30 Traffic Noise and Vibration

This chapter describes the noise and vibration impacts of the proposed scheme on receptors within the Southern Leg study area.

For this strategic assessment, 18 properties within 300m of the scheme were selected. The results showed that, without mitigation, the majority of residential properties would be subject to Substantial adverse impacts. This is because the properties are, to a large extent, remote from road traffic noise at present and so any increases in noise levels would have sizeable relative impacts.

Of the 18 selected properties, 16 meet the threshold for consideration of mitigation, and five of these properties may qualify in terms of the Noise Insulation (Scotland) Regulations 1975 in the Design Year, 15 years after opening, unless additional mitigation measures are incorporated into the scheme.

30.1 Introduction

30.1.1 This chapter provides a strategic overview of the noise and vibration impact of the proposed scheme on receptors within the Southern Leg study area. Further assessment of the noise and vibration impact will be provided in an Environmental Assessment Report (EAR) in 2007 following completion of noise modelling. This strategic overview meets the requirements for a Stage 3 assessment as set out in DMRB Volume 11.

Noise

30.1.2 The World Health Organisation (WHO, 1999) has defined noise as unwanted sound, and sound is measured in terms of decibels (dB). Whilst the audible range of hearing extends from 20 Hertz (Hz) to 20,000Hz, human hearing is not equally sensitive to all frequencies. Consequently, the A-weighting is used to simulate the response of the human ear and environmental noise is generally measured in terms of dB(A). A glossary of terms is included as Appendix A30.1

30.1.3 Generally, noise fluctuates over time and to compare different types of time-varying sound it is therefore necessary to obtain representative levels. For environmental noise this is commonly the equivalent continuous sound pressure level, the Leq. It is also possible to represent time-varying noise by means of statistical parameters such as analysis of the distributions of sound levels. For example, L90 is the level exceeded for 90% of the measurement time and L10 is the level exceeded for 10% of the measurement time period. The index adopted by the Government to assess traffic noise is the LA10(18hr), which is the arithmetic mean of the noise levels exceeded for 10% of the time in each of the one hour periods between 06:00h and midnight.

30.1.4 Noise impacts are considered as increases or decreases in road traffic or construction noise relative to the pre-existing noise levels within the area affected. When considering noise levels it may be of assistance to note that doubling or halving of the otherwise similar traffic flow is equivalent to a change of approximately 3 dB(A), and a subjective impression of a doubling of loudness generally corresponds to a 10 dB(A) sound level increase. As noise is assessed as a logarithmic ratio of pressure levels (i.e. decibels), it is sometimes helpful to consider the relationship between the subjective evaluation of noise and the actual objective levels, and examples are therefore provided in Table 30.1.

Table 30.1 – Typical Noise Levels and Subjective Evaluation

Noise Level dB(A)	Description
120	Threshold of pain
95	Pneumatic drill (unsilenced); 7m distance
83	Heavy diesel lorry (40 km/h at 7 metres distance)
81	Modern Twin-engined Jet (at take-off at 152 metres distance)
70	Passenger Car (60 km/h at 7 metres distance)
60	Office Environment
50	Ordinary Conversation
40	Library
35	Quiet Bedroom
0	Threshold of hearing

30.1.5 When considering noise from traffic, the main sources of noise can be separated into two 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 contributes a significant proportion of low frequency noise and is particularly apparent from heavy goods vehicles (HGVs) when accelerating, braking or changing gear. The second noise source component is generated from the interaction of tyres with the road surface; this 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.

30.1.6 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 by the residents of a property, and these can be separated into two categories. First 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 HGVs), and the gradient and surface characteristics of the carriageway. Second 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.

Vibration

30.1.7 Traffic-induced vibration is a low frequency disturbance which can be transmitted through the air or ground. Vibration can be measured in terms of peak particle velocities, or PPVs (i.e. the maximum speed of movement of a point in the ground during the passage of a vibration). For traffic vibration generally a PPV of 0.2mm/s measured on a floor in the vertical direction is imperceptible; at about 0.5mm/s it is perceptible and may become disturbing or annoying at higher levels. Air-borne vibration from traffic is produced by the engines and exhausts, whereas ground-borne vibration is produced by the interaction between rolling wheels and the road surface.

30.1.8 There are two effects of traffic vibration that need to be considered: the effects on buildings, and the disturbance caused to occupiers of properties. However, 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.

