noise to be measured and observed prior to the proposed Scheme construction and operation.

8.3.2 In order to obtain an overview of the existing ambient noise environment at NSRs within the vicinity of the proposed Scheme, 27 monitoring locations were identified to undertake unattended baseline noise level measurements and agreed with the Environmental Health Department of The Highland Council. These properties were considered to be representative of their surrounding locale. The baseline noise monitoring locations are provided in Table 8.7 below and also in Figure 8.2.

Table 8.7: Baseline Noise Monitoring Locations

| ID | Address | Grid Reference | |
|-------|--|----------------|----------|
| | | Easting | Northing |
| NV001 | Roseacre, Stratton, Inverness, IV2 7NS | 270214 | 846323 |
| NV002 | Brambly Hedge, Milton of Culloden, Inverness, IV2 7NU | 270675 | 846792 |
| NV003 | 6 Milton of Culloden, Inverness, IV2 7NU | 271051 | 846943 |
| NV004 | The Bungalow, Allanfearn, Inverness, IV2 7JX | 271759 | 847372 |
| NV005 | 117 Hazel Avenue, Culloden, Inverness, IV2 7JX | 271748 | 847035 |
| NV006 | Thornhill, Cullernie Road, Balloch, Inverness, IV2 7HU | 273131 | 847490 |
| NV007 | Morayston Farmhouse, Dalcross, Inverness, IV2 7JQ | 275141 | 848920 |
| NV008 | 3 Kerrowaird Cottage, Dalcross, Inverness, IV2 7JQ | 276138 | 849753 |
| NV009 | Woodend House, Dalcross, IV2 7JJ | 276508 | 850750 |
| NV010 | 1 Culblair Farm Cottages, Dalcross, Inverness, IV2 7JJ | 277769 | 851387 |
| NV011 | Milton of Braichlaich Farm, Inverness, IV2 7QT | 278961 | 852097 |
| NV012 | Brackley Farmhouse, Gollanfield, Inverness, IV2 7QT | 280247 | 852136 |
| NV013 | New House, Easter Glackton Road, Gollanfield, Inverness, IV2 7UR | 282210 | 853283 |
| NV014 | Blackcastle Cottage, Inverness Road, Inverness, Nairn, IV2 7QP | 283180 | 854197 |
| NV015 | New House, North Kildrummie Farm, Nairn, IV12 5NZ | 284954 | 854476 |
| NV016 | Athenry, Balnaspirach, Nairn, IV12 5NY | 286089 | 854393 |
| NV017 | Fonn, Cawdor Road, Nairn, IV12 5QU | 287245 | 853705 |
| NV018 | Skene Park Farm, Auldearn, IV12 5RY | 289109 | 854442 |
| NV019 | Blackpark Farm, Kinsteary, Auldearn, Nairn, IV12 5HY | 289729 | 854904 |
| NV020 | Orchard House, Kinnudie Farm, Auldearn, IV12 5QF | 291003 | 855347 |
| NV021 | Millhill, Auldearn, Nairn, IV12 5JU | 291276 | 856400 |
| NV022 | East Lodge Cottage, Boath, Auldearn, IV12 5JU | 291809 | 856145 |
| NV023 | 3 The Steading, Auldearn, Nairn, IV12 5JY | 292546 | 855611 |
| NV024 | Penick Farmhouse, Auldearn, Nairn, IV12 5QG | 293456 | 856118 |
| NV025 | Innesfree, Auldearn, Nairn, IV12 5QG | 294034 | 855584 |
| NV026 | Hardmuir of Boath, Auldearn, Nairn, IV12 5QG | 295127 | 855699 |
| NV027 | The Gate Lodge, Gollanfield, Inverness, IV2 7QP | 281117 | 853245 |

8.3.3 In addition to the noise monitoring at the above selected residential receptors further monitoring was undertaken at 10 locations along the existing A96 as shown in Table 8.8 and Figure 8.2. These measurements were undertaken in accordance with the shortened measurement methodology prescribed in the CRTN. These measurements were then compared against predicted noise level measurements in order to validate the noise model.

Table 8.8: CRTN Road Traffic Noise Measurements

| ID | Approximate Location/Address | Grid Reference | |
|-------|---|----------------|----------|
| | | Easting | Northing |
| NV028 | Seafield, Inverness adjacent to A96 | 269776 | 845970 |
| NV029 | Ozzy's Restaurant adjacent to A96 | 280190 | 852294 |
| NV030 | Properties at Sandown Road/Russell Place, Nairn adjacent to A96 | 286594 | 855904 |
| NV031 | Properties at Rowan Place, Nairn adjacent to A96 | 286962 | 855966 |
| NV032 | Properties at Inverness Road/Elmgrove adjacent to A96 | 287554 | 856026 |
| NV033 | Properties at Newton Gate, Nairn adjacent to A96 | 287777 | 856243 |
| NV034 | Rosebank Primary School/Properties at Academy Street, Nairn adjacent to A96 | 288053 | 856430 |
| NV035 | Properties at Macrae Avenue/Merryton Crescent, Nairn adjacent to A96 | 288808 | 856485 |
| NV036 | Properties at Suttors Avenue, Nairn adjacent to the A96 | 289235 | 856251 |
| NV037 | Properties at Doocot Road, Auldearn adjacent to A96 | 291938 | 855673 |

8.3.4 The noise survey was undertaken between January 2016 and March 2016. At measurement locations NV001 to NV027 noise monitoring equipment was left unattended within the garden area of the NSR for a period of three to seven days. Although the monitoring was unattended, survey staff did visit each location for a period of 20 to 30 minutes in the morning, afternoon and evening periods in order to subjectively characterise the noise climate and make detailed notes on meteorological conditions.

8.3.5 At measurement locations NV028 to NV037, noise level measurements of the existing road traffic noise level on the existing A96 was undertaken in accordance with the shortened measurement methodology prescribed in CRTN.

8.3.6 Appendix A8.2 (Detailed Baseline Noise Survey Results and Notes) provides detailed site, notes, photographs and noise levels measured at each of the monitoring locations. However, for ease of reference the average measured $L_{A10,18h}$, $L_{Aeq,16h}$ and $L_{night,outside}$ noise levels over the survey periods are summarised in Table 8.9 for the unattended baseline noise measurements. Whereas the measured $L_{A10,3h}$, $L_{Aeq,3h}$, $L_{A90,3h}$ and $L_{AFmax,3h}$ noise levels during the CRTN are presented in Table 8.10.

Table 8.9: Summary of Unattended Baseline Noise Measurements

| ID | Address/ Representative Location | Average Measured Noise Levels (dB) | | |
|-------|----------------------------------|------------------------------------|---------------|---------------------|
| | | $L_{A10,18h}$ | $L_{Aeq,16h}$ | $L_{night,outside}$ |
| NV001 | Roseacre | 59.4 | 58.5 | 52.9 |
| NV002 | Brambly Hedge | 52.4 | 52.8 | 47.9 |
| NV003 | 6 Milton of Culloden | 64.7 | 62.1 | 56.5 |
| NV004 | The Bungalow | 52.1 | 51.3 | 44.2 |
| NV005 | 117 Hazel Avenue | 49.7 | 50.4 | 42.9 |
| NV006 | Thornhill | 56.5 | 54.0 | 48.8 |
| NV007 | Morayston Farmhouse | 56.8 | 55.5 | 48.7 |
| NV008 | 3 Kerrowaird Cottages | 63.6 | 61.2 | 55.0 |
| NV009 | Woodend House | 47.8 | 53.5 | 48.8 |
| NV010 | 1 Culblair Farm Cottages | 52.9 | 52.3 | 48.1 |
| NV011 | Milton of Braichlaich Farm | 52.3 | 55.0 | 44.4 |
| NV012 | Brackley Farmhouse | 57.1 | 55.3 | 50.2 |
| NV013 | New House, Easter Glackton Road | 53.5 | 54.0 | 46.8 |
| NV014 | Blackcastle Cottage | 54.3 | 53.2 | 48.1 |
| NV015 | New House, North Kildrummie Farm | 43.9 | 48.7 | 39.1 |
| NV016 | Athenry | 43.9 | 45.7 | 39.2 |
| NV017 | Fonn | 45.6 | 47.1 | 38.5 |
| NV018 | Skene Park Farm | 42.9 | 43.1 | 36.4 |

| ID | Address/ Representative Location | Average Measured Noise Levels (dB) | | |
|-------|----------------------------------|------------------------------------|----------------------|----------------------------|
| | | L _{A10,18h} | L _{Aeq,16h} | L _{night,outside} |
| NV019 | Blackpark Farm | 38.9 | 52.3 | 33.2 |
| NV020 | Orchard House | 42.3 | 42.9 | 37.4 |
| NV021 | Millhill | 50.4 | 49.8 | 44.6 |
| NV022 | East Lodge Cottage | 48.4 | 49.2 | 45.2 |
| NV023 | 3 The Steading | 56.6 | 54.5 | 47.9 |
| NV024 | Penick Farmhouse | 51.9 | 51.9 | 45.8 |
| NV025 | Innesfree | 53.0 | 54.8 | 46.0 |
| NV026 | Hardmuir of Boath Farmhouse | 51.8 | 52.0 | 44.5 |
| NV027 | The Gate Lodge | 51.5 | 51.2 | 43.7 |

Table 8.10: Summary of Attended 3-hour Shortened CRTN Noise Measurements

| ID | Address/Representative Location | Noise Levels (dB) | | | | |
|-------|---|----------------------|---------------------|---------------------|---------------------|-----------------------|
| | | Predicted | | Measured | | |
| | | L _{A10,18h} | L _{A10,3h} | L _{Aeq,3h} | L _{A90,3h} | L _{AFmax,3h} |
| NV028 | Seafield | 79.4 | 80.4 | 76.8 | 71.1 | 87.6 |
| NV029 | Ozzy's Restaurant | 77.3 | 78.3 | 74.1 | 56.7 | 97.8 |
| NV030 | Sandown Road/Russell Place | 76.4 | 77.4 | 73.1 | 55.0 | 87.0 |
| NV031 | Rowan Place | 72.4 | 73.4 | 69.3 | 55.2 | 82.0 |
| NV032 | Inverness Road/Elmgrove | 73.6 | 74.6 | 71.2 | 59.8 | 88.0 |
| NV033 | Newton Gate | 74.4 | 75.4 | 72.4 | 62.9 | 87.6 |
| NV034 | Rosebank Primary School/ Academy Street | 72.7 | 73.7 | 70.6 | 61.7 | 88.1 |
| NV035 | Macrae Avenue/Merryton Crescent | 73.0 | 74.0 | 70.8 | 56.6 | 94.1 |
| NV036 | Suttors Avenue | 74.6 | 75.6 | 72.0 | 56.0 | 88.0 |
| NV037 | Doocot Road | 78.3 | 79.3 | 74.3 | 53.4 | 90.2 |

8.4 Impacts – Construction

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

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

- the noise generated by plant or equipment used on site, generally expressed as sound power levels (SWL);
- the periods of operation of the plant on the site, known as its 'on-time';
- the distance between the noise source and the receptor; and
- the attenuation due to ground absorption, air absorption and barrier effects.

8.4.3 In order to evaluate the noise during the demolition and construction phase it is necessary to have knowledge of the various activities that would be undertaken. Contractors may use different working methods and plant to achieve the same ends. An accurate demolition and construction noise and vibration impact assessment is not normally possible until appointment of the approved Contractor with knowledge of the exact working routine and plant schedule. However, during the construction phase the use of plant, and the likely noise impact thereof, would be determined following the guidance detailed in BS 5228:2009+A1:2014 and, where necessary, mitigation would be provided. Moreover, should complaints be received from local residents, the local authority would determine whether the best practicable means is being applied. Therefore, best practicable means would be employed to ensure that noise levels are minimised. Outline mitigation measures to minimise construction impacts can be found in Section 8.6 (Mitigation).

- 8.4.4 It is likely that the potentially worst affected noise sensitive receptors to construction noise would be those located directly adjacent to the proposed Scheme, with lesser impacts at those properties located adjacent to the existing road network due to potential increase in HGV movements.
- 8.4.5 Disturbance due to construction noise from a proposed Scheme of this sort, although it may be significant, is usually short-term since the period of noisy construction work is relatively limited and disturbance is normally reversed once the noisy parts of the construction phase are completed.
- 8.4.6 Although a quantitative assessment of construction noise impacts has not been undertaken, it is not unreasonable to assume that, without mitigation, the significance of construction noise impacts may result in temporary, short-term impacts of Moderate/Large adverse significance at the NSRs closest to the works.
- 8.4.7 The NSRs that are likely to be most exposed to temporary construction noise impacts are those located adjacent to the proposed Scheme. The 2008 version of DMRB 'Noise and Vibration' previously advised that construction impacts should be considered by providing an estimate of the number of dwellings within 100m of the proposed Scheme alignment.
- 8.4.8 In practice, construction noise levels and resulting impacts are likely to vary during the different construction phases of the proposed Scheme depending upon the works activities, location and proximity of receptors. Furthermore, best practicable means of mitigation will be employed to minimise construction noise impacts.
- 8.4.9 Concern is often expressed by local residents that vibration from construction activities could cause structural damage to their properties. However DMRB 'Noise and Vibration states that *'it has been shown that vibrations that can be felt indoors and which often cause occupants anxiety are an order of magnitude smaller than would be needed to activate pre-existing strains and cause cracks to propagate. It should be borne in mind that superficial cracks in plaster around openings such as doors and windows can often appear during the life of a building'*.
- 8.4.10 Surface plant, such as cranes, compressors and generators, are not recognised as sources of high levels of environmental vibration. Also, it is generally accepted that without a highly detailed understanding of the media, waveform and frequency distribution, ground-borne vibration prediction methods are complex and beset with uncertainties. Whilst it is considered unlikely that typical road construction working methods would generate levels of vibration at local receptors above which cosmetic damage would be expected to be sustained, given the proximity of some NSRs to the proposed Scheme there is the potential that vibration impacts could cause complaints at the closest NSRs. However, the level of impact at different receptors would be dependent upon a number of factors including the precise distance between the works and NSR, ground conditions and activities being undertaken at any given time. Based upon professional judgement at this stage, as a worst case and without mitigation in place, vibration impacts of up to Moderate adverse significance might be experienced by the nearest residents to the works.
- 8.4.11 Where heavy earthwork, piling, or other significant vibration producing operations are proposed in the vicinity of existing NSRs, further consideration should be given to potential impacts once the main works Contractor is appointed and the construction requirements are developed. Potential mitigation measures are discussed in Section 8.6 (Mitigation).

8.5 Impacts – Operation

- 8.5.1 Tables 8.11 to Table 8.14 summarises the modelled noise impacts at the 27 Sample NSRs identified in Table 8.7, whilst the results for all 8,187 NSRs modelled are provided in Appendix A8.3 (Predicted Noise Levels at Receptors). In the following tables, where reference is made to the predicted daytime and night-time noise levels, the assessment corresponds to both the ground and first floors of all buildings. Noise contour change maps for the DM 2021 versus the DM 2036, the DM 2021 versus the DS 2021 and DM 2021 versus the DS 2036 scenarios are provided in Figures 8.3 to 8.8 for first and ground floor respectively. Furthermore, maps showing the predicted noise levels at the Sample NSRs locations at ground and first floor during the daytime period are provided in Figures 8.14 and 8.15. The respective predicted noise levels during the night-time period are provided in Figures 8.18 and 8.19.

8.5.2 It is important to note that the methodology of DMRB ‘Noise in Vibration’ requires that the least beneficial change in noise level is reported. Accordingly, the DM 2021 noise levels in each of the tables may be different for the same sample NSR. This is because, for example, in the DM 2021 versus the DM 2036 scenario the least beneficial noise impact may occur at the façade of a property facing the existing A96, whereas in the DM 2021 versus the DS 2021/DS2036 scenario the opposite façade of a property could show the least beneficial noise impact, as it is facing the proposed Scheme.