30.1.9 Ground-borne vibration is much less likely to be the cause of disturbance to occupiers than air-borne vibration (Baughan and Martin, 1981, Watts, 1984). Although there is no evidence that traffic-induced air-borne vibration can cause even minor damage to buildings, it can be a source of annoyance to local people, causing vibrations of flexible elements (e.g. doors, windows and occasionally floors) within properties close to the carriageway. This chapter therefore addresses the issue of nuisance at properties caused by air-borne vibration.

30.2 Approach and Methods

30.2.1 This chapter describes a strategic assessment undertaken to identify noise and vibration impacts that would be expected due to the operation of the proposed scheme. These include changes to noise and vibration levels, and perceived noise and vibration nuisance. Noise and vibration impacts due to construction are addressed separately in Chapter 33 (Disruption due to Construction).

30.2.2 This strategic assessment has been carried out with reference to the following documents:

- Design Manual for Roads and Bridges (DMRB) (The Highways Agency et al., 1993);
- Calculation of Road Traffic Noise (CRTN) (Department of Transport, 1988);
- The Noise Insulation (Scotland) Regulations 1975 (NISR);
- Memorandum on the Noise Insulation (Scotland) Regulations 1975 (Memorandum); and
- World Health Organisation (WHO), Guidelines for Community Noise, 1999

30.2.3 All traffic data have been supplied by MVA using the ASAM3B traffic model. The traffic modelling is fully explained in Chapter 5 (Overview of Assessment Process). In accordance with the requirements of DMRB Volume 11, Section 3, Part 7, a Stage 3 assessment has been carried out by:

- identifying sample noise sensitive locations and calculating the ambient and proposed noise levels to determine potential noise changes due to the scheme. Properties in the vicinity of the proposed road and side roads where traffic would increase by 25% or decrease by 20% as a result of the scheme have been assessed;
- identifying generic mitigation methods to reduce the impact of any adverse effects;
- undertaking a noise nuisance assessment for sample properties which would experience a noise change of 1dB(A) or more;
- considering traffic-induced vibration; and
- estimating which properties are likely to be eligible in terms of NISR.

Study Area

30.2.4 The operational noise has been considered within a 500m 'Core Study Area' extending to each side of the proposed scheme centreline. This has been extended form the more commonly accepted 300m because of the rural nature of parts of the proposed scheme. However, DMRB advises that beyond 300m the varying effects of wind and temperature render forecasting difficult in most circumstances and the 300m-500m is therefore included only to provide additional comparative information. The operational noise has also been considered within a 'Wider Study Area' encompassing any predicted indirect changes to noise levels (by +25%, or -20%) as a consequence of changes to traffic flows and speeds on the existing road network. The 'Wider Study Area' is necessary because the introduction of an entirely new route may change traffic flows on roads some distance from the proposed scheme. Hence the proposed scheme may affect the noise levels, and the level of perceived noise nuisance, experienced by some local residents already exposed to road traffic noise. Such impacts cannot be assigned to any single section of the proposed scheme and are dealt with in Chapter 54 (Cumulative Impact Assessment).

30.2.5 As explained in Chapter 1 (Introduction), the noise from the proposed scheme has been considered within three separate study areas. This chapter is therefore limited to consideration of the noise and vibration impacts of the proposed scheme on properties located within the Southern Leg Core Study Area, as indicated on Figures 30.1a-h and 30.3a-h. Any properties located to the north of the dividing line at Kingswells, as shown on Figures 30.1h and 30.3h, are considered in Chapter 15 (Northern Leg: Traffic Noise and Vibration). Any properties located to the south of the dividing line at Cleanhill Junction, as shown on Figures 30.1c and 30.3c, are considered in Chapter

45 (Fastlink: Traffic Noise and Vibration). Impacts of traffic utilising the full proposed scheme (i.e. not the Southern Leg traffic in isolation) are considered for each receptor.

30.2.6 Within the Core Study Area indicated on Figures 30.1a-h and 30.3a-h, the traffic noise assessment has classified locations according to their measured ambient levels, in bands of: below 50 dB(A), 50 to <60 dB(A), 60 to <70 dB(A) and ≥70 dB(A). For each band, the number of properties, and other receptors, subject to the following increases or decreases have been assessed: 1 to <3 dB(A), 3 to <5 dB(A), 5 to <10 dB(A), 10 to 15 dB(A) and over 15 dB(A).

Assessment Criteria

30.2.7 The assessment of the significance of noise impacts was based on the sensitivity of noise receptors and the magnitude of impact in terms of predicted noise levels and extent of noise change.

30.2.8 The significance of impact was assessed by comparing future year scenarios, (i.e. Year of Opening and Design Year, 15 years after opening, with and without the scheme). The difference in noise levels, together with the sensitivity of the receptors, determines the significance of impact as explained in this section.

Sensitivity

30.2.9 The criteria used for classification of the sensitivity of receptors to noise resulting from the proposed scheme are defined in Table 30.2.

Table 30.2 – Criteria used to Define Noise Sensitive Receptors

Sensitivity	Description	Examples of Receptors
High	Receptors where people or operations are particularly susceptible to noise	Residential Quiet outdoor areas used for recreation Conference facilities Auditoria/studios Schools in daytime Hospitals/residential care homes
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Restaurants
Low	Receptors where distraction or disturbance from noise is minimal	Residences and other buildings not occupied during working hours. Factories and working environments with existing high noise levels.

Magnitude of Impact

30.2.10 When considering two sounds of similar acoustic properties, i.e. similar spectral and temporal characteristics, a change of more than 3 dB(A) is regarded as being just perceptible to the human ear. The magnitude of impact can therefore be based on this acoustic 'rule of thumb', supplemented with the evidence contained within DMRB Vol. 11, Section 3, Part 7, Chapter 3, Paragraph 3.5. The latter highlights that 'people are more sensitive to abrupt changes in traffic noise associated with new road schemes than would be predicted from the 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 1 dB(A)'.

30.2.11 The magnitude of impact has been assessed by comparison between the increase or decrease in noise levels between the future year 'Do-minimum' and 'Do-something' (Preferred route scheme scenarios, i.e., Year of Opening and Design Year. The magnitude of impact is defined as shown in Table 30.3.

Table 30.3 – Magnitude of Impacts due to Changes in Road Traffic Noise

Change in Noise Level	Magnitude of Impact
5 dB(A) and greater	High adverse
3 to < 5 dB(A)	Medium adverse
1 to < 3 dB(A)	Low adverse
0 to < 1 dB(A)	Negligible adverse
0 dB(A)	No impact
0 to <-1 dB(A)	Negligible beneficial
-1 to < -3 dB(A)	Low beneficial
-3 to < -5 dB(A)	Medium beneficial
-5 dB(A) and greater	High beneficial

Significance of Impact

30.2.12 The significance of noise impacts was determined according to the relationship between magnitude and sensitivity, as shown in Table 30.4.

Table 30.4 – Significance of Noise Impacts

Magnitude	Sensitivity		
	Low	Medium	High
High	Moderate	Moderate/Substantial	Substantial
Medium	Slight/Moderate	Moderate	Moderate/Substantial
Low	Negligible/Slight	Slight/Moderate	Moderate
Negligible	Negligible	Negligible/Slight	Slight

Assessment Methods

30.2.13 Sample properties within the Core Study Area were assessed in accordance with DMRB. However, for discussion purposes some properties and locations were selected as representative on the basis of one or more of the following principles:

- where it has been anticipated that properties will experience significant changes in noise level;
- where properties are representative of surrounding buildings and the effects of noise will be similar; and
- where it has been considered that buildings may qualify for sound insulation.

Baseline (Ambient) Noise Monitoring

30.2.14 With regard to the determination of existing (ambient) noise levels DMRB advises that there are three basic types of ambient noise situations which can occur:

i. where the ambient noise is dominated by traffic noise;

ii. where the ambient noise is comprised of a combination of several undefined sources, such as might be encountered in low noise sites in rural settings; or

iii. where the ambient noise is dominated by noise from non-road traffic sources, such as aircraft or trains.

30.2.15 Where ambient noise is dominated by traffic noise, the ambient noise should be measured using L_{A10}. Where ambient noise is compiled from several undefined sources, it is advised that the L_{A10} may be inappropriate and suggests that, while the L_{Aeq} parameter could be considered, the L_{A90} scale is a suitable alternative. Where ambient noise is dominated by noise from non-road traffic sources, DMRB recommends the L_{A90}. Where the existing noise climate is determined by road traffic noise, the existing ambient levels can also be predicted using the methodology set out in CRTN.