Sample NSR Locations

Long Term Assessment Without the Proposed Scheme

Day

8.5.3 The predicted noise levels at the Sample NSRs for the DM 2021 and the DM 2036 with the associated long-term significance of impacts for the daytime period are presented in Table 8.11.

Table 8.11: Sample NSRs – DM 2021 vs. DM 2036 – Day (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|------------------------|-------------|------------|------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DM 2036 | Significance of Impact | DM 2021 | DM 2036 | Significance of Impact |
| NV001 | Roseacre | 53.7 | 53.7 | Neutral | 56.4 | 56.5 | Slight adverse |
| NV002 | Brambly Hedge | 56.6 | 56.6 | Neutral | 59.2 | 59.2 | Neutral |
| NV003 | 6 Milton of Culloden | 61.8 | 61.8 | Neutral | 63.3 | 63.3 | Neutral |
| NV004 | The Bungalow | 49.0 | 48.7 | Slight beneficial | 50.6 | 50.3 | Slight beneficial |
| NV005 | 117 Hazel Avenue | 50.7 | 50.2 | Slight beneficial | 51.7 | 51.2 | Slight beneficial |
| NV006 | Thornhill | 58.7 | 58.9 | Slight adverse | 60.2 | 60.5 | Slight adverse |
| NV007 | Morayston Farmhouse | 49.1 | 49.2 | Slight adverse | 51.1 | 51.2 | Slight adverse |
| NV008 | 3 Kerrowaird Cottages | 73.8 | 73.9 | Slight adverse | 74.9 | 75.0 | Slight adverse |
| NV009 | Woodend House | 42.2 | 43.4 | Slight adverse | 44.0 | 45.1 | Slight adverse |
| NV010 | 1 Culblair Farm Cottages | 49.2 | 49.4 | Slight adverse | 50.7 | 50.9 | Slight adverse |
| NV011 | Milton of Braichlaich Farm | 50.1 | 50.2 | Slight adverse | 51.4 | 51.5 | Slight adverse |
| NV012 | Brackley Farmhouse | 51.0 | 51.7 | Slight adverse | 52.6 | 53.3 | Slight adverse |
| NV013 | New House, Easter Glackton Road | 55.1 | 55.3 | Slight adverse | 55.7 | 55.9 | Slight adverse |
| NV014 | Blackcastle Cottage | 66.9 | 67.1 | Slight adverse | 68.0 | 68.2 | Slight adverse |
| NV015 | New House, North Kildrummie Farm | 44.9 | 45.2 | Slight adverse | 46.6 | 46.9 | Slight adverse |
| NV016 | Athenry | 33.1 | 33.6 | Slight adverse | 35.2 | 35.6 | Slight adverse |
| NV017 | Fonn | 30.2 | 32.4 | Slight adverse | 31.4 | 33.6 | Slight adverse |
| NV018 | Skene Park Farm | 35.2 | 37.1 | Slight adverse | 36.7 | 38.6 | Slight adverse |
| NV019 | Blackpark Farm | 40.3 | 41.9 | Slight adverse | 41.7 | 43.3 | Slight adverse |

| ID | Address/ Representative Location | Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) | | | | | |
|-------|--|---|------------|------------------------|-------------|------------|------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DM 2036 | Significance of Impact | DM 2021 | DM 2036 | Significance of Impact |
| NV020 | Orchard House | 43.4 | 44.9 | Slight adverse | 44.7 | 46.2 | Slight adverse |
| NV021 | Millhill | 49.5 | 50.2 | Slight adverse | 51.0 | 51.7 | Slight adverse |
| NV022 | East Lodge Cottage | 49.2 | 49.9 | Slight adverse | 50.3 | 51.0 | Slight adverse |
| NV023 | 3 The Steading | 57.1 | 57.7 | Slight adverse | 57.9 | 58.5 | Slight adverse |
| NV024 | Penick Farmhouse | 36.1 | 36.8 | Slight adverse | 41.3 | 42.0 | Slight adverse |
| NV025 | Innesfree | 58.5 | 59.1 | Slight adverse | 59.8 | 60.4 | Slight adverse |
| NV026 | Hardmuir of Boath Farmhouse | 50.9 | 51.5 | Slight adverse | 51.7 | 52.3 | Slight adverse |
| NV027 | The Gate Lodge | 53.8 | 54.0 | Slight adverse | 56.1 | 56.3 | Slight adverse |

- 8.5.4 The results show that in general, over the 15 year period from 2021 to 2036 without the proposed Scheme, noise levels are expected to increase for both the day and night-time periods at the sample properties and would have a Slight adverse significance which can be attributed to the anticipated normal traffic growth. The exceptions are property IDs NV002 and NV003 where there is predicted to be a Neutral significance at the ground and first floors, property ID NV001 where there is predicted to be a Neutral significance at the ground floor and property IDs NV004 and NV005 where there is predicted to be a Slight beneficial significance at the ground and first floors..

Night

- 8.5.5 The analysis of night-time noise levels have shown that there are two sample receptors with noise levels in excess of $L_{night, outside}$ 55dB, in the long-term without the proposed Scheme. The night-time assessment results at these two dwellings are shown in Table 8.12.

Table 8.12: Sample NSRs – DM 2021 vs. DM 2036 – Night (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted $L_{night, outside}$ (dB) Noise Level (Free Field at Façade) | | | | | |
|-------|--|--|------------|------------------------|-------------|------------|------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DM 2036 | Significance of Impact | DM 2021 | DM 2036 | Significance of Impact |
| NV008 | 3 Kerrowaird Cottages | 60.4 | 60.5 | Slight adverse | 61.4 | 61.5 | Slight adverse |
| NV014 | Blackcastle Cottage | 54.2 | 54.4 | Slight adverse | 55.2 | 55.4 | Slight adverse |

Short Term Assessment at with the Proposed Scheme

Day

- 8.5.6 The predicted noise levels at the Sample NSRs for the DM 2021 and the DS 2021 with the associated short-term significance of impacts for the daytime period are presented in Table 8.13.

Table 8.13: Sample NSRs – DM 2021 vs. DS 2021 – Day (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|--------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV001 | Roseacre | 53.7 | 55.9 | Slight/ Moderate adverse | 56.4 | 57.2 | Slight adverse |
| NV002 | Brambly Hedge | 55.9 | 60.4 | Moderate/ Large adverse | 56.6 | 60.3 | Moderate/ Large adverse |
| NV003 | 6 Milton of Culloden | 52.1 | 59.4 | Large/ V. Large adverse | 53.7 | 60.6 | Large/ V. Large adverse |
| NV004 | The Bungalow | 49.4 | 58.3 | Large/ V. Large adverse | 49.9 | 58.4 | Large/ V. Large adverse |
| NV005 | 117 Hazel Avenue | 50.5 | 57.1 | Large/ V. Large adverse | 51.5 | 58.3 | Large/ V. Large adverse |
| NV006 | Thornhill | 46.0 | 48.7 | Slight/ Moderate adverse | 47.8 | 50.4 | Slight/ Moderate adverse |
| NV007 | Morayston Farmhouse | 39.9 | 51.1 | Large/V. Large adverse | 44.7 | 54.1 | Large/V. Large adverse |
| NV008 | 3 Kerrowaird Cottages | 48.7 | 55.7 | Large/ V. Large adverse | 51.5 | 57.2 | Large/ V. Large adverse |
| NV009 | Woodend House | 41.6 | 48.0 | Large/ V. Large adverse | 43.3 | 49.2 | Large/ V. Large adverse |
| NV010 | 1 Culblair Farm Cottages | 39.1 | 53.4 | Large/ V. Large adverse | 42.5 | 55.1 | Large/ V. Large adverse |
| NV011 | Milton of Braichlaich Farm | 38.6 | 45.1 | Large/ V. Large adverse | 41.5 | 47.2 | Large/ V. Large adverse |
| NV012 | Brackley Farmhouse | 52.0 | 54.8 | Slight/ Moderate adverse | 58.8 | 60.8 | Slight/ Moderate adverse |
| NV013 | New House, Easter Glackton Road | 53.1 | 56.2 | Moderate/ Large adverse | 53.7 | 56.9 | Moderate/ Large adverse |
| NV014 | Blackcastle Cottage | 52.1 | 58.3 | Large/ V. Large adverse | 55.7 | 60.3 | Moderate/ Large adverse |
| NV015 | New House, North Kildrummie Farm | 37.3 | 58.2 | Large/ V. Large adverse | 39.1 | 59.0 | Large/ V. Large adverse |
| NV016 | Athenry | 32.0 | 54.7 | Large/ V. Large adverse | 34.6 | 56.1 | Large/ V. Large adverse |
| NV017 | Fonn | 18.7 | 40.3 | Large/ V. Large adverse | 21.9 | 41.4 | Large/ V. Large adverse |
| NV018 | Skene Park Farm | 39.5 | 57.1 | Large/ V. Large adverse | 33.8 | 52.9 | Large/ V. Large adverse |
| NV019 | Blackpark Farm | 35.8 | 44.8 | Large/ V. Large adverse | 38.5 | 46.8 | Large/ V. Large adverse |
| NV020 | Orchard House | 44.1 | 46.2 | Slight/ Moderate adverse | 45.3 | 47.0 | Slight/ Moderate adverse |
| NV021 | Millhill | 43.9 | 53.9 | Large/ V. Large adverse | 44.9 | 54.2 | Large/ V. Large adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|-----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV022 | East Lodge Cottage | 38.5 | 55.8 | Large/ V. Large adverse | 41.0 | 57.3 | Large/ V. Large adverse |
| NV023 | 3 The Steading | 47.5 | 47.2 | Slight beneficial | 49.7 | 48.2 | Slight/ Moderate beneficial |
| NV024 | Penick Farmhouse | 39.0 | 41.8 | Slight/ Moderate adverse | 41.1 | 43.1 | Slight/ Moderate adverse |
| NV025 | Innesfree | 56.6 | 56.5 | Slight beneficial | 50.9 | 50.5 | Slight beneficial |
| NV026 | Hardmuir of Boath Farmhouse | 39.4 | 40.2 | Slight adverse | 41.1 | 41.9 | Slight adverse |
| NV027 | The Gate Lodge | 45.8 | 46.2 | Slight adverse | 46.9 | 47.2 | Slight adverse |

8.5.7 The results show that at ground floor level and without mitigation 16 of the sample receptors are predicted to have a Large/Very Large adverse significance. Two sample receptors are predicted to have a Moderate/Large adverse significance, six sample receptors are predicted to have a Slight/Moderate adverse significance, one sample receptor is predicted to have a Slight adverse significance and two sample receptors are predicted to have a Slight beneficial significance of impact.

8.5.8 At the first floor level and without mitigation 15 sample receptors are predicted to have a Large/Very Large adverse significance, three sample receptors are predicted to have a Moderate/Large adverse significance, four sample receptors are predicted to have a Slight/Moderate adverse significance, three sample receptors are predicted to have a Slight adverse significance, one sample receptor is predicted to have a Slight beneficial significance of impact. Finally, a single sample receptor is predicted to have a Slight/Moderate beneficial significance of impact.

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

Long Term Assessment with the Proposed Scheme

Day

8.5.10 The predicted noise levels at the Sample NSRs for the DM 2021 and the DS 2036 with the associated long-term significance of impacts for the daytime period are presented in Table 8.14.

Table 8.14: Sample NSRs – DM 2021 vs. DS 2036 – Day (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|-------------------------|-------------|------------|--------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV001 | Roseacre | 53.7 | 56.4 | Slight adverse | 56.4 | 57.7 | Slight adverse |
| NV002 | Brambly Hedge | 55.9 | 61.2 | Moderate/ Large adverse | 56.6 | 61.1 | Slight/ Moderate adverse |
| NV003 | 6 Milton of Culloden | 52.1 | 60.1 | Moderate/ Large adverse | 53.7 | 61.3 | Moderate/ Large adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|--------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV004 | The Bungalow | 48.3 | 57.9 | Moderate/ Large adverse | 49.9 | 59.1 | Moderate/ Large adverse |
| NV005 | 117 Hazel Avenue | 50.5 | 57.8 | Moderate/ Large adverse | 51.5 | 59.0 | Moderate/ Large adverse |
| NV006 | Thornhill | 46.0 | 49.5 | Slight/ Moderate adverse | 47.8 | 51.2 | Slight/ Moderate adverse |
| NV007 | Morayston Farmhouse | 39.9 | 52.0 | Large/V. Large adverse | 44.7 | 55.0 | Large/V. Large adverse |
| NV008 | 3 Kerrowaird Cottages | 48.7 | 56.6 | Moderate/ Large adverse | 51.5 | 58.1 | Moderate/ Large adverse |
| NV009 | Woodend House | 41.6 | 48.9 | Moderate/ Large adverse | 43.3 | 50.1 | Moderate/ Large adverse |
| NV010 | 1 Culblair Farm Cottages | 39.1 | 54.4 | Large/ V. Large adverse | 42.5 | 56.1 | Large/ V. Large adverse |
| NV011 | Milton of Braichlaich Farm | 38.6 | 45.9 | Moderate/ Large adverse | 41.5 | 48.1 | Moderate/ Large adverse |
| NV012 | Brackley Farmhouse | 52.0 | 54.5 | Slight adverse | 52.6 | 54.5 | Slight adverse |
| NV013 | New House, Easter Glackton Road | 53.1 | 57.0 | Slight/ Moderate adverse | 53.7 | 57.7 | Slight/ Moderate adverse |
| NV014 | Blackcastle Cottage | 52.1 | 59.1 | Moderate/ Large adverse | 55.7 | 61.1 | Moderate/ Large adverse |
| NV015 | New House, North Kildrummie Farm | 37.3 | 59.3 | Large/ V. Large adverse | 39.1 | 60.1 | Large/ V. Large adverse |
| NV016 | Atheny | 32.0 | 55.7 | Large/ V. Large adverse | 34.6 | 57.1 | Large/ V. Large adverse |
| NV017 | Fonn | 18.7 | 41.3 | Large/ V. Large adverse | 21.9 | 42.4 | Large/ V. Large adverse |
| NV018 | Skene Park Farm | 39.0 | 57.7 | Large/ V. Large adverse | 33.8 | 54.0 | Large/ V. Large adverse |
| NV019 | Blackpark Farm | 35.8 | 45.9 | Large/ V. Large adverse | 38.5 | 47.9 | Moderate/ Large adverse |
| NV020 | Orchard House | 44.1 | 47.2 | Slight/ Moderate adverse | 45.3 | 48.0 | Slight/ adverse |
| NV021 | Millhill | 43.9 | 54.9 | Large/ V. Large adverse | 44.9 | 55.2 | Large/ V. Large adverse |
| NV022 | East Lodge Cottage | 38.5 | 56.7 | Large/ V. Large adverse | 41.0 | 58.3 | Large/ V. Large adverse |
| NV023 | 3 The Steading | 47.5 | 48.3 | Slight adverse | 49.7 | 49.3 | Slight beneficial |
| NV024 | Penick Farmhouse | 39.0 | 42.9 | Slight/ Moderate adverse | 41.1 | 44.1 | Slight/ Moderate adverse |
| NV025 | Innesfree | 56.6 | 57.4 | Slight adverse | 50.9 | 51.4 | Slight adverse |
| NV026 | Hardmuir of Boath Farmhouse | 39.4 | 41.3 | Slight adverse | 41.1 | 42.8 | Slight adverse |
| NV027 | The Gate Lodge | 45.8 | 47.0 | Slight adverse | 46.9 | 47.9 | Slight adverse |

- 8.5.11 The results show that during the daytime period at ground floor level and without mitigation, nine of the sample receptors are predicted to have a Large/Very Large adverse significance. Eight sample receptors are predicted to have a Moderate/Large adverse significance, four sample receptors are predicted to have a Slight/Moderate adverse significance and six sample receptors are predicted to have a Slight adverse significance.
- 8.5.12 During the daytime period at first floor level and without mitigation, eight of the sample receptors are predicted to have a Large/Very Large adverse significance. Eight sample receptors are predicted to have a Moderate/Large adverse significance, four sample receptors are predicted to have a Slight/Moderate adverse significance, six sample receptors are predicted to have a Slight adverse significance and one sample receptor is predicted to have a Slight beneficial significance.