30.2.16 For condition (i) the ambient noise should be measured using L_{A10}. For condition (ii) it is advised that the L_{A10} may be inappropriate and suggests that, while the L_{Aeq} parameter could be considered, the L_{A90} scale is a suitable alternative. For condition (iii) DMRB recommends the L_{A90}. Where the existing noise climate is determined by road traffic noise, the existing ambient levels can also be predicted using the methodology set out in the 1988 Department of Transport publication 'Calculation of Road Traffic Noise' (CRTN).

30.2.17 Ambient noise monitoring was undertaken during June, July, August and September 2006 at representative locations along the route of the proposed scheme. All instrumentation was calibrated before, and after, each measurement, and there was no significant shift in the calibration level recorded. A summary of the results together with the instrumentation used is contained within Appendix 30.2.

30.2.18 The sample monitoring locations and results are shown on Figures 30.1a-h and 30.3a-h. The sample monitoring locations were as listed below. The order of the property list is roughly from north of the scheme to south of the scheme, with individual properties being representative of their locality. Only those properties marked with an asterix (*) were included within the current 'strategic' assessment of proposed scheme noise impacts; for the remainder, only baseline data are provided, with a further noise impact assessment to be included in an EAR to be published in 2007. The properties were selected on the basis of obtaining a geographical representation of the route:

- Westholme, Kingswells, Aberdeen, AB15 8RX*
- Ardenlea, Kingswells, Aberdeen, AB15 8RT
- Clark and Sutherland, Brae, Kingswells, Aberdeen, AB15 8SL*
- Hillview, Kingswells, Aberdeen, AB15 8SL
- Benview, Kingswells, Aberdeen, AB15 8QQ
- Tigh-na Bruaich, Kingswells, Aberdeen, AB15 8QQ*
- Craiglug, Kingswells, Aberdeen, AB15 8QQ
- Gairn Farm, Blacktop, Kingswells, Aberdeen, AB15 8QJ*
- Broomhill, Kingswells, Aberdeen, AB15 8QL
- Ardnamoine Kingswells, Aberdeen, AB15 8QL*
- Gairn Park, Kingswells, Aberdeen, AB15 8QL
- Beanshill Lodge, Milltimber, AB13 0ER*
- 1 Hill Farm, Milltimber, AB13 0ET
- Nether Beanshill Farm, Milltimber, AB13 0EQ
- Golf Course, Milltimber
- Croft House, Culter House Road, Milltimber, AB13 0EP
- 69B Culter House Road, Milltimber, AB13 0EP*
- East Lodge, Culter House Road, Milltimber, AB13 0EP
- The Stables, Bellenden Walk, Milltimber AB13 0EY

- Hawkhill House Residential Nursing Home, 234 North Deeside Road, Milltimber, AB13 0DQ
- Culter House Nursing Home, Culter House Road, Milltimber, AB13 0EZ
- Pavilion, 384 North Deeside Road, Milltimber, AB13 0AJ
- 381 North Deeside Road, Milltimber, AB13 0AD
- Aberdeen Petroleum Club Lodge, North Deeside Road, Milltimber AB13 0AB*
- 1 Milltimber Brae East, Milltimber, AB13 0DN
- The Siding, Station Road, Milltimber, AB13 0DP
- Beltane, Camphill, Milltimber, AB13 0AP*
- The Gables, Milltimber Brae, Milltimber, AB13 0AA*
- Old Mill Inn, MaryCulter, Aberdeen, AB12 5FX
- North Lodge, Kingcausie Estate, Maryculter, Aberdeen, AB12 5FR
- Kingcausie House, Maryculter, Aberdeen, AB12 5FR*
- Eastland Cottage, Kingcausie, Maryculter, Aberdeen, AB12 5FS
- 2 Eastland House, Maryculter, Aberdeen, AB12 5FS*
- Tarns, Blairs, Aberdeen, AB12 5YX
- Burnhead Cottage, Blairs, Aberdeen, AB12 5YX*
- Kemehede, Blairs, Aberdeen, AB12 5YT
- Merchant's Croft, Blairs, Aberdeen, AB12 5YB
- Newlands farm, Blairs, Aberdeen, Ab12 5YB
- Sunnyside Auchlunes Cottage, Blairs, Aberdeen, AB12 5YA*
- Bishopton Farm, Portlethen, Aberdeen, AB12 4RS
- Little Bishopton, Portlethen, Aberdeen, AB12 4RS
- Midfield Cottage, Portlethen, Aberdeen, AB12 4RT
- Haremoss Cottage, Portlethen, Aberdeen, AB12 4RT
- The Beaches, Banchory Devenick, Aberdeen, AB12 5YD*
- Duffshill, Portlethen, Aberdeen, AB12 4RX
- Turnamiddle House, Portlethen, Aberdeen, AB12 4RX*
- Whistlebrae Farmhouse, Banchory Devenick, Aberdeen, AB12 5YT*
- The Clachan, Nigg, Aberdeen, AB12 3LL
- Novara, Nigg, Aberdeen, AB12 3LL*
- Brae View, Charleston, Nigg, Aberdeen, AB12 3LN
- Mosside of Auchlea, Kingswells, Aberdeen, AB15 8ST

30.2.19 The Camphill Milltimber Campus houses and educates children with special needs and is particularly noise sensitive. In recognition of this an extensive separate baseline study was undertaken and is included as Appendix A30.3. This baseline data will be used more comprehensively for a detailed assessment of noise impacts at Camphill, to be reported at a later date.

30.2.20 Unless otherwise specified, all measured noise levels were taken in free field conditions (i.e. not at the façade of the property, and at least 3.5m away from any hard reflecting surface other than the

ground). The measured noise readings therefore need to be adjusted to be comparable with the calculated noise levels, which are determined at the property façade (+ 2.5dB to the measured free field). A summary of the field results is contained within Appendix A30.2.

30.2.21 In all areas further than 300m from a georectified road (i.e. a road for which traffic data was provided and subsequently attached to the road centre line as an attribute for use in noise modelling), the ambient descriptor was taken to be the $L_{A90(T)}$. It should be noted that for a one hour period, the L_{A90} is determined by the quietest six minutes, whereas the predicted level of traffic noise is described by the L_{A10}, which is determined by the noisiest six minutes. Therefore, it is possible that in evaluating the effects for areas with no existing traffic, the DMRB comparison of the L_{A10} and the L_{A90} can in certain circumstances lead to some distortion of impact. DMRB expects that once the scheme is in place, the L_{A90} will tend towards the L_{A10}. Any possible exaggeration of impact will be illustrated by considering the measured results for L_{A90} and L_{A10} from an area where the existing noise climate is dominated by road traffic.

Traffic Noise Prediction

30.2.22 The prediction of traffic noise levels for the strategic assessment was calculated using spreadsheets which adopt the algorithms contained within the 1988 Department of Transport publication 'Calculation of Road Traffic Noise' (CRTN). Drawings were also referenced to buildings identified within OS Mastermap data under license from the Scottish Executive. In addition to this, building uses were verified as residential using Address Point Data.

30.2.23 Using the methodology set out in CRTN, noise levels were calculated at sample properties within 500m of the current road network; with Base Year, as well as for the Do-minimum and Do-something scenarios in the Year of Opening and the Design Year. Calculations were based on measurements at a point 1m in front of the most exposed façade (unless in open areas where the levels are reported as free field levels). All calculations are based on the predicted traffic flows as summarised in Chapter 4 (The Proposed Scheme). Noise calculations have been undertaken using the AAWT (Annual Average Weekday Traffic - 18hr, 5 day average).

Noise Nuisance Assessment

30.2.24 DMRB states that a noise nuisance assessment should be carried out for properties with a 1dB change. Due to variability in individual responses, DMRB recommends that community annoyance ratings are used for each noise level. It is therefore important to note that the results of the nuisance assessment should not be related to individual annoyance response.

30.2.25 The term 'nuisance' is assessed as the percentage of people bothered by traffic noise (i.e. those who say they are 'very much' or 'quite a lot' bothered on a four point worded scale).