Night

- 8.5.13 The analysis undertaken for night-time noise levels has shown that none of the sample receptors are predicted to experience noise levels in excess of $L_{\text{night, outside}} 55\text{dB}$.

Summary Tables for all NSRs within 600m Calculation Area

Do-Minimum Scenario in the Baseline Year vs. Do-Minimum Scenario in the Future Assessment Year

- 8.5.14 In accordance with DMRB 'Noise and Vibration' Table A1.2, summaries of the magnitude of noise impacts at dwellings for the DM 2021 scenario versus the DM 2036 scenario, for the daytime period at the ground and first floor are presented in Table 8.15 and Table 8.16, respectively. These tables include the predicted noise level change at all dwellings and other sensitive receptors (defined as 'High' sensitivity in Table 8.2) within the 600m calculation area, so provide a broader view of potential noise impacts than the sample property assessment tables shown earlier.

Table 8.15: Summary – Ground Floor DM 2021 vs. DM 2036 – Day (Without Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|-----------|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 7,139 | 65 |
| | 3.0 – 4.9 | minor | 22 | 0 |
| | 5.0 – 9.9 | moderate | 0 | 0 |
| | 10.0+ | major | 0 | 0 |
| No Change | 0 | no change | 212 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 748 | 0 |
| | 3.0 – 4.9 | minor | 1 | 0 |
| | 5.0 – 9.9 | moderate | 0 | 0 |
| | 10.0+ | major | 0 | 0 |

Table 8.16: Summary – First Floor DM 2021 vs. DM 2036 – Day (Without Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|-----------|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 7,080 | 61 |
| | 3.0 – 4.9 | minor | 19 | 0 |
| | 5.0 – 9.9 | moderate | 0 | 0 |
| | 10.0+ | major | 0 | 0 |
| No Change | 0 | no change | 190 | 3 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 832 | 1 |
| | 3.0 – 4.9 | minor | 1 | 0 |
| | 5.0 – 9.9 | moderate | 0 | 0 |
| | 10.0+ | major | 0 | 0 |

8.5.15 Although the above tables show the magnitude of noise impacts, the following text presents the predicted significance of noise impacts at dwellings as set out in Table 8.5.

8.5.16 The results show that during the daytime period at ground floor level without the proposed Scheme, 7,139 dwellings would have Slight adverse significance of noise impact, whilst 22 dwellings would have a Slight/Moderate adverse significance. 212 dwellings are predicted to have a Neutral significance, 748 dwellings are predicted to have a Slight beneficial impact and a single dwelling is predicted to have a Slight/Moderate beneficial significance of impact. At first floor level there is similar significance of noise impacts.

8.5.17 The corresponding summary tables for the DM 2021 scenario versus the DM 2036 scenario, for the night-time period at the ground and first floor are presented in Table 8.17 and Table 8.18, respectively. These tables provide the magnitude of impacts for all dwellings within the 600m calculation. In addition the tables provide information on:

- the number of dwellings with noise levels below $L_{night, outside}$ 55dB in the DM 2021 scenario which increase to above $L_{night, outside}$ 55dB in the DM 2036 scenario;
- the number of dwellings with noise levels above $L_{night, outside}$ 55dB in both the DM 2021 and DM 2036 scenarios; and
- the number of dwellings with noise levels above $L_{night, outside}$ 55dB in the DM 2021 scenario which reduce to below $L_{night, outside}$ 55dB in the DM 2036 scenario.

8.5.18 It should be noted that N/A in the below table is reported where a condition cannot be met e.g., dwellings that have a noise level less than 55dB in the DM 2021 scenario cannot have a decrease in noise level if the DM 2036 noise level is greater than or equal to 55dB.

Table 8.17: Summary – Ground Floor DM 2021 vs. DM 2036 – Night (Without Receptor Specific Mitigation)

| Change in Noise Level $L_{night, outside}$ dB | Magnitude of Impact | Number of Dwellings | Number of Dwellings | | Number of Dwellings (DM 2021 \geq 55dB, DM 2036 \geq 55dB) | Number of Dwellings (DM 2021 \geq 55dB, DM 2036 $<$ 55dB) |
|---|---------------------|---------------------|---|--|--|---|
| | | | (DM 2021 $<$ 55dB, DM 2036 \geq 55dB) | (DM 2021 \geq 55dB, DM 2036 \geq 55dB) | | |
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 7,139 | 47 | 192 | N/A |
| | 3.0 – 4.9 | minor | 14 | 0 | 0 | N/A |
| | 5.0 – 9.9 | moderate | 0 | 0 | 0 | N/A |
| | 10.0+ | major | 0 | 0 | 0 | N/A |

| Change in Noise Level $L_{\text{night, outside}}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Dwellings (DM 2021 < 55dB, DM 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DM 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DM 2036 < 55dB) |
|---|-----------|---------------------|---------------------|--|--|--|
| No Change | 0 | no change | 232 | 0 | 6 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 736 | N/A | 0 | 0 |
| | 3.0 – 4.9 | minor | 1 | N/A | 0 | 0 |
| | 5.0 – 9.9 | moderate | 0 | N/A | 0 | 0 |
| | 10.0+ | major | 0 | N/A | 0 | 0 |

Table 8.18: Summary – First Floor DM 2021 vs. DM 2036 – Night (Without Receptor Specific Mitigation)

| Change in Noise Level $L_{\text{night, outside}}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Dwellings (DM 2021 < 55dB, DM 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DM 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DM 2036 < 55dB) |
|---|-----------|---------------------|---------------------|--|--|--|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 7,068 | 42 | 217 | N/A |
| | 3.0 – 4.9 | minor | 11 | 1 | 0 | N/A |
| | 5.0 – 9.9 | moderate | 0 | 0 | 0 | N/A |
| | 10.0+ | major | 0 | 0 | 0 | N/A |
| No Change | 0 | no change | 225 | 0 | 6 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 817 | N/A | 0 | 0 |
| | 3.0 – 4.9 | minor | 1 | N/A | 0 | 0 |
| | 5.0 – 9.9 | moderate | 0 | N/A | 0 | 0 |
| | 10.0+ | major | 0 | N/A | 0 | 0 |

8.5.19 Although the above tables show the magnitude of noise impacts at ground and first floor, the following text presents the predicted significance of noise impacts at dwellings as set out in Table 8.5.

8.5.20 As can be seen in Table 8.17 during the night-time period at ground floor level there are a total of 245 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}}$ 55dB. 239 dwellings are predicted to have a Slight adverse significance of noise impact, whilst six dwellings would have a Neutral significance.

8.5.21 At first floor level the number of dwellings exposed to a noise level of $L_{\text{night, outside}}$ 55dB increases to 266, which have a similar significance of noise impact as the ground floor although one dwelling is predicted to have a Slight/Moderate significance of noise impact.

8.5.22 Graphics illustrating the noise level changes during the daytime period, within the calculation area for the DM 2021 scenario versus the DM 2036 scenario are shown in Figures 8.3 and 8.4.

Do-Minimum Scenario vs. Do-Something Scenario in the Baseline Year

8.5.23 In accordance with DMRB 'Noise and Vibration' Table A1.1, a summary of the magnitude of noise impacts at all dwellings within the 600m calculation area for the DM 2021 scenario versus the DS 2021 scenario, for the daytime period at ground and first floor are presented in Table 8.19 and Table 8.20, respectively. Note that in accordance with DMRB 'Noise and Vibration', assessment of night-time noise is not required for this 'short-term' assessment.

Table 8.19: Summary – Ground Floor DM 2021 vs. DS 2021 – Day (Without Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|-----------|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 0.9 | negligible | 1,954 | 15 |
| | 1.0 – 2.9 | minor | 1,599 | 8 |
| | 3.0 – 4.9 | moderate | 462 | 2 |
| | 5.0+ | major | 487 | 5 |
| No Change | 0 | no change | 121 | 1 |
| Decrease (Beneficial) in Noise Level | 0.1 – 0.9 | negligible | 673 | 8 |
| | 1.0 – 2.9 | minor | 2,127 | 16 |
| | 3.0 – 4.9 | moderate | 673 | 10 |
| | 5.0+ | major | 26 | 0 |

Table 8.20: Summary – First Floor DM 2021 vs. DS 2021 – Day (Without Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|-----------|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 0.9 | negligible | 1,917 | 14 |
| | 1.0 – 2.9 | minor | 1,631 | 9 |
| | 3.0 – 4.9 | moderate | 429 | 0 |
| | 5.0+ | major | 398 | 5 |
| No Change | 0 | no change | 125 | 2 |
| Decrease (Beneficial) in Noise Level | 0.1 – 0.9 | negligible | 727 | 8 |
| | 1.0 – 2.9 | minor | 2,169 | 12 |
| | 3.0 – 4.9 | moderate | 698 | 15 |
| | 5.0+ | major | 28 | 0 |

- 8.5.24 Although the above tables show the magnitude of noise impacts, the following text presents the predicted significance of noise impacts at dwellings as set out in Table 8.5.
- 8.5.25 As can be seen in Table 8.19, as a result of the proposed Scheme in the short-term 1,954 dwellings would experience a Slight adverse significance of noise impact. 1,599 dwellings are predicted to have a Slight/Moderate adverse significance, 462 dwellings are predicted to have a Moderate/Large adverse significance and 487 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 673 dwellings would experience a Slight beneficial significance, 2,127 dwellings would experience a Slight/Moderate beneficial significance, 673 dwellings would experience a Moderate/Large beneficial significance and 26 dwellings would experience a Major beneficial significance. There are 121 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.
- 8.5.26 Graphics illustrating the noise level changes during the daytime period, within the calculation area for the DM 2021 scenario versus the DS 2021 scenario are shown in Figures 8.5 and 8.6.

Do-Minimum Scenario vs. Do-Something Scenario in the Future Assessment Year

8.5.27 In accordance with DMRB 'Noise and Vibration' Table A1.2, summaries of the magnitude of noise impacts at all dwellings within the 600m calculation area for the DM 2021 scenario versus the DS 2036 scenario, for the daytime period at ground and first floor are presented in Table 8.21 and Table 8.22, respectively.

Table 8.21: Summary – Ground Floor DM 2021 vs. DS 2036 – Day (Without Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|-----------|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,772 | 29 |
| | 3.0 – 4.9 | minor | 756 | 5 |
| | 5.0 – 9.9 | moderate | 414 | 5 |
| | 10.0+ | major | 190 | 0 |
| No Change | 0 | no change | 76 | 1 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,823 | 25 |
| | 3.0 – 4.9 | minor | 86 | 0 |
| | 5.0 – 9.9 | moderate | 5 | 0 |
| | 10.0+ | major | 0 | 0 |

Table 8.22: Summary – First Floor DM 2021 vs. DS 2036 – Day (Without Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|-----------|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,765 | 28 |
| | 3.0 – 4.9 | minor | 759 | 3 |
| | 5.0 – 9.9 | moderate | 367 | 5 |
| | 10.0+ | major | 167 | 0 |
| No Change | 0 | no change | 93 | 2 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,854 | 27 |
| | 3.0 – 4.9 | minor | 111 | 0 |
| | 5.0 – 9.9 | moderate | 6 | 0 |
| | 10.0+ | major | 0 | 0 |

8.5.28 Although the above tables show the magnitude of noise impacts at ground and first floor, the following text presents the predicted significance of noise impacts at dwellings as set out in Table 8.5.

8.5.29 As can be seen in Table 8.21, as a result of the proposed Scheme in the long-term 3,772 dwellings would experience a Slight adverse significance of noise impact. 756 dwellings are predicted to have a Slight/Moderate adverse significance, 414 dwellings are predicted to have a Moderate/Large adverse significance and 190 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 2,823 dwellings would experience a Slight beneficial significance, 86 dwellings would experience a Slight/Moderate beneficial significance and five dwellings would experience a Moderate/Large beneficial significance. There are 76 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.

8.5.30 Graphics illustrating the noise level changes during the day time periods, within the calculation area for the DM 2021 scenario versus the DS 2036 scenario are shown in Figures 8.7 and 8.8.

8.5.31 The corresponding summary tables for the DM 2021 scenario versus the DS 2036 scenario, for the night-time period at the ground and first floor are presented in Table 8.23 and Table 8.24, respectively. These tables provide the magnitude of impacts for all dwellings within the 600m calculation. In addition the tables provide information on:

- the number of dwellings with noise levels below $L_{\text{night, outside}} 55\text{dB}$ in the DM 2021 scenario which increase to above $L_{\text{night, outside}} 55\text{dB}$ in the DS 2036 scenario;
- the number of dwellings with noise levels above $L_{\text{night, outside}} 55\text{dB}$ in both the DM 2021 and DS 2036 scenarios; and
- the number of dwellings with noise levels above $L_{\text{night, outside}} 55\text{dB}$ in the DM 2021 scenario which reduce to below $L_{\text{night, outside}} 55\text{dB}$ in the DS 2036 scenario.

Table 8.23: Summary – Ground Floor DM 2021 vs. DS 2036 – Night (Without Receptor Specific Mitigation)

| Change in Noise Level $L_{\text{night, outside}}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Dwellings (DM 2021 < 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DMS2036 < 55dB) |
|--|-----------|---------------------|---------------------|--|--|--|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,947 | 41 | 59 | N/A |
| | 3.0 – 4.9 | minor | 660 | 1 | 0 | N/A |
| | 5.0 – 9.9 | moderate | 382 | 0 | 0 | N/A |
| | 10.0+ | major | 144 | 0 | 0 | N/A |
| No Change | 0 | no change | 81 | 0 | 0 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,875 | N/A | 10 | 2 |
| | 3.0 – 4.9 | minor | 31 | N/A | 2 | 0 |
| | 5.0 – 9.9 | moderate | 2 | N/A | 0 | 0 |
| | 10.0+ | major | 0 | N/A | 0 | 0 |

Table 8.24: Summary – First Floor DM 2021 vs. DS 2036 – Night (Without Receptor Specific Mitigation)

| Change in Noise Level $L_{\text{night, outside}}$ dB | | Magnitude of Impact | Number of Dwellings | Number of Dwellings (DM 2021 < 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DMS2036 < 55dB) |
|--|-----------|---------------------|---------------------|--|--|--|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,957 | 55 | 71 | N/A |
| | 3.0 – 4.9 | minor | 615 | 1 | 0 | N/A |
| | 5.0 – 9.9 | moderate | 350 | 0 | 0 | N/A |
| | 10.0+ | major | 117 | 0 | 0 | N/A |
| No Change | 0 | no change | 120 | 0 | 0 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,921 | N/A | 10 | 3 |
| | 3.0 – 4.9 | minor | 39 | N/A | 2 | 2 |
| | 5.0 – 9.9 | moderate | 3 | N/A | 0 | 0 |
| | 10.0+ | major | 0 | N/A | 0 | 0 |

- 8.5.32 As can be seen in Table 8.23 during the night-time period at ground floor level in the long-term there are a total of 113 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 100 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are two dwellings which are predicted to experience noise levels below $L_{\text{night, outside}} 55\text{dB}$ which were exposed to a noise level above this in the Do-minimum scenario.
- 8.5.33 At first floor level in the long-term there are a total of 139 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 126 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are five dwellings which are predicted to experience noise levels below $L_{\text{night, outside}} 55\text{dB}$ which were exposed to a noise level above this in the Do-minimum scenario.