30.2.26 DMRB details procedures for estimating changes in traffic noise nuisance when a new road scheme is planned. This method is based on the results of surveys which examined the relationship between objective measures of road traffic noise outside residential properties, and the percentage of people bothered by road traffic noise. The 1977 National Environmental Survey (England) (Harland and Abbot, 1997) has shown that once people become accustomed to a change in noise, their general dissatisfaction with traffic noise does not alter until changes in level on the $L_{A10(18h)}$ scale exceed at least 3 dB(A). However, in the period immediately following the completion of a road scheme, people may find appreciable benefits or disbenefits when noise changes are less than 3 dB(A). Prior to the publication of DMRB, available research (1977) indicated that an abrupt change in traffic noise as small as 1 dB(A) may result in a 21% change in the number of people bothered 'very much' or 'quite a lot' by road traffic noise. A noise disturbance assessment was therefore made for all properties with an expected noise change of 1 dB(A) or greater due to the proposed scheme. This change in noise level would be produced by a change in traffic flow of approximately +25% or -20%, assuming that other factors such as the average speed and the percentage of HGVs remain unchanged.

30.2.27 Noise nuisance predictions for the proposed scheme are based on the highest nuisance levels expected during the first 15 years after opening. These assessments have been undertaken in accordance with the predictive technique presented in DMRB, although the method has limitations as discussed in paragraphs 30.2.33 – 30.2.35.

30.2.28 DMRB also requires an indication of the number of properties which are likely to be eligible for statutory insulation. The Noise Insulation (Scotland) Regulations 1975 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), regulations 3 and 6. The qualifying criteria are as follows:

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

Vibration

30.2.29 Investigations have determined a relationship between the number of people affected by the traffic noise and those adversely impacted by air-borne vibration. It was found that the $L_{A10(18h)}$ index was among the physical variables most closely associated with average vibration disturbance ratings. The relationships between the percentage of people affected by largely air-borne vibration and this noise exposure index are similar to that for noise nuisance. However, it is recommended in DMRB that the percentage of people bothered by vibration is 10% lower than the corresponding noise nuisance figure, and that at noise levels below 58dB $L_{A10(18h)}$ it should be assumed that no people would be affected.

30.2.30 In accordance with DMRB Volume 11, the prediction of disturbance caused by air-borne vibration is made for properties within 40m of the road centreline which are un-screened. However, as this is a strategic assessment undertaken with a small sample of properties it was considered that the incorporation of a note on vibration for this number of properties would not be appropriate because the comparison should not be taken as indicative of responses at individual properties.

Limitations to Assessment

30.2.31 The surveys on which the DMRB methods for noise nuisance assessment are based were conducted at sites where road traffic was the dominant noise source, noise levels ranged from 65 to 78 $dBL_{A10,18h}$, the changes in traffic noise were up to 10 dB $L_{A10,18h}$, and properties were up to 18m from the road. Therefore, it is only at these noise levels and distance ranges that the method is strictly valid. The DMRB method is also valid only for noise changes caused by alterations in traffic flow and will not necessarily give a good prediction if traffic noise changes are brought about by other means, such as barriers or low noise road surfaces.

30.2.32 The Northern Leg of the proposed scheme has areas where the ambient levels are dominated by road traffic noise, and also areas where the ambient noise climate is not dominated by road traffic noise. The ambient descriptor will therefore be the L_{A90} or L_{A10} as appropriate (refer to paragraphs 30.2.14 and 30.2.15), but as the nuisance assessment is based on changes in road traffic noise level, the results are strictly not applicable where the L_{A90} is used. However, DMRB, Volume 11, Section 3, Part 7, Chapter 8, Paragraph 5.10 states that 'Strictly, the method should not be used outside the noise and distance ranges covered by the surveys, or when the ambient noise is not

from traffic. However, it seems likely that the mechanisms underlying the survey results will operate outside these ranges. Until better information becomes available, it is recommended that the method is used to predict nuisance changes outside these noise and distance ranges, albeit with caution.'

30.2.33 As the method for assessing vibration is similar to noise nuisance it is subject to the same limitations as discussed above.

30.2.34 The prediction method detailed within the NISR Memorandum for considering requirements for statutory noise insulation has been improved since 1975. While DMRB does allow for the use of the method detailed within the NISR Memorandum, the prediction methodology employed in this assessment uses the more detailed and accurate predictive methods set out in CRTN. However, to ensure compliance with NISR the assessment uses as a proxy a CRTN predicted level of 65dB(A) as a preliminary indicator of the need to utilise the full NISR Memorandum methodology assessment of eligibility, where all the other qualifying criteria are met.