Health and Educational Establishments

- 8.5.34 Figure 8.2 identifies the location of identified health and educational establishments located within the 600m calculation area. For each of the buildings, the daytime noise levels at ground and first floor for the DM 2021 scenario and the DM 2036 scenario, with associated magnitude of impacts is presented in Table 8.25. The DM 2021 scenario and DS 2021 scenario and associated magnitude of impacts are presented in Table 8.26. Whilst the DM 2021 scenario and the DS 2036 scenario and associated magnitude of impacts are presented in Table 8.27.

Table 8.25: Health and Educational Establishments – DM 2021 vs DM 2036 – Day (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) | | | | | |
|-------|--|---|------------|-------------------------|-------------|------------|------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DM 2036 | Significance of Impact | DM 2021 | DM 2036 | Significance of Impact |
| NV038 | Millburn Academy Pavilion, Victoria Drive, Inverness, IV2 3QB | 50.4 | 50.8 | Slight Adverse | 46.7 | 47.1 | Slight Adverse |
| NV039 | Millburn Academy, Diriebught Road, Inverness, IV2 3QR | 43.4 | 43.9 | Slight Adverse | 53.2 | 53.6 | Slight Adverse |
| NV040 | Raigmore Primary School, King Duncans Road, Inverness, IV2 3UG | 48.1 | 48.4 | Slight Adverse | 50.0 | 50.3 | Slight Adverse |
| NV041 | Stoneyfield Dental Surgery, Hazel House, Stoneyfield, Inverness, IV2 7PA | 53.0 | 53.1 | Neutral/ Slight Adverse | 55.6 | 55.6 | Neutral |
| NV042 | Smithton Primary School, Smithton Park, Smithton, Inverness, IV2 7PD | 38.9 | 39.0 | Slight Adverse | 41.3 | 41.2 | Slight Beneficial |
| NV043 | Balloch Primary School, Culloden Road, Balloch, Inverness, IV2 7HQ | 49.9 | 50.2 | Slight Adverse | 52.3 | 52.7 | Slight Adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|---|--|------------|-------------------------|-------------|------------|-------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DM 2036 | Significance of Impact | DM 2021 | DM 2036 | Significance of Impact |
| NV044 | Old School, 28 Cherry Park, Balloch, Inverness, IV2 7HG | 43.7 | 43.8 | Slight Adverse | 45.8 | 45.9 | Slight Adverse |
| NV045 | Gowan Brae, 45 Culloden Road, Balloch, Inverness, IV2 7HQ | 49.6 | 49.9 | Slight Adverse | 50.2 | 50.5 | Slight Adverse |
| NV046 | Nairn Academy, Duncan Drive, Nairn, IV12 4RD | 40.5 | 41.2 | Slight Adverse | 44.7 | 45.3 | Slight Adverse |
| NV047 | Nairn Town and County Hospital, Cawdor Road, Nairn, IV12 5EE | 35.4 | 36.2 | Neutral/ Slight Adverse | 39.0 | 39.7 | Neutral/ Slight Adverse |
| NV048 | The Manor Care Centre, Cawdor Road Nairn, IV12 5ED | 34.4 | 35.3 | Neutral/ Slight Adverse | 37.5 | 38.3 | Neutral/ Slight Adverse |
| NV049 | Nairn Dental Care Ltd, 4A Albert Street, Nairn, IV12 4HP | 42.9 | 43.4 | Slight Adverse | 46.9 | 47.4 | Slight Adverse |
| NV050 | Rosebank Primary School, Lodgehill Road, Nairn, IV12 4RB | 61.7 | 62.2 | Slight Adverse | 62.0 | 62.5 | Slight Adverse |
| NV051 | Chiropody Clinic at Westbury House, Westbury Road, Nairn, IV12 4QF | 41.3 | 41.7 | Neutral/ Slight Adverse | 43.2 | 43.6 | Neutral/ Slight Adverse |
| NV052 | Windsor House Dental Practice, 7 High Street, Nairn, IV12 4AG | 40.1 | 40.4 | Neutral/ Slight Adverse | 42.2 | 42.6 | Neutral/ Slight Adverse |
| NV053 | The Dental Surgery, Millbank Crescent, Nairn, IV12 4QB | 40.2 | 40.7 | Neutral/ Slight Adverse | 41.9 | 42.4 | Neutral/ Slight Adverse |
| NV054 | Millbank Primary School, Millbank Crescent, Nairn, IV12 4QB | 38.8 | 39.8 | Slight Adverse | 41.2 | 42.1 | Slight Adverse |
| NV055 | Moray College Learning Centre, Balmakeith Industrail Estate, 10B Tom Semple Road, Nairn, IV12 5QW | 57.0 | 57.6 | Neutral/ Slight Adverse | 60.2 | 60.8 | Neutral/ Slight Adverse |
| NV056 | Auldearn Primary School, Manse Road, Auldearn, IV12 5SX | 57.3 | 58.6 | Slight Adverse | 58.7 | 60.0 | Slight Adverse |

Table 8.26: Health and Educational Establishments – DM 2021 vs. DS 2021 – Day (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) | | | | | |
|-------|--|---|------------|-----------------------------|-------------|------------|-----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV038 | Millburn Academy Pavilion | 50.4 | 50.5 | Slight Adverse | 45.6 | 45.8 | Slight Adverse |
| NV039 | Millburn Academy | 50.2 | 50.4 | Slight Adverse | 51.2 | 51.4 | Slight Adverse |
| NV040 | Raigmore Primary School | 42.6 | 42.8 | Slight Adverse | 51.5 | 51.6 | Slight Adverse |
| NV041 | Stoneyfield Dental Surgery | 52.6 | 53.1 | Neutral/ Slight Adverse | 55.4 | 55.8 | Neutral/ Slight Adverse |
| NV042 | Smithton Primary School | 40.4 | 42.7 | Slight/ Moderate Adverse | 43.3 | 45.5 | Slight/ Moderate Adverse |
| NV043 | Balloch Primary School | 46.3 | 48.0 | Slight/ Moderate Adverse | 48.6 | 50.1 | Slight/ Moderate Adverse |
| NV044 | Old School, 28 Cherry Park | 42.6 | 45.3 | Slight/ Moderate Adverse | 45.8 | 47.9 | Slight/ Moderate Adverse |
| NV045 | Gowan Brae, 45 Culloden Road | 47.4 | 49.1 | Slight/ Moderate Adverse | 49.4 | 51.1 | Slight/ Moderate Adverse |
| NV046 | Nairn Academy | 39.4 | 43.0 | Moderate/ Large Adverse | 41.5 | 44.1 | Slight/ Moderate Adverse |
| NV047 | Nairn Town and County Hospital | 34.0 | 40.4 | Moderate/ Large Adverse | 36.9 | 42.1 | Moderate/ Large Adverse |
| NV048 | The Manor Care Centre | 31.9 | 39.8 | Moderate/ Large Adverse | 35.2 | 41.8 | Moderate/ Large Adverse |
| NV049 | Nairn Dental Care Ltd | 42.9 | 40.0 | Slight/ Moderate Beneficial | 45.0 | 42.0 | Moderate/ Large Beneficial |
| NV050 | Rosebank Primary School | 44.4 | 44.3 | Slight Beneficial | 46.4 | 45.9 | Slight Beneficial |
| NV051 | Chiropody Clinic at Westbury House | 45.2 | 46.3 | Slight Adverse | 46.5 | 47.2 | Neutral/ Slight Adverse |
| NV052 | Windsor House Dental Practice | 64.6 | 64.4 | Neutral/ Slight Beneficial | 64.3 | 64.1 | Neutral/ Slight Beneficial |
| NV053 | The Dental Surgery, Millbank Crescent | 39.9 | 40.2 | Neutral/ Slight Adverse | 42.1 | 42.1 | Neutral |
| NV054 | Millbank Primary School | 36.2 | 39.0 | Slight/ Moderate Adverse | 38.7 | 40.9 | Slight/ Moderate Adverse |
| NV055 | Moray College Learning Centre | 43.2 | 39.6 | Moderate Beneficial | 45.7 | 42.1 | Moderate Beneficial |
| NV056 | Auldearn Primary School | 59.2 | 58.0 | Slight/ Moderate Beneficial | 59.8 | 58.5 | Slight/ Moderate Beneficial |

Table 8.27: Health and Educational Establishments – DM 2021 vs. DS 2036 – Day (Without Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|----------------------------|-------------|------------|----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV038 | Millburn Academy Pavilion | 42.3 | 43.0 | Slight Adverse | 45.7 | 46.3 | Slight Adverse |
| NV039 | Millburn Academy | 47.3 | 48.0 | Slight Adverse | 47.7 | 48.4 | Slight Adverse |
| NV040 | Raigmore Primary School | 49.3 | 50.1 | Slight Adverse | 50.7 | 51.5 | Slight Adverse |
| NV041 | Stoneyfield Dental Surgery | 52.6 | 53.8 | Neutral/ Slight Adverse | 57.6 | 58.7 | Neutral/ Slight Adverse |
| NV042 | Smithton Primary School | 40.4 | 43.5 | Slight/ Moderate Adverse | 43.3 | 46.2 | Slight Adverse |
| NV043 | Balloch Primary School | 46.3 | 48.5 | Slight Adverse | 50.2 | 52.2 | Slight Adverse |
| NV044 | Old School, 28 Cherry Park | 43.7 | 47.1 | Slight/ Moderate Adverse | 45.8 | 48.7 | Slight Adverse |
| NV045 | Gowan Brae, 45 Culloden Road | 47.4 | 49.7 | Slight Adverse | 49.4 | 51.8 | Slight Adverse |
| NV046 | Nairn Academy | 39.4 | 43.9 | Slight/ Moderate Adverse | 41.5 | 45.0 | Slight/ Moderate Adverse |
| NV047 | Nairn Town and County Hospital | 34.0 | 41.4 | Moderate Adverse | 36.9 | 43.1 | Moderate Adverse |
| NV048 | The Manor Care Centre | 31.9 | 40.8 | Moderate Adverse | 34.9 | 42.6 | Moderate Adverse |
| NV049 | Nairn Dental Care Ltd | 42.9 | 40.6 | Slight Beneficial | 45.0 | 42.6 | Slight Beneficial |
| NV050 | Rosebank Primary School | 44.4 | 44.8 | Slight Adverse | 46.7 | 46.7 | Neutral |
| NV051 | Chiropody Clinic at Westbury House | 45.2 | 46.7 | Neutral/ Slight Adverse | 46.5 | 47.6 | Neutral/ Slight Adverse |
| NV052 | Windsor House Dental Practice | 64.6 | 64.6 | Neutral | 64.3 | 64.3 | Neutral |
| NV053 | The Dental Surgery, Millbank Crescent | 39.9 | 40.9 | Neutral/ Slight Adverse | 42.1 | 42.8 | Neutral/ Slight Adverse |
| NV054 | Millbank Primary School | 36.2 | 39.9 | Slight/ Moderate Adverse | 39.1 | 42.2 | Slight/ Moderate Adverse |
| NV055 | Moray College Learning Centre | 43.2 | 40.5 | Neutral/ Slight Beneficial | 45.7 | 42.9 | Neutral/ Slight Beneficial |
| NV056 | Auldearn Primary School | 59.2 | 57.7 | Slight Beneficial | 59.8 | 58.3 | Slight Beneficial |

8.5.35 In the short-term, without the proposed Scheme in place (DM 2021 v DM 2036) at the ground floor level 12 buildings are predicted to experience a Slight adverse significance of noise impact and seven buildings are predicted to experience a Neutral/Slight adverse significance of noise impact (i.e. an increase in noise level of less than 1dB). At first floor level 11 buildings are predicted to experience a Slight adverse significance of noise impact, six buildings are predicted to experience a Neutral/Slight adverse significance of noise impact, one building is predicted to experience a

neutral significance of noise impact and one building is predicted to experience a Slight beneficial significance of noise impact.

8.5.36 In the short-term, with the proposed Scheme in place at the ground floor level three buildings are predicted to have a Moderate/Large adverse significance, five buildings have a Slight/Moderate adverse significance, four buildings have a Slight adverse significance, two buildings have a Neutral/Slight adverse significance, one building is predicted to have a Neutral/Slight Beneficial of noise impact, one building is predicted to have a Slight beneficial significance two buildings have a Slight/Moderate beneficial significance of noise impact and one building is predicted to have a Moderate beneficial significance of noise impact. Similar significance of impacts are predicted to occur at the first floor level of these buildings

8.5.37 In the long-term, with the proposed Scheme in place at the ground floor level two buildings are predicted to have a Moderate adverse significance, four buildings are predicted to have a Slight/Moderate adverse significance, six buildings are predicted to have a Slight adverse significance, three buildings are predicted to have a Neutral/Slight adverse significance, one building is predicted to have a Neutral significance of noise impact, one building is predicted to have a Neutral/Slight beneficial significance of noise impact and two buildings are predicted to have a Slight beneficial significance of noise impact. Similar significance of noise impacts are predicted to occur at the first floor level of these buildings.

Noise Nuisance

8.5.38 The predicted noise nuisance for the DM 2021 scenario versus the DM 2036 scenario and the DM 2021 scenario versus the DS 2036 scenario have been determined, and are summarised in Table 8.28 to illustrate the potential noise impacts (based on maximum façade noise levels).

Table 8.28 Summary of Traffic Noise Nuisance (Without Receptor Specific Mitigation)

| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Assessment Year (Do-Minimum) and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Assessment Year (Do-Something) | | | | | |
|---|----------|---------------------|--------------|-------------|--------------|
| Change in Traffic Induced Noise Nuisance | | Ground Floor | | First Floor | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| | | Number of Dwellings | | | |
| Increase (Adverse) in Noise Nuisance | < 10% | 6,296 | 1,266 | 6,729 | 1,462 |
| | 10 < 20% | 0 | 994 | 0 | 941 |
| | 20 < 30% | 0 | 1,694 | 0 | 1,744 |
| | 30 < 40% | 0 | 680 | 0 | 588 |
| | > 40% | 0 | 269 | 0 | 239 |
| No Change | | 1,442 | 2,159 | 816 | 1,537 |
| Decrease (Beneficial) in Noise Nuisance | < 10% | 384 | 1,060 | 577 | 1,610 |
| | 10 < 20% | 0 | 0 | 0 | 1 |
| | 20 < 30% | 0 | 0 | 0 | 0 |
| | 30 < 40% | 0 | 0 | 0 | 0 |
| | > 40% | 0 | 0 | 0 | 0 |

8.5.39 As shown in Table 8.28 at the ground floor level there is an overall reduction in noise nuisance with the proposed Scheme compared to without the proposed Scheme. There are 6,296 dwellings with adverse noise nuisance without the proposed Scheme and 4,903 dwellings with the proposed Scheme, although 3,637 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands. In addition, following the introduction of the proposed Scheme there are 1,060 dwellings predicted to experience a reduction in noise nuisance compared with 384 reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings.

Vibration Nuisance

8.5.40 When determining vibration nuisance Figures A6.1 and A6.2 of DMRB ‘Noise and Vibration’ have been used to determine the percentage of people bothered by traffic vibration, based on the predicted noise levels where the percentage of people bothered, very much, or quite a lot, by vibration nuisance for the DM 2021 scenario versus the DM 2036 scenario, and the DM 2021 scenario versus the DS 2036 scenario have been determined and summarised in Table 8.29 for all properties that are within 40m of affected roads with a predicted noise level greater than $L_{A10,18h}$ 58dB.

Table 8.29: Summary of Traffic Induced Airborne Vibration Nuisance (Without Receptor Specific Mitigation)

| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Assessment Year (Do-Minimum); and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Assessment Year (Do-Something) | | | | | |
|---|----------|---------------------|--------------|-------------|--------------|
| Change in Traffic Induced Airborne Vibration Nuisance | | Ground Floor | | First Floor | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| | | Number of Dwellings | | | |
| Increase (Adverse) in Noise Nuisance | < 10% | 1,176 | 386 | 1,214 | 395 |
| | 10 < 20% | 0 | 358 | 0 | 408 |
| | 20 < 30% | 0 | 34 | 0 | 36 |
| | 30 < 40% | 0 | 3 | 0 | 2 |
| | > 40% | 0 | 0 | 0 | 0 |
| No Change | | 553 | 926 | 514 | 855 |
| Decrease (Beneficial) in Noise Nuisance | < 10% | 3 | 25 | 4 | 36 |
| | 10 < 20% | 0 | 0 | 0 | 0 |
| | 20 < 30% | 0 | 0 | 0 | 0 |
| | 30 < 40% | 0 | 0 | 0 | 0 |
| | > 40% | 0 | 0 | 0 | 0 |

8.5.41 With regard to airborne traffic induced vibration, at ground floor level there are 1,176 dwellings within 40m of all assessed roads with adverse vibration nuisance without the proposed Scheme and 781 dwellings with the proposed Scheme, although 395 of these dwellings are predicted to experience an increase in vibration nuisance in the higher level bands. In addition, following the introduction of the proposed Scheme there are 25 dwellings predicted to experience a reduction in vibration nuisance compared with three reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings within 40m of all assessed roads.

- 8.5.42 In respect to the occurrence of ground-borne vibration, it is necessary to have defects in the road surface for it to occur. Since it must be assumed that the proposed Scheme would initially have a surface that is of a high standard without defects, it can be assumed that, on opening, ground-borne vibration would not be an issue. However, should the road surface condition deteriorate sufficiently that road surface defects occur, then as vehicles pass over these defects ground-borne vibrations would be generated and may affect the closest dwellings. To prevent the potential adverse impacts that may arise because of defective road surfacing on the proposed Scheme, it is recommended that the organisation responsible for the upkeep of the road maintain it in good repair. Accordingly, should the new road be maintained in good repair ground-borne vibration is not likely to be an issue.

Noise Insulation

- 8.5.43 As noted in paragraph 8.2.23, Regulation 3 of the Noise Insulation (Scotland) Regulations 1975 (NISR), confers a duty on the roads authorities in certain instances to offer insulation to eligible residential properties affected by noise.

- 8.5.44 The results of the noise assessment indicate that there are ten residential buildings which may be eligible for noise insulation, which are as follows:

- Seafield of Raigmore, Inverness, Highland, IV2 7PA;
- Stratton Farmhouse, Barn Church Road, Culloden, Inverness, IV2 7NS;
- Stratton Farm Cottage, Barn Church Road, Culloden, Inverness, IV2 7NS;
- Churchfield Cottage, Barn Church Road, Culloden, Inverness, IV2 7NS;
- 6 Milton of Culloden, Inverness, IV2 7NX;
- Shamal, Cullernie Road, Balloch, Inverness IV2 7HU;
- 2 Upper Cullernie Cottages, Cullernie Road, Balloch, Inverness IV2 7HU;
- 3 Upper Cullernie Cottages, Cullernie Road, Balloch, Inverness IV2 7HU;
- Edgefield, Cullernie Road, Balloch, Inverness IV2 7HU; and
- Laurel Cottage, Gollanfield, Inverness, IV2 7UR.

Wider Study Area

- 8.5.45 DMRB 'Noise and Vibration' guidance indicates that an assessment of the impacts upon the wider network, i.e. properties that are within 50m of roads outside the study area that are predicted to experience a change of 1dB or more in the short-term or 3dB or more in the long-term.

- 8.5.46 There are 80 roads outside the study area which are predicted to meet the aforementioned criteria and full details of these roads are provided in Appendix A8.4 (Wider Road Network Assessment). However, in summary there are predicted to be 16 NSRs within 50m of an adversely affected road and 195 NSRs within 50m of a beneficially affected road in the short-term. In the long-term there are predicted to be 13 NSRs within 50m of an adversely affected road and 27 NSRs within 50m of a beneficially affected road.

Committed Development

- 8.5.47 With regards to committed development the potential noise impact on residential development areas have been assessed. Full details of the potential noise impacts are provided in Appendix A8.5 (Noise Impacts on Committed Developments).

Amenity Areas

- 8.5.48 From the data provided, 46 'designated' areas (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Scheduled Monuments (SM) etc.) have been identified, according to DMRB 'Noise and Vibration'. Details of the potential noise impacts are provided in

Appendix A8.6 (Noise Impacts on Amenity Areas). An indication of the noise climate for other public areas, such as Public Rights of Way (as shown on Figure 16.1), can be derived from Figures 8.7 and 8.8 which illustrate the noise level changes during the day time periods, within the calculation area, for the DM 2021 scenario versus the DS 2036 scenario.

8.6 Mitigation

8.6.1 Mitigation measures for the proposed Scheme in relation to noise and vibration are detailed below and take into account best practice, legislation guidance and professional experience. The mitigation commitments identified in the SEAs for the STPR (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 208) and A96 Dualling Programme (CH2M 2015 and 2016) have also been taken into consideration.

Construction Mitigation (Mitigation Item GR1)

8.6.2 As previously stated, at this stage of the proposed Scheme, phasing, methods of working and type of plant that are likely to be employed during the construction phase is not fully known.

8.6.3 When details on construction phasing and methodologies are available following appointment of the contractor, it is recommended that construction noise and, if necessary, vibration levels are predicted and assessed. Close liaison with The Highland Council and local residents is essential.

8.6.4 If best practice is followed, including the use of appropriate mitigation and following a Construction Environmental Management Plan (CEMP) it is likely that construction noise impacts can be minimised to acceptable levels.

8.6.5 The following recommended (mitigation) measures, as recommended in BS 5228, would be employed to minimise the noise impacts during the construction phase:

Community Relations

- The establishment and maintenance of good community relations would be a priority. This may include informing local residents on progress of the works by way of leaflet drops and/or public meetings and ensuring measures are put in place to minimise noise impacts. A designated contact telephone number during construction and agreed procedure for the contractor to investigate and report on complaints would be set up.

Training of Employees

- Operatives would be trained to employ appropriate techniques to keep site noise to a minimum, and would be effectively supervised to ensure that best working practice in respect of noise reduction is followed.

Execution of Works

- Reasonably practicable measures to manage construction noise and vibration impacts that could be undertaken during these works include the following:
 - the hours of working would be planned and account would be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on site, taking into account the nature of land use in the areas concerned, the duration of work and the likely consequence of any lengthening of work periods;
 - where reasonably practicable, quiet working methods would be employed, including use of the most suitable plant, reasonable hours of working for noisy operations, and economy and speed of operations;
 - noise would be controlled at source, for example, by modification of existing plant/equipment, its use and location and ensuring maintenance of all noise-generating equipment;

- the spread of noise would be limited, i.e. by distance between source and receiver and/or screening;
- on-site noise levels would be monitored regularly, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose. A method of noise measurement would be agreed prior to the commencement of site works; and
- on those parts of a site where high levels of noise are likely to be a hazard to persons working on the site, prominent warning notices would be displayed and, where necessary, ear protectors would be provided.

8.6.6 A range of good site practices would be adopted in order to mitigate construction phase noise and vibration. Such measures, and other good site practice mitigation techniques, are defined below:

- proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works would be fitted with effective exhaust silencers and would be maintained in good, efficient working order;
- selection of inherently quiet plant where appropriate. All major compressors would be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- machines in intermittent use would be shut down in the intervening periods between work or throttled down to a minimum;
- all ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures would be provided; and
- adherence to the codes of practice for construction working and piling given in British Standard BS 5228:2009+A1:2014 and the guidance given therein minimising noise emissions from the site.

8.6.7 In order to minimise the likelihood of complaints, The Highland Council and affected residents would be kept informed of the works to be carried out and of any proposed work outside normal hours. Residents would be provided with a point of contact for any queries or complaints. **(Mitigation Items NV1 and NV2).**

8.6.8 In addition, The Highland Council would be consulted regarding any proposed working out-with normal working hours. . **(Mitigation Items NV1 and NV2).**

Operational Mitigation

8.6.9 As stated in paragraph 8.2.33 mitigation would be implemented, where practicable, where the significance of impact is ‘Slight/Moderate adverse’ or worse and where the predicted façade noise level exceeds 59.5dB $L_{A10,18h}$ at ground floor level during the daytime period and where the significance of impact is ‘Slight/Moderate adverse’ or worse and where the predicted façade noise level exceeds 55.0dB $L_{night,outside}$ during the night-time period. Tables 8.30, 8.31 and 8.32, below show the number of residential buildings which may qualify for mitigation.

Table 8.30: Mitigation Criteria Qualification (Short Term: Day)

| Number of Residential Buildings | | |
|--|---|-------------------------|
| DS 2021 – DM 2021 Noise Level Change \geq 1dB | DS 2021 Noise Level > 59.5dB ($L_{A10,18h}$) | Both Criteria Fulfilled |
| 2,235 | 750 | 30 |

Table 8.31: Mitigation Criteria Qualification (Long Term: Day)

| Number of Residential Buildings | | |
|--|---|-------------------------|
| DS 2036 – DM 2021 Noise Level Change \geq 3dB | DS 2036 Noise Level > 59.5dB ($L_{A10,18h}$) | Both Criteria Fulfilled |
| 1,172 | 873 | 33 |

Table 8.32: Mitigation Criteria Qualification (Long Term: Night)

| Number of Residential Buildings | | |
|--|---|-------------------------|
| DS 2036 – DM 2021 Noise Level Change \geq 3dB | DS 2036 Noise Level > 55.0dB ($L_{night,outside}$) | Both Criteria Fulfilled |
| 1015 | 242 | 7 |

Incorporated Mitigation

- 8.6.10 The noise modelling has assumed that all new road sections on the dual carriageway and slip roads (with the exception of the slip roads at Brackley Junction and the eastbound off slip at Nairn West Junction) of the proposed Scheme have been surfaced with low noise road surfacing material which can reduce noise levels by approximately 3.5dB $L_{A10,18h}$ when compared with conventional hot rolled asphalt surfacing of 2mm texture depth, although this is only valid for sections of the proposed Scheme with traffic speeds in excess of 75kmh. For sections of the proposed Scheme with traffic speeds below 75kmh noise levels would only be reduced by approximately 1dB $L_{A10,18h}$. **(Mitigation Item NV3).**
- 8.6.11 In addition, the design of the proposed Scheme was developed through an iterative process that facilitates the opportunity for noise mitigation measures, in the forms of bunds/earthworks to be incorporated. As a consequence the following noise mitigation earthwork bunds have been included within the 3D noise model:
- 1.3m high earthwork bund between ch900 to ch1000 on the north side of the proposed Scheme.
 - 2.0m high earthwork bund between ch3010 to ch3775 on the north side of the proposed Scheme
 - 2.2m high earthwork bund between ch23320 to ch23820 on the south side of the proposed Scheme
 - 2.2m high earthwork bund between ch26830 to ch27020 on south side of the proposed Scheme.

Receptor Specific Mitigation

- 8.6.12 Additional receptor specific mitigation would be positioned as close to the dual carriageway as is reasonably practicable to ensure maximum noise attenuation, taking into account alignment requirements, land available, landscape and visual requirements and ecological requirements. Noise barriers set close to a road can provide protection to garden areas as well as the living space of properties.
- 8.6.13 The additional receptor specific mitigation measures are summarised in Table 8.33 and also shown on Figure 8.9 and have been provided to minimise the impacts at properties which meet the mitigation threshold previously defined in paragraph 8.2.33.
- 8.6.14 As a minimum these receptor specific mitigation measures can take the form of an earth bund or close boarded timber fence, or a combination of the two. For any noise barrier fences these would need to be of a minimum mass per unit area of 15kg/m² with no holes or gaps. Timber fences must be overlapped to allow for shrinkage.

Table 8.33: Additional Receptor-Specific Mitigation

| Mitigation Item | Approximate Start Chainage | Height (m) | Length (m) | Type of Mitigation |
|-----------------|---|------------|------------|--------------------|
| NVB1 | ch1000 | 1.3 | 90 | Barrier |
| NVB2 | ch1520 | 2.0 | 440 | Barrier |
| NVB3 | ch2200 | 2.0 | 447 | Barrier |
| NVB4 | ch2570 | 2.8 | 353 | Barrier |
| NVB5 | Offline Barrier on Barn Church Road (C1032) | 1.3 | 100 | Barrier |
| NVB6 | ch16300 | 1.6 | 321 | Barrier |
| NVB7 | ch18560 | 1.5 | 144 | Barrier |

8.6.15 With the additional receptor specific mitigation shown in Table 8.33 and Figure 8.9, there are still 36 noise sensitive receptors that exceeded the mitigation criteria, either in the short-term, long-term or during the long-term night-time period. The majority of these noise sensitive receptors exceed the mitigation criteria as a consequence of changes to traffic flow on local roads rather than as a consequence of road traffic noise on the dual carriageway and slip roads of the proposed Scheme.

8.6.16 As these properties are not directly adversely affected by noise from the dual carriageway and slip roads of the proposed Scheme, receptor specific mitigation has not been considered for these properties.

8.7 Residual Impacts

Construction

8.7.1 It is assumed that should the mitigation measures be adopted as previously described, then any potential adverse impacts associated with the construction may not arise and any that do would be short-term in nature.

Operation

8.7.2 The following tables and paragraphs show the predicted noise impacts of the proposed Scheme when the additional receptor specific mitigation measures outlined in Table 8.33 and Figure 8.9 are incorporated. Noise contour change maps for the DM 2021 versus the DS 2021 and DM 2021 versus the DS 2036 scenarios with mitigation are provided in Figures 8.10 to 8.13 for first and ground floor respectively. Furthermore, maps showing the predicted noise levels at the Sample NSRs locations at ground and first floor during the daytime period are provided in Figures 8.16 and 8.17. The respective predicted noise levels during the night-time period are provided in Figures 8.20 and 8.21.

Sample NSR Locations

Short Term Assessment with the Proposed Scheme

Day

8.7.3 The predicted noise levels for the DM 2021 and the DS 2021 scenario with the associated short-term significance of impacts for the daytime period, with additional receptor specific mitigation incorporated, are presented in Table 8.34.