Threshold for Mitigation

30.2.35 As best practice, mitigation should be implemented, where practicable, where the significance of impact is in the Year of Opening found to be ''Moderate adverse' or worse. This is an onerous target as mitigation is therefore considered where there is an increase of greater than 1dB irrespective of the absolute noise level (in recognition of the sudden change effects as reported within DMRB), and must be applied with caution in rural areas where there are at present no traffic sources. For guidance on onset of effects, reference was made to the current WHO document entitled 'Community Noise' (WHO, 1999). This document does not contain recommendations, but provides guideline values based on the precautionary principle. The WHO document states that 'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} 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'.

30.2.36 The WHO refers to a daytime time base of 16 hours ($L_{Aeq(16hr}$), and CRTN predictions are in terms of $L_{A10(18hr)}$. To translate the WHO $L_{Aeq(16hr)}$ to $L_{A10(18hr)}$ a correction of approximately +2dB is therefore required, with a further +2.5dB necessary to translate into façade levels. This translation applied to 55dB $L_{Aeq,16hr}$ gives an equivalent threshold façade level of 59.5dB $L_{A10(18hr)}$.

30.2.37 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 2, Part 3, Mitigation, Paragraph 1.2(a)). Examples which could preclude the use of mitigation are disproportionate cost and unacceptable visual impact.

30.2.38 In summary, taking into account the above WHO and DMRB guidance, mitigation was considered where the significance of impact at a receptor was assessed as Moderate Adverse or worse, and where the predicted façade level exceeded 59.5dB $L_{A10(18hr)}$. As noted in paragraph 30.2.13, noise prediction beyond 300m may be inaccurate, and the mitigation threshold was therefore only applied to receptors within 300m in accordance with DMRB.

30.3 Baseline Conditions

30.3.1 A total of 907 residential properties and 122 additional potential sensitive receptors/areas were identified within 500m of the Southern Leg of the proposed scheme. These are shown below in Table 30.5.

Table 30.5 - Number of Properties (Address Points) Within 500m of the Proposed Southern Leg

Distance from centreline	Residential	Commercial/ Industrial	Amenity/ Recreational	Farms	Educational	Ancient Woodlands	Historic Buildings	Footpath	SSSI	Health
0 – 50m	89	4	-	3	1	14	-	5	-	-
50 – 100m	47	7	-	1	-	3	1	2	-	-
100 – 200m	103	4	-	2	-	2	7	2	-	-
200 – 300m	70	6	-	3	-	3	7	-	-	-
300m – 500m	598	7	-	7	1	7	7	1	-	1
Total	907	28	-	16	2	29	22	10	-	1

30.3.2 DMRB requires that the assessment also include 'all relevant locations' and relevant is further defined as 'e.g. sports fields, canals, footpaths'. Receptor locations other than residential properties within 500m of the proposed scheme are listed below and are illustrated in Figures 30.1a-h and 30.3a-h.

30.3.3 Educational:

- Rudolf Steiner Schools Limited, Camphill House, Milltimber, Aberdeen
- The International School of Aberdeen, Fairgirth, North Deeside road, Milltimber, Aberdeen

Historical:

- Cloghill House, Aberdeen.
- Culter House (St. Margaret's School For Girls), Aberdeen
- March Stone No. 24 (to the west of the farm building), Aberdeen
- March Stone No. 21. (on a knoll west of the farm), Aberdeen
- March Stone No. 22 (on another knoll west of the farm), Aberdeen
- Eastland House, Aberdeen
- Kingcausie House - Sundial (1), Aberdeen
- Kingcausie House - Sundial (2), Aberdeen
- Fairley House, Aberdeen
- Cloghill House, Offices, Aberdeen
- Milton Bridge over Crynoch Burn, Aberdeen
- Kingcausie House, Aberdeen
- Mill Inn, Old Corn Mill, Aberdeen
- Cloghill House Sundial, Aberdeen

- Culter House Walled Garden, Gazebo, Dovecot, Aberdeen
- March Stone No. 23 At Top Of Beans Hill, Aberdeen
- Friends Burial Ground West-Northwest of Kingswells House, Aberdeen
- West Hatton, Long Cairn, Kingwells, Aberdeen
- Kingswells, Consumption Dykes, Aberdeen
- Kingswells, Consumption Dykes, Aberdeen
- Kingswells, Consumption Dykes, Aberdeen
- Kingswells, Consumption Dykes, Aberdeen