Table 8.34: Sample NSRs – DM 2021 vs. DS 2021 – Day (With Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|---------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV001 | Roseacre | 53.7 | 56.9 | Moderate/ Large adverse | 56.4 | 58.1 | Slight/ Moderate adverse |
| NV002 | Brambly Hedge | 53.3 | 56.7 | Moderate/ Large adverse | 54.9 | 57.6 | Slight/ Moderate adverse |
| NV003 | 6 Milton of Culloden | 52.1 | 57.2 | Large/ V. Large adverse | 53.7 | 58.5 | Moderate/ Large adverse |
| NV004 | The Bungalow | 48.3 | 57.2 | Large/ V. Large adverse | 49.9 | 58.3 | Large/ V. Large adverse |
| NV005 | 117 Hazel Avenue | 50.1 | 56.7 | Large/ V. Large adverse | 51.5 | 58.3 | Large/ V. Large adverse |
| NV006 | Thornhill | 46.0 | 48.7 | Slight/ Moderate adverse | 47.8 | 50.4 | Slight/ Moderate adverse |
| NV007 | Morayston Farmhouse | 39.9 | 51.1 | Large/ V. Large adverse | 44.7 | 54.1 | Large/ V. Large adverse |
| NV008 | 3 Kerrowaird Cottages | 48.7 | 55.7 | Large/ V. Large adverse | 51.5 | 57.2 | Large/ V. Large adverse |
| NV009 | Woodend House | 41.6 | 48.0 | Large/ V. Large adverse | 43.3 | 49.2 | Large/ V. Large adverse |
| NV010 | 1 Culblair Farm Cottages | 39.1 | 53.4 | Large/ V. Large adverse | 42.5 | 55.1 | Large/ V. Large adverse |
| NV011 | Milton of Braichlaich Farm | 38.6 | 45.1 | Large/ V. Large adverse | 41.5 | 47.2 | Large/ V. Large adverse |
| NV012 | Brackley Farmhouse | 52.0 | 54.8 | Slight/ Moderate adverse | 58.8 | 60.8 | Slight/ Moderate adverse |
| NV013 | New House, Easter Glackton Road | 53.1 | 55.6 | Slight/ Moderate adverse | 53.7 | 56.3 | Slight/ Moderate adverse |
| NV014 | Blackcastle Cottage | 52.1 | 58.3 | Large/ V. Large adverse | 55.7 | 60.3 | Moderate/ Large adverse |
| NV015 | New House, North Kildrummie Farm | 37.3 | 58.2 | Large/ V. Large adverse | 39.1 | 59.0 | Large/ V. Large adverse |
| NV016 | Athenry | 32.0 | 54.7 | Large/ V. Large adverse | 34.6 | 56.1 | Large/ V. Large adverse |
| NV017 | Fonn | 18.7 | 40.3 | Large/ V. Large adverse | 21.9 | 41.4 | Large/ V. Large adverse |
| NV018 | Skene Park Farm | 39.5 | 57.1 | Large/ V. Large adverse | 33.8 | 52.9 | Large/ V. Large adverse |
| NV019 | Blackpark Farm | 35.8 | 44.8 | Large/ V. Large adverse | 38.5 | 46.8 | Large/ V. Large adverse |
| NV020 | Orchard House | 44.1 | 46.2 | Slight/ Moderate adverse | 45.3 | 47.0 | Slight/ Moderate adverse |
| NV021 | Millhill | 43.9 | 53.9 | Large/ V. Large adverse | 44.9 | 54.2 | Large/ V. Large adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|-----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV022 | East Lodge Cottage | 38.5 | 55.8 | Large/ V. Large adverse | 41.0 | 57.3 | Large/ V. Large adverse |
| NV023 | 3 The Steading | 47.5 | 47.2 | Slight beneficial | 49.7 | 48.2 | Slight/ Moderate beneficial |
| NV024 | Penick Farmhouse | 39.0 | 41.8 | Slight/ Moderate adverse | 41.1 | 43.1 | Slight/ Moderate adverse |
| NV025 | Innesfree | 56.6 | 56.5 | Slight beneficial | 50.9 | 50.5 | Slight beneficial |
| NV026 | Hardmuir of Boath Farmhouse | 39.4 | 40.4 | Slight/ Moderate adverse | 41.1 | 41.9 | Slight adverse |
| NV027 | The Gate Lodge | 45.8 | 46.2 | Slight adverse | 46.9 | 47.2 | Slight adverse |

8.7.4 The results show that at ground floor level with receptor specific mitigation, 16 of the sample receptors are predicted to have a Large/Very Large adverse significance. Two sample receptors are predicted to have a Moderate/Large adverse significance, six sample receptors are predicted to have a Slight/Moderate adverse impact, one sample receptor is predicted to have a Slight adverse significance and two sample receptors are predicted to have a Slight beneficial significance of impact. It should be appreciated that although some of the sample receptors still have Large/Very Large adverse significance of noise impacts the mitigation threshold criteria defined in paragraph 8.2.33 is not met at any of the sample receptors.

8.7.5 At the first floor level there are 14 sample receptors that are predicted to have a Large/Very Large adverse significance. Two sample receptors are predicted to have a Moderate/Large adverse significance, seven sample receptors are predicted to have a Slight/Moderate adverse significance, two sample receptors are predicted to have a Slight adverse significance, one sample receptor is predicted to have a Slight beneficial significance of impact and a single sample receptor is predicted to have a Slight/Moderate beneficial significance of impact.

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

Long Term Assessment with the Proposed Scheme

Day

8.7.7 The predicted noise levels for the DM 2021 scenario and the DS 2036 scenario with the associated long-term significance of impacts for the daytime period, with additional receptor specific mitigation incorporated, are presented in Table 8.35.

Table 8.35: Sample NSRs – DM 2021 vs. DS 2036 – Day (With Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|--------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV001 | Roseacre | 53.7 | 57.4 | Slight/ Moderate adverse | 56.4 | 58.6 | Slight adverse |
| NV002 | Brambly Hedge | 53.3 | 57.5 | Slight/ Moderate adverse | 54.9 | 58.4 | Slight/ Moderate adverse |
| NV003 | 6 Milton of Culloden | 52.1 | 57.9 | Moderate/ Large adverse | 53.7 | 59.2 | Moderate/ Large adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|--------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV004 | The Bungalow | 48.3 | 57.9 | Moderate/ Large adverse | 49.9 | 59.0 | Moderate/ Large adverse |
| NV005 | 117 Hazel Avenue | 50.5 | 57.8 | Moderate/ Large adverse | 51.5 | 59.0 | Moderate/ Large adverse |
| NV006 | Thornhill | 46.0 | 49.5 | Slight/ Moderate adverse | 47.8 | 51.2 | Slight/ Moderate adverse |
| NV007 | Morayston Farmhouse | 39.9 | 52.0 | Large/ V. Large adverse | 44.7 | 55.0 | Large/ V. Large adverse |
| NV008 | 3 Kerrowaird Cottages | 48.7 | 56.6 | Moderate/ Large adverse | 51.5 | 58.1 | Moderate/ Large adverse |
| NV009 | Woodend House | 41.6 | 48.9 | Moderate/ Large adverse | 43.3 | 50.1 | Moderate/ Large adverse |
| NV010 | 1 Culblair Farm Cottages | 39.1 | 54.4 | Large/ V. Large adverse | 42.5 | 56.1 | Large/ V. Large adverse |
| NV011 | Milton of Braichlaich Farm | 38.6 | 45.9 | Moderate/ Large adverse | 41.5 | 48.1 | Moderate/ Large adverse |
| NV012 | Brackley Farmhouse | 52.0 | 54.5 | Slight adverse | 52.6 | 54.5 | Slight adverse |
| NV013 | New House, Easter Glackton Road | 52.5 | 55.8 | Slight/ Moderate adverse | 53.7 | 57.1 | Slight/ Moderate adverse |
| NV014 | Blackcastle Cottage | 52.1 | 59.1 | Moderate/ Large adverse | 55.7 | 61.1 | Moderate/ Large adverse |
| NV015 | New House, North Kildrummie Farm | 37.3 | 59.3 | Large/ V. Large adverse | 39.1 | 60.1 | Large/ V. Large adverse |
| NV016 | Atheny | 32.0 | 55.7 | Large/ V. Large adverse | 34.6 | 57.1 | Large/ V. Large adverse |
| NV017 | Fonn | 18.7 | 41.3 | Large/ V. Large adverse | 21.9 | 42.4 | Large/ V. Large adverse |
| NV018 | Skene Park Farm | 39.0 | 57.7 | Large/ V. Large adverse | 33.8 | 54.0 | Large/ V. Large adverse |
| NV019 | Blackpark Farm | 35.8 | 45.9 | Large/ V. Large adverse | 38.5 | 47.9 | Moderate/ Large adverse |
| NV020 | Orchard House | 44.1 | 47.2 | Slight/ Moderate adverse | 45.3 | 48.0 | Slight adverse |
| NV021 | Millhill | 43.9 | 54.9 | Large/ V. Large adverse | 44.9 | 55.2 | Large/ V. Large adverse |
| NV022 | East Lodge Cottage | 38.5 | 56.7 | Large/ V. Large adverse | 41.0 | 58.3 | Large/ V. Large adverse |
| NV023 | 3 The Steading | 47.5 | 48.3 | Slight adverse | 49.7 | 49.3 | Slight beneficial |
| NV024 | Penick Farmhouse | 39.0 | 42.9 | Slight/ Moderate adverse | 41.1 | 44.1 | Slight/ Moderate adverse |
| NV025 | Innesfree | 56.6 | 57.4 | Slight adverse | 50.9 | 51.4 | Slight adverse |
| NV026 | Hardmuir of Boath Farmhouse | 39.4 | 41.3 | Slight adverse | 41.1 | 42.8 | Slight adverse |
| NV027 | The Gate Lodge | 45.8 | 47.0 | Slight adverse | 46.9 | 47.9 | Slight adverse |

- 8.7.8 The results show that during the daytime period at ground floor level and with receptor specific nine of the sample receptors are predicted to have a Large/Very Large adverse significance. Seven sample receptors are predicted to have a Moderate/Large adverse significance, six sample receptors are predicted to have a Slight/Moderate adverse significance and five sample receptors are predicted to have a Slight adverse significance of noise impact.
- 8.7.9 During the daytime period at first floor level and with receptor specific eight of the sample receptors are predicted to have a Large/Very Large adverse significance. Eight sample receptors are predicted to have a Moderate/Large adverse significance, four sample receptors are predicted to have a Slight/Moderate adverse significance, six sample receptors are predicted to have a Slight adverse significance and one sample receptor is predicted to have a Slight beneficial significance of noise impact.
- 8.7.10 As has been previously stated although some of the sample receptors still have Large/Very Large adverse significance of noise impacts the ground-level mitigation threshold criteria defined in paragraph 8.2.33 is not met at any of the sample receptors.

Night

- 8.7.11 The analysis undertaken for night-time noise levels has shown that none of the sample receptors are predicted to experience noise levels in excess of $L_{night, outside}$ 55dB.

Summary Tables for all NSRs within 600m Calculation Area

Do-Minimum Scenario vs. Do-Something Scenario in the Baseline Year

- 8.7.12 In accordance with DMRB 'Noise and Vibration' Table A1.1, a summary of the magnitude of noise impacts at all dwellings within the 600m calculation area for the DM 2021 scenario versus the DS 2021 scenario, for the daytime period, at ground and first floor, with additional receptor specific mitigation, is presented in Table 8.36 and Table 8.37, respectively. Note that in accordance with DMRB 'Noise and Vibration', assessment of night-time noise is not required for this 'short-term' assessment.

Table 8.36: Summary – Ground Floor DM 2021 vs. DS 2021 – Day (With Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors | |
|--|---------------------|---------------------|-------------------------------------|----|
| Increase (Adverse) in Noise Level | 0.1 – 0.9 | negligible | 1,980 | 15 |
| | 1.0 – 2.9 | minor | 1,601 | 8 |
| | 3.0 – 4.9 | moderate | 441 | 2 |
| | 5.0+ | major | 480 | 5 |
| No Change | 0 | no change | 121 | 1 |
| Decrease (Beneficial) in Noise Level | 0.1 – 0.9 | negligible | 673 | 8 |
| | 1.0 – 2.9 | minor | 2,127 | 16 |
| | 3.0 – 4.9 | moderate | 673 | 10 |
| | 5.0+ | major | 26 | 0 |

Table 8.37: Summary – First Floor DM 2021 vs. DS 2021 – Day (With Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors |
|--|---------------------|---------------------|-------------------------------------|
| Increase (Adverse) in Noise Level | 0.1 – 0.9 | negligible | 1,963 |
| | 1.0 – 2.9 | minor | 1,612 |
| | 3.0 – 4.9 | moderate | 405 |
| | 5.0+ | major | 395 |
| No Change | 0 | no change | 124 |
| Decrease (Beneficial) in Noise Level | 0.1 – 0.9 | negligible | 729 |
| | 1.0 – 2.9 | minor | 2,168 |
| | 3.0 – 4.9 | moderate | 698 |
| | 5.0+ | major | 28 |

8.7.13 Although the above tables show the magnitude of residual noise impacts the following text presents the predicted significance of noise impacts at dwellings as set out in Table 8.5.

8.7.14 As can be seen in Table 8.36, as a result of the proposed Scheme in the short-term and with receptor specific mitigation in place 1,980 dwellings would experience a Slight adverse significance of noise impact. 1,601 dwellings are predicted to have a Slight/Moderate adverse significance, 441 dwellings are predicted to have a Moderate/Large adverse significance and 480 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 673 dwellings would experience a Slight beneficial significance, 2,127 dwellings would experience a Slight/Moderate beneficial significance, 673 dwellings would experience a Moderate/Large beneficial significance and 26 dwellings would experience a Major beneficial significance. There are 121 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.

8.7.15 Of the 480 residential dwellings in the short term predicted to experience a Large/Very Large adverse significance of noise impact it should be appreciated that 393 of these receptors are predicted to have noise levels as a result of the Scheme equal to or less than $L_{A10,18h}$ 50dB. This equates to a $L_{Aeq,16h}$ free-field noise level of 45.5dB, which is 4.5dB below the World Health Organizations moderate annoyance guideline value of $L_{Aeq,16h}$ 50dB for outdoor living areas. The reason that these properties have a predicted Large/Very Large adverse significance of noise impact can be attributed to the fact that in the Do-minimum scenario they are predicted to have very low noise levels, in most cases less than $L_{A10,18h}$ 40dB. Indeed, the majority of the receptors in this band are situated at the southern suburbs of Nairn and are currently shielded from the existing road traffic noise on the A96 by other buildings within Nairn. In addition, of the remaining 87 residential dwellings with a Large/Very Large adverse significance of noise impact none of these dwellings are predicted to have noise levels in excess of $L_{A10,18h}$ 59.5dB

8.7.16 Graphics illustrating the noise level changes during the daytime period, within the calculation area for the DM 2021 scenario versus the DS 2021 scenario, with additional receptor specific mitigation, are shown in Figures 8.10 and 8.11.

Do-Minimum Scenario vs. Do-Something Scenario in the Future Assessment Year

8.7.17 In accordance with DMRB 'Noise and Vibration' Table A1.2, summaries of the magnitude of noise impacts at all dwellings within the 600m calculation area for the DM 2021 scenario versus the DS 2036 scenario, for the daytime period at ground and first floor, with additional receptor specific mitigation, are presented in Table 8.38 and Table 8.39, respectively.

Table 8.38: Summary – Ground Floor DM 2021 vs. DS 2036 – Day (With Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors | |
|--|---------------------|---------------------|-------------------------------------|----|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,809 | 29 |
| | 3.0 – 4.9 | minor | 732 | 5 |
| | 5.0 – 9.9 | moderate | 401 | 5 |
| | 10.0+ | major | 190 | 0 |
| No Change | 0 | no change | 77 | 1 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,822 | 25 |
| | 3.0 – 4.9 | minor | 86 | 0 |
| | 5.0 – 9.9 | moderate | 5 | 0 |
| | 10.0+ | major | 0 | 0 |

Table 8.39: Summary – First Floor DM 2021 vs. DS 2036 – Day (With Receptor Specific Mitigation)

| Change in Noise Level Day $L_{A10,18h}$ dB | Magnitude of Impact | Number of Dwellings | Number of Other Sensitive Receptors | |
|--|---------------------|---------------------|-------------------------------------|----|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,829 | 28 |
| | 3.0 – 4.9 | minor | 701 | 3 |
| | 5.0 – 9.9 | moderate | 361 | 5 |
| | 10.0+ | major | 167 | 0 |
| No Change | 0 | no change | 95 | 2 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,852 | 27 |
| | 3.0 – 4.9 | minor | 111 | 0 |
| | 5.0 – 9.9 | moderate | 6 | 0 |
| | 10.0+ | major | 0 | 0 |

- 8.7.18 Although the above tables show the magnitude of noise impacts the following text presents the predicted significance of residual noise impacts at dwellings as set out in Table 8.5.
- 8.7.19 As can be seen in Table 8.38, as a result of the proposed Scheme in the long-term 3,809 dwellings would experience a Slight adverse significance of noise impact. 732 dwellings are predicted to have a Slight/Moderate adverse significance, 401 dwellings are predicted to have a Moderate/Large adverse significance and 190 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 2,822 dwellings would experience a Slight beneficial significance, 86 dwellings would experience a Slight/Moderate beneficial significance and five dwellings would experience a Moderate/Large beneficial significance. There are 77 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.
- 8.7.20 Of the 190 residential dwellings predicted to experience a Large/Very Large adverse significance of noise impact it should be appreciated that of these, 144 receptors are predicted to have noise levels as a result of the Scheme equal to or less than $L_{A10,18h}$ 50dB and these occur for similar reasons as they do in the short term. In addition of the remaining 46 residential dwellings with a Large/Very Large adverse significance of noise impact none of these dwellings are predicted to have noise levels in excess of $L_{A10,18h}$ 59.5dB.
- 8.7.21 Graphics illustrating the noise level changes during the daytime period, within the calculation area for the DM 2021 scenario versus the DS 2036 scenario, with additional receptor specific mitigation, are shown in Figures 8.12 to 8.13
- 8.7.22 The corresponding summary tables for the DM 2021 scenario versus the DS 2036 scenario, for the night-time period at the ground and first floor are presented in Table 8.40 and Table 8.41, respectively. These tables provide the magnitude of impacts for all dwellings within the 600m calculation. In addition the tables provide information on:

- the number of dwellings with noise levels below $L_{\text{night, outside}} 55\text{dB}$ in the DM 2021 scenario which increase to above $L_{\text{night, outside}} 55\text{dB}$ in the DS 2036 scenario;
- the number of dwellings with noise levels above $L_{\text{night, outside}} 55\text{dB}$ in both the DM 2021 and DS 2036 scenarios; and
- the number of dwellings with noise levels above $L_{\text{night, outside}} 55\text{dB}$ in the DM 2021 scenario which reduce to below $L_{\text{night, outside}} 55\text{dB}$ in the DS 2036 scenario.

Table 8.40: Summary – Ground Floor DM 2021 vs. DS 2036 – Night (With Receptor Specific Mitigation)

| Change in Noise Level $L_{\text{night, outside}}$ dB | Magnitude of Impact | Number of Dwellings | Number of Dwellings (DM 2021 < 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DMS2036 < 55dB) | |
|--|---------------------|---------------------|--|--|--|-----|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 3,993 | 41 | 59 | N/A |
| | 3.0 – 4.9 | minor | 621 | 1 | 0 | N/A |
| | 5.0 – 9.9 | moderate | 375 | 0 | 0 | N/A |
| | 10.0+ | major | 144 | 0 | 0 | N/A |
| No Change | 0 | no change | 82 | 0 | 0 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,874 | N/A | 10 | 2 |
| | 3.0 – 4.9 | minor | 31 | N/A | 2 | 0 |
| | 5.0 – 9.9 | moderate | 2 | N/A | 0 | 0 |
| | 10.0+ | major | 0 | N/A | 0 | 0 |

Table 8.41: Summary – First Floor DM 2021 vs. DS 2036 – Night (With Receptor Specific Mitigation)

| Change in Noise Level $L_{\text{night, outside}}$ dB | Magnitude of Impact | Number of Dwellings | Number of Dwellings (DM 2021 < 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DS 2036 ≥ 55dB) | Number of Dwellings (DM 2021 ≥ 55dB, DMS2036 < 55dB) | |
|--|---------------------|---------------------|---|--|--|-----|
| Increase (Adverse) in Noise Level | 0.1 – 2.9 | negligible | 4,016 | 55 | 71 | N/A |
| | 3.0 – 4.9 | minor | 558 | 1 | 0 | N/A |
| | 5.0 – 9.9 | moderate | 348 | 0 | 0 | N/A |
| | 10.0+ | major | 117 | 0 | 0 | N/A |
| No Change | 0 | no change | 122 | 0 | 0 | 0 |
| Decrease (Beneficial) in Noise Level | 0.1 – 2.9 | negligible | 2,919 | N/A | 10 | 3 |
| | 3.0 – 4.9 | minor | 39 | N/A | 2 | 2 |
| | 5.0 – 9.9 | moderate | 3 | N/A | 0 | 0 |
| | 10.0+ | major | 0 | N/A | 0 | 0 |

8.7.23 Although the above tables show the magnitude of noise impacts the following text presents the predicted significance of residual noise impacts at dwellings as set out in Table 8.5.

8.7.24 As can be seen in Table 8.40 during the night-time period at ground floor level in the long-term and with receptor specific mitigation there are a total of 113 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 100 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are two dwellings which are predicted to experience noise levels below $L_{\text{night, outside}} 55\text{dB}$ which were exposed to a noise level above this in the Do-minimum scenario.

8.7.25 At first floor level in the long-term there are a total of 139 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 126 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a

Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are five dwellings which are predicted to experience noise levels below $L_{\text{night, outside}} 55\text{dB}$ and were exposed to a noise level above this in the Do-minimum scenario.

Health and Educational Establishments

8.7.26 For each of the identified health and educational buildings, the daytime noise levels at ground and first floor for the DM 2021 scenario and the DS 2021 scenario, with additional receptor specific mitigation, with associated magnitude of impacts is presented in Table 8.42. The DM 2021 scenario and the DS 2036 scenario, with additional receptor specific mitigation, with the associated magnitude of impacts are presented in Table 8.43.

Table 8.42: Health and Educational Establishments – DM 2021 vs. DS 2021 – Day (With Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted $L_{A10,18h}$ (dB) Noise Level (Façade) | | | | | |
|-------|--|---|------------|-----------------------------|-------------|------------|----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV038 | Millburn Academy Pavilion | 50.4 | 50.5 | Slight Adverse | 45.6 | 45.8 | Slight Adverse |
| NV039 | Millburn Academy | 50.2 | 50.4 | Slight Adverse | 51.2 | 51.4 | Slight Adverse |
| NV040 | Raigmore Primary School | 42.6 | 42.8 | Slight Adverse | 51.5 | 51.6 | Slight Adverse |
| NV041 | Stoneyfield Dental Surgery | 52.7 | 53.2 | Neutral/ Slight Adverse | 55.4 | 55.8 | Neutral/ Slight Adverse |
| NV042 | Smithton Primary School | 40.4 | 42.7 | Slight/ Moderate Adverse | 43.3 | 45.4 | Slight/ Moderate Adverse |
| NV043 | Balloch Primary School | 46.3 | 48.0 | Slight/ Moderate Adverse | 48.6 | 50.1 | Slight/ Moderate Adverse |
| NV044 | Old School, 28 Cherry Park | 42.6 | 45.3 | Slight/ Moderate Adverse | 45.8 | 47.9 | Slight/ Moderate Adverse |
| NV045 | Gowan Brae, 45 Culloden Road | 47.4 | 49.1 | Slight/ Moderate Adverse | 49.4 | 51.1 | Slight/ Moderate Adverse |
| NV046 | Nairn Academy | 39.4 | 43.0 | Moderate/ Large Adverse | 41.5 | 44.1 | Slight/ Moderate Adverse |
| NV047 | Nairn Town and County Hospital | 34.0 | 40.4 | Moderate/ Large Adverse | 36.9 | 42.1 | Moderate/ Large Adverse |
| NV048 | The Manor Care Centre | 31.9 | 39.8 | Moderate/ Large Adverse | 35.2 | 41.8 | Moderate/ Large Adverse |
| NV049 | Nairn Dental Care Ltd | 42.9 | 40.0 | Slight/ Moderate Beneficial | 45.0 | 42.0 | Moderate/ Large Beneficial |
| NV050 | Rosebank Primary School | 44.4 | 44.3 | Slight Beneficial | 46.4 | 45.9 | Slight Beneficial |
| NV051 | Chiropody Clinic at Westbury House | 45.2 | 46.3 | Slight Adverse | 46.5 | 47.2 | Neutral/ Slight Adverse |
| NV052 | Windsor House Dental Practice | 64.6 | 64.4 | Neutral/ Slight Beneficial | 64.3 | 64.1 | Neutral/ Slight Beneficial |
| NV053 | The Dental Surgery, Millbank Crescent | 39.9 | 40.2 | Neutral/ Slight Adverse | 42.1 | 42.1 | Neutral |
| NV054 | Millbank Primary School | 36.2 | 39.0 | Slight/ Moderate Adverse | 38.7 | 40.9 | Slight/ Moderate Adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|-----------------------------|-------------|------------|-----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2021 | Significance of Impact | DM 2021 | DS 2021 | Significance of Impact |
| NV055 | Moray College Learning Centre | 43.2 | 39.6 | Moderate Beneficial | 45.7 | 42.1 | Moderate Beneficial |
| NV056 | Auldearn Primary School | 59.2 | 58.0 | Slight/ Moderate Beneficial | 59.8 | 58.5 | Slight/ Moderate Beneficial |

Table 8.43: Health and Educational Establishments – DM 2021 vs. DS 2036 – Day (With Receptor Specific Mitigation)

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|--------------------------|-------------|------------|--------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV038 | Millburn Academy Pavilion | 42.3 | 43.0 | Slight Adverse | 45.7 | 46.3 | Slight Adverse |
| NV039 | Millburn Academy | 47.3 | 48.0 | Slight Adverse | 47.7 | 48.4 | Slight Adverse |
| NV040 | Raigmore Primary School | 49.3 | 50.1 | Slight Adverse | 50.7 | 51.5 | Slight Adverse |
| NV041 | Stoneyfield Dental Surgery | 52.6 | 53.8 | Neutral/ Slight Adverse | 58.1 | 59.2 | Neutral/ Slight Adverse |
| NV042 | Smithton Primary School | 40.4 | 43.4 | Slight/ Moderate Adverse | 43.3 | 46.2 | Slight Adverse |
| NV043 | Balloch Primary School | 46.3 | 48.5 | Slight Adverse | 50.2 | 52.2 | Slight Adverse |
| NV044 | Old School, 28 Cherry Park | 43.7 | 47.1 | Slight/ Moderate Adverse | 44.8 | 47.7 | Slight Adverse |
| NV045 | Gowan Brae, 45 Culloden Road | 47.4 | 49.7 | Slight Adverse | 49.4 | 51.8 | Slight Adverse |
| NV046 | Nairn Academy | 39.4 | 43.9 | Slight/ Moderate Adverse | 41.5 | 45.0 | Slight/ Moderate Adverse |
| NV047 | Nairn Town and County Hospital | 34.0 | 41.4 | Moderate Adverse | 36.9 | 43.1 | Moderate Adverse |
| NV048 | The Manor Care Centre | 31.9 | 40.8 | Moderate Adverse | 34.9 | 42.6 | Moderate Adverse |
| NV049 | Nairn Dental Care Ltd | 42.9 | 40.6 | Slight Beneficial | 45.0 | 42.6 | Slight Beneficial |
| NV050 | Rosebank Primary School | 44.4 | 44.8 | Slight Adverse | 46.7 | 46.7 | Neutral |
| NV051 | Chiropody Clinic at Westbury House | 45.2 | 46.7 | Neutral/ Slight Adverse | 46.5 | 47.6 | Neutral/ Slight Adverse |
| NV052 | Windsor House Dental Practice | 64.6 | 64.6 | Neutral | 64.3 | 64.3 | Neutral |
| NV053 | The Dental Surgery, Millbank Crescent | 39.9 | 40.9 | Neutral/ Slight Adverse | 42.1 | 42.8 | Neutral/ Slight Adverse |
| NV054 | Millbank Primary School | 36.2 | 39.9 | Slight/ Moderate Adverse | 39.1 | 42.2 | Slight/ Moderate Adverse |

| ID | Address/ Representative Location | Predicted L _{A10,18h} (dB) Noise Level (Façade) | | | | | |
|-------|--|--|------------|----------------------------|-------------|---------|----------------------------|
| | | Ground Floor | | | First Floor | | |
| | | DM 2021 | DS 2036 | Significance of Impact | DM 2021 | DS 2036 | Significance of Impact |
| NV055 | Moray College Learning Centre | 43.2 | 40.5 | Neutral/ Slight Beneficial | 45.7 | 42.9 | Neutral/ Slight Beneficial |
| NV056 | Auldearn Primary School | 59.2 | 57.7 | Slight Beneficial | 59.8 | 58.3 | Slight Beneficial |

8.7.27 In the short-term, with the proposed Scheme in place at the ground floor level three buildings are predicted to have a Moderate/Large adverse significance, five buildings have a Slight/Moderate adverse significance, four buildings have a Slight adverse significance, two buildings have a Neutral/Slight adverse significance, one building has a Neutral/Slight beneficial significance, one building has a Slight beneficial significance, two buildings have a Slight/Moderate beneficial significance and one building has a Moderate beneficial significance of impact. A similar significance of impact is predicted to occur at the first floor level.

8.7.28 In the long-term, with the proposed Scheme in place at the ground floor level, two buildings are predicted to have a Moderate adverse significance, four buildings are predicted to have a Slight/Moderate adverse significance, six buildings are predicted to have a Slight adverse significance, three buildings are predicted to have a Neutral/Slight adverse significance, one building is predicted to have a Neutral/ significance and one building is predicted to have a Neutral/Slight beneficial significance of noise impact and 2 buildings are predicted to have a Slight Beneficial significance of noise impact. Similar significance of impacts is predicted to occur at the first floor level of these buildings.

Noise Nuisance

8.7.29 The predicted DMRB noise nuisance for the DM 2021 scenario versus the DM 2036 scenario and the DM 2021 scenario versus the DS 2036 scenario, with additional receptor specific mitigation, have been determined, and are summarised in Table 8.44 to illustrate the potential noise impacts (based on maximum façade noise levels).

Table 8.44 Summary of Traffic Noise Nuisance (With Receptor Specific Mitigation)

| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Assessment Year (Do-Minimum); and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Assessment Year (Do-Something) | | | | | |
|---|----------|---------------------|---------------------|---------------------|---------------------|
| Change in Traffic Induced Noise Nuisance | | Ground Floor | | First Floor | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| | | Number of Dwellings | Number of Dwellings | Number of Dwellings | Number of Dwellings |
| Increase (Adverse) in Noise Nuisance | < 10% | 6,296 | 1,268 | 6,729 | 1,457 |
| | 10 < 20% | 0 | 1,016 | 0 | 988 |
| | 10 < 30% | 0 | 1,699 | 0 | 1,729 |
| | 30 < 40% | 0 | 653 | 0 | 561 |
| | > 40% | 0 | 268 | 0 | 239 |
| No Change | | 1,442 | 2,160 | 816 | 1,539 |
| Decrease | < 10% | 384 | 1,058 | 577 | 1,608 |

| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Assessment Year (Do-Minimum); and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Assessment Year (Do-Something) | | | | | |
|---|----------|---------------------|---------------------|---------------------|---------------------|
| Change in Traffic Induced Noise Nuisance | | Ground Floor | | First Floor | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| | | Number of Dwellings | Number of Dwellings | Number of Dwellings | Number of Dwellings |
| (Beneficial) in Noise Nuisance | 10 < 20% | 0 | 0 | 0 | 1 |
| | 10 < 30% | 0 | 0 | 0 | 0 |
| | 30 < 40% | 0 | 0 | 0 | 0 |
| | > 40% | 0 | 0 | 0 | 0 |

8.7.30 As shown in Table 8.44 at the ground floor level there is an overall reduction in noise nuisance with the proposed Scheme compared to without the proposed Scheme. There are 6,296 dwellings with adverse noise nuisance without the proposed Scheme and 4,904 dwellings with the proposed Scheme, of which 3,636 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands ($\geq 10\%$ increase in noise nuisance levels). In addition, following the introduction of the proposed Scheme there are 1,058 dwellings predicted to experience a reduction in noise nuisance compared with 384 reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings.

Vibration Nuisance

8.7.31 The predicted vibration nuisance for the DM 2021 scenario versus the DM 2036 scenario and the DM 2021 scenario versus the DS 2036 scenario, with additional receptor specific mitigation, have been determined and are summarised in Table 8.45 for all properties that are within 40m of affected roads with a predicted noise level greater than $L_{A10,18h}$ 58dB.

Table 8.45: Summary of Traffic Induced Airborne Vibration Nuisance (With Receptor Specific Mitigation)

| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Assessment Year (Do-Minimum) and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Assessment Year (Do-Something) | | | | | |
|---|----------|---------------------|---------------------|---------------------|---------------------|
| Change in Traffic Induced Airborne Vibration Nuisance | | Ground Floor | | First Floor | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| | | Number of Dwellings | Number of Dwellings | Number of Dwellings | Number of Dwellings |
| Increase (Adverse) in Noise Nuisance | < 10% | 1,176 | 392 | 1,214 | 393 |
| | 10 < 20% | 0 | 357 | 0 | 412 |
| | 10 < 30% | 0 | 32 | 0 | 33 |
| | 30 < 40% | 0 | 0 | 0 | 1 |
| | > 40% | 0 | 0 | 0 | 0 |
| No Change | | 553 | 926 | 514 | 857 |
| Decrease | < 10% | 3 | 25 | 4 | 36 |

| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Assessment Year (Do-Minimum) and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Assessment Year (Do-Something) | | | | | |
|---|----------|---------------------|---------------------|---------------------|---------------------|
| Change in Traffic Induced Airborne Vibration Nuisance | | Ground Floor | | First Floor | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| | | Number of Dwellings | Number of Dwellings | Number of Dwellings | Number of Dwellings |
| (Beneficial) in Noise Nuisance | 10 < 20% | 0 | 0 | 0 | 0 |
| | 10 < 30% | 0 | 0 | 0 | 0 |
| | 30 < 40% | 0 | 0 | 0 | 0 |
| | > 40% | 0 | 0 | 0 | 0 |

8.7.32 With regard to airborne traffic induced vibration at ground floor level, there are 1,176 dwellings within 40m of all assessed roads with adverse vibration nuisance without the proposed Scheme and a total of 781 dwellings with the proposed Scheme, although 389 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands ($\geq 10\%$ increase in noise nuisance level). In addition, following the introduction of the proposed Scheme there are 25 dwellings predicted to experience a reduction in vibration nuisance compared with three reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings within 40m of all assessed roads.

Noise Insulation

8.7.33 As noted in paragraph 8.2.23, Regulation 3 of the Noise Insulation (Scotland) Regulations 1975 (NISR), confers a duty on the roads authorities in certain instances to offer insulation to eligible residential properties affected by noise.

8.7.34 The results of the noise assessment indicate that with the mitigation outlined in Table 8.34 there are eight residential buildings which may still be eligible for noise insulation. These are:

- Seafield of Raigmore, Inverness, Highland, IV2 7PA;
- Stratton Farmhouse, Barn Church Road, Culloden, Inverness, IV2 7NS;
- Stratton Farm Cottage, Barn Church Road, Culloden, Inverness, IV2 7NS;
- Churchfield Cottage, Barn Church Road, Culloden, Inverness, IV2 7NS;
- 2 Upper Cullernie Cottages, Cullernie Road, Balloch, Inverness IV2 7HU;
- 3 Upper Cullernie Cottages, Cullernie Road, Balloch, Inverness IV2 7HU;
- Edgefield, Cullernie Road, Balloch, Inverness IV2 7HU; and
- Laurel Cottage, Gollanfield, Inverness, IV2 7UR

8.7.35 The procedure for offering noise insulation work or grants is detailed within Regulation 8 of the NISR, and is summarised below:

- A list (or map) of all properties that are eligible for noise insulation shall be published no later than twelve months after opening of the proposed scheme;
- An offer to carry out work, or the offer of a grant to cover such work, shall be made within three months of the list (or map) of eligible properties being published; and
- Each eligible property will be offered the opportunity of work to be undertaken, or a grant be made available, for each eligible room on the building.

- 8.7.36 Acceptance of the noise insulation offer must be received by the roads authority within six months of the offer being made, or within twelve months of the scheme opening, whichever expires later.
- 8.7.37 It should also be noted that there is a requirement (5c of the NISR Memorandum) for reassessments, based on subsequent traffic counts, to be made in the fifth, tenth and fifteenth years after scheme opening following the original assessment. The reassessment is undertaken to identify properties that originally did not qualify for an offer of noise insulation but have since become eligible following reassessment.

Summary of Residual Impacts

- 8.7.38 An assessment of the potential noise and vibration impacts from both the construction and operational phases of the proposed Scheme has been undertaken for all noise sensitive receptors within the study area.
- 8.7.39 The assessment has been undertaken in accordance with the requirements of the DMRB Volume 11, Section 3, Part 7, HD213/11 Revision 1 Noise and Vibration Highways Agency, Transport Scotland, Welsh Government and The Department for Regional Development Northern Ireland 2011 Detailed Assessment methodology which is the recommended method for assessing noise and vibration impacts from new or altered road schemes.
- 8.7.40 A baseline noise survey of the existing ambient noise levels at a number of dwellings along the proposed Scheme which were representative of the noise climate of the study area was undertaken.
- 8.7.41 During construction of the road project, short-term noise impacts of Moderate/Large adverse significance at the worst affected NSRs close to the works might be expected based upon professional judgement and therefore appropriate mitigation would be identified to minimise noise impacts once a Contractor is engaged. Based upon professional judgement at this stage, without mitigation in place, vibration impacts of up to Moderate adverse significance might be experienced by the nearest residents to the proposed Scheme. Again, appropriate mitigation would be employed by the Contractor to ensure vibration impacts are mitigated.
- 8.7.42 Without the proposed Scheme, over the 15 year period from opening (2021 – 2036), at ground floor level, there is predicted to be 7,139 dwellings which would experience a Slight adverse significance of noise impact, 22 dwellings with a Slight/Moderate adverse significance, 748 dwellings with a Slight beneficial significance, a single dwelling with a Slight/Moderate beneficial impact and 212 dwellings with a Neutral significance of noise impact. Similar significance of noise impacts are predicted to occur at the first floor.
- 8.7.43 During the night-time period, without the proposed Scheme there are predicted to be 245 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 239 of these dwellings are predicted to have a Slight adverse significance of noise impact, whilst six dwellings would have a Neutral significance. Similar significance of noise impacts are predicted at first floor level although a single dwelling is predicted to experience a Slight/Moderate adverse significance of noise impact.
- 8.7.44 In the short-term with the proposed Scheme and with no additional receptor specific mitigation during the daytime period at ground floor level there are predicted to be 1,954 dwellings which would experience a Slight adverse significance of noise impact. 1,599 dwellings are predicted to have a Slight/Moderate adverse significance, 462 dwellings are predicted to have a Moderate/Large adverse significance and 487 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 673 dwellings would experience a Slight beneficial significance, 2,127 dwellings would experience a Slight/Moderate beneficial significance, 673 dwellings would experience a Moderate/Large beneficial significance and 26 dwellings would experience a Major beneficial significance. There are 121 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor

- 8.7.45 In the long-term with the proposed Scheme during the day at ground floor level and with no incorporated mitigation the results show that there would be 3,772 dwellings which would experience a Slight adverse significance of noise impact. 756 dwellings are predicted to have a Slight/Moderate adverse significance, 414 dwellings are predicted to have a Moderate/Large adverse significance and 190 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 2,823 dwellings would experience a Slight beneficial significance, 86 dwellings would experience a Slight/Moderate beneficial significance and five dwellings would experience a Moderate/Large beneficial significance. There are 76 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.
- 8.7.46 In the long-term with the proposed Scheme during the night-time period at ground floor and with no additional receptor specific mitigation there are a total of 113 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 100 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are two dwellings which are predicted to experience noise levels below $L_{\text{night, outside}} 55\text{dB}$ which were exposed to a noise level above this in the Do-minimum scenario.
- 8.7.47 During the night-time period at first floor level in the long-term there are a total of 139 dwellings with noise levels which would exceed the WHO interim night target of $L_{\text{night, outside}} 55\text{dB}$. 126 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are five dwellings which are predicted to experience noise levels below $L_{\text{night, outside}} 55\text{dB}$ and were exposed to a noise level above this in the Do-minimum scenario.
- 8.7.48 There is an overall reduction in noise nuisance with the proposed Scheme compared to without the proposed Scheme. There are 6,296 dwellings with adverse noise nuisance without the proposed Scheme and 4,903 dwellings with the proposed Scheme, although 3,637 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands. In addition, following the introduction of the proposed Scheme there are 1,060 dwellings predicted to experience a reduction in noise nuisance compared with 384 reductions for without the proposed Scheme. The reduction in noise nuisance for residents of Nairn is shown on Figure 8.5 and Figure 8.7. There are similar effects at the first floor of these dwellings.
- 8.7.49 With regard to airborne traffic induced vibration, with the road scheme in place, there are 1,176 dwellings within 40m of all assessed roads with adverse vibration nuisance without the proposed Scheme and 781 dwellings with the proposed Scheme, although 395 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands. In addition, following the introduction of the proposed Scheme there are 25 dwellings predicted to experience a reduction in vibration nuisance compared with three reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings within 40m of all assessed roads.
- 8.7.50 The foregoing operational noise impact assessment indicated that there were up to 53 dwellings which could potentially qualify for mitigation, that is noise sensitive receptors which have a predicted daytime significance of noise impact of Slight/Moderate adverse or worse and the predicted façade level exceeds $59.5\text{dB } L_{A10,18h}$, or the night-time significance of noise impact has a significance of Slight/Moderate adverse or worse and the predicted free-field noise level exceeds $L_{\text{night, outside}} 55\text{dB}$.
- 8.7.51 The outline details of the additional receptor specific mitigation, are reproduced in Table 8.46. As a minimum the mitigation would take the form of an earth bund or close boarded timber fence, or a combination of the two. For any noise barrier fences these would need to be of a minimum mass per unit area of 15kg/m^2 with no holes or gaps. Timber fences must be overlapped to allow for shrinkage.

Table 8.46: Additional Receptor Specific Mitigation

| Mitigation Item | Approximate Start Chainage | Height (m) | Length (m) | Type of Mitigation |
|-----------------|-------------------------------------|------------|------------|--------------------|
| B1 | ch1000 | 1.3 | 90 | Barrier |
| B2 | ch1520 | 2.0 | 440 | Barrier |
| B3 | ch2200 | 2.0 | 447 | Barrier |
| B4 | ch2570 | 2.8 | 353 | Barrier |
| B6 | Offline Barrier on Barn Church Road | 1.3 | 100 | Barrier |
| B7 | ch16300 | 1.6 | 321 | Barrier |
| B8 | ch18560 | 1.5 | 144 | Barrier |

- 8.7.52 Accordingly, with the receptor specific mitigation, the results show that in the short-term during the daytime period at ground floor level, the proposed Scheme would result in 1,980 dwellings which would experience a Slight adverse significance of noise impact. 1,601 dwellings are predicted to have a Slight/Moderate adverse significance, 441 dwellings are predicted to have a Moderate/Large adverse significance and 480 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 673 dwellings would experience a Slight beneficial significance, 2,127 dwellings would experience a Slight/Moderate beneficial significance, 673 dwellings would experience a Moderate/Large beneficial significance and 26 dwellings would experience a Major beneficial significance. There are 221 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.
- 8.7.53 Of the 480 residential dwellings in the short term predicted to experience a Large/Very Large adverse significance of noise impact it should be appreciated that 393 of these receptors are predicted to have noise levels as a result of the Scheme equal to or less than $L_{A10,18h}$ 50dB. This equates to a $L_{Aeq,16h}$ free field noise level of 45.5dB, which is 4.5dB below the World Health Organizations moderate annoyance guideline value of $L_{Aeq,16h}$ 50dB for outdoor living areas. The reason that these properties have a predicted Large/Very Large adverse significance of noise impact can be attributed to the fact that in the Do-minimum scenario they are predicted to have very low noise levels, in most cases less than $L_{A10,18h}$ 40dB. Indeed, the majority of the receptors in this band are situated at the southern suburbs of Nairn and are currently shielded from the existing road traffic noise on the A96 by other buildings within Nairn. Reference to the noise contour change map, Figure 8.10, will help to visualise these changes. The Large/Very Large adverse significantly affected properties are situated within the dark and light red noise difference contour bands. In addition, of the remaining 87 residential dwellings with a Large/Very Large adverse significance of noise impact none of these dwellings are predicted to have noise levels in excess of $L_{A10,18h}$ 59.5dB.
- 8.7.54 In the long-term during the daytime period at ground floor level, with the proposed Scheme and with receptor specific mitigation there are 3,809 dwellings predicted to experience a Slight adverse significance of noise impact. 732 dwellings are predicted to have a Slight/Moderate adverse significance, 401 dwellings are predicted to have a Moderate/Large adverse significance and 190 dwellings are predicted to have a Large/Very Large adverse significance. The beneficial impacts as a result of the proposed Scheme show that 2,822 dwellings would experience a Slight beneficial significance, 86 dwellings would experience a Slight/Moderate beneficial significance and five dwellings would experience a Moderate/Large beneficial significance. There are 77 dwellings predicted to have a Neutral significance. Similar significance of noise impacts are predicted to occur at the first floor.
- 8.7.55 Of the 190 residential dwellings predicted to experience a Large/Very Large adverse significance of noise Impact it should be appreciated that of these, 144 receptors are predicted to have noise levels as a result of the Scheme equal to or less than $L_{A10,18h}$ 50dB and these occur for similar reasons as they do in the short term. Reference to Figure 8.12 will help to visualise this. The Large/Very Large adverse significantly affected properties are situated within the darker red noise difference contour band. In addition of the remaining 46 residential dwellings with a Large/Very

Large adverse significance of noise impact none of these dwellings are predicted to have noise levels in excess of $L_{A10,18h}$ 59.5dB.

- 8.7.56 During the night-time period at ground floor level in the long-term and with receptor specific mitigation there are a total of 113 dwellings with noise levels which would exceed the WHO interim night target of $L_{night,outside}$ 55dB. 100 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are two dwellings which are predicted to experience noise levels below $L_{night,outside}$ 55dB which were exposed to a noise level above this in the Do-minimum scenario.
- 8.7.57 At first floor level in the long-term there are a total of 139 dwellings with noise levels which would exceed the WHO interim night target of $L_{night,outside}$ 55dB. 126 dwellings are predicted to have a Slight adverse significance of noise impact and one dwelling is predicted to experience a Slight/Moderate adverse significance. There are 10 dwellings predicted to have a Slight beneficial significance as a result of the proposed Scheme and two dwellings predicted to have a Slight/Moderate beneficial significance of noise impact. It should also be noted that as a result of the proposed Scheme there are five dwellings which are predicted to experience noise levels below $L_{night,outside}$ 55dB and were exposed to a noise level above this in the Do-minimum scenario.
- 8.7.58 With additional receptor specific mitigation in place there is overall reduction in noise nuisance at ground floor with the proposed Scheme compared to without the proposed Scheme. With 6,296 dwellings with adverse noise nuisance without the proposed Scheme and 4,904 dwellings with the proposed Scheme, although 3,636 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands. In addition, following the introduction of the proposed Scheme there are 1,058 dwellings predicted to experience a reduction in noise nuisance compared with 384 reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings.
- 8.7.59 With regard to airborne traffic induced vibration, with the road scheme in place, there are 1,176 dwellings within 40m of all assessed roads with adverse vibration nuisance without the proposed Scheme and 781 dwellings with the proposed Scheme, although 389 of these dwellings are predicted to experience an increase in noise nuisance in the higher level bands. In addition, following the introduction of the proposed Scheme there are 25 dwellings predicted to experience a reduction in vibration nuisance compared with three reductions for without the proposed Scheme. There are similar effects at the first floor of these dwellings within 40m of all assessed roads.

8.8 Monitoring and Management

- 8.8.1 DMRB 'Noise and Vibration' does not have any specific requirements to undertake noise and vibration monitoring following the completion of a road project.
- 8.8.2 For properties that have been identified as being likely to be eligible for insulation under NISR there would be a requirement for a noise assessment to be undertaken pre-construction in order to determine the prevailing noise level in accordance with NISR and within 12 months of the opening of the road. NISR also require that eligibility for noise insulation is reviewed for the scheme in the 5th 10th and 15th year after the road has opened.

8.9 References

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