Footpaths:

- Near Station Road, Milltimber, Aberdeen
- Near Camphill House, Milltimber, Aberdeen
- Near Locality Maryculter, Aberdeen
- Near Road Pittengullies Brae, Aberdeen
- Kingswells, Aberdeen
- March Stone No 24 (to the west of the farm building), Aberdeen
- Near Westfield Cottage, Aberdeen
- Kingswells, Aberdeen
- Kingswells, Aberdeen
- Near Haywood Cottage, Kingswells, Aberdeen

Woodlands:

- Near building Hillhouse, Milltimber, Aberdeen
- Near building Hillhouse, Milltimber, Aberdeen
- Near Culter House Road, Aberdeen
- Near St. Ronan's Circle, Aberdeen
- Near building Highfield, Kingswell, Aberdeen
- Gairnhill/Kingshill woods, Aberdeen
- Gairnhill/Kingshill woods, Aberdeen
- Near Silverburn Farm, Aberdeen
- Near Binghill, Garden House, Aberdeen
- Near Culter House Road, Milltimber, Aberdeen
- Near Bloomfield House, Milltimber, Aberdeen
- Near Culter House Road, Milltimber, Aberdeen
- Near Banchory Devenick, Aberdeen
- Near North Lodge, Kingcausie Estate, Maryculter, Aberdeen
- Near Whistlebrae Farmhouse, Aberdeen
- Near building Corbie Lynn, Maryculter, Aberdeen
- Lower Deeside Caravan Park, Aberdeen

- Craigingles/Cleanhill Wood, Aberdeen
- Near building Green Loanings, Blairs, Aberdeen
- Craigingles/Cleanhill Wood, Aberdeen
- Near building Heatherknowes, Blairs, Aberdeen
- Near building Whitestones, Blairs, Aberdeen
- Near building Kemehede, Blairs, Aberdeen
- Near Sunnyside Farm, Blairs, Aberdeen
- Kingshill Wood, Kingswells, Aberdeen
- Near Culter House Road, Milltimber, Aberdeen
- Near building Charanwood House, Aberdeen
- Near Camphill Cottage, Milltimber, Aberdeen
- Near Kingcausie Estate, Maryculter, Aberdeen

30.3.4 All Listed Historic Buildings within 500m of the proposed scheme were considered during identification of sensitive receptors. However, noise climate is not one of the listing criteria, and, as such, noise would not have any cultural heritage implications.

30.4 Potential Impacts

30.4.1 The results for the selected sample receptors at ground and first floor, for both Year of Opening and Design Year for the Do-Minimum and Do-Something scenarios, are presented in Table 30.6(a) and Table 30.6(b) together with the associated significance of impact. The noise related impacts for the Wider Area network are presented in Chapter 54 (Cumulative Impact Assessment). The results in Table 30.6(a) and Table 30.6(b) are reproduced graphically in Figures 30.1a-h and 30.3a-h.

Table 30.6(a) – Predicted Noise Impacts at Sample Properties at Ground Floor (receiver height=1.5m, ** = $L_{A90(T)}$)

(Note: DS = Do-Something (i.e. With Proposed scheme), DM = Do-minimum (i.e. without scheme)

Property	Building Type	Noise Levels $L_{A10(18hr)}$					Significance of Impact	
		Base Year	Year of Opening		Design Year		Year of Opening	Design Year
			DS	DM	DS	DM		
Westholme	Residential	50.6	59.9	51.5	58.9	50.6	Substantial Adverse	Substantial Adverse
Clark & Sutherland, Smiddy Brae	Commercial/Industrial	59.8	72	58.8	71	58.4	Moderate/ Substantial Adverse	Moderate/ Substantial Adverse
Tigh-Na-Bruaich	Residential	46.9	67.8	45.5	66.8	45.2	Substantial Adverse	Substantial Adverse
Gairn Farm, Blacktop	Residential	34.9	65.9	34.1	64.9	33.2	Substantial Adverse	Substantial Adverse
Ardnamoine	Residential	49.2	66.1	49	65.1	46.7	Substantial Adverse	Substantial Adverse
Beanshill Lodge	Residential	34.9	55	32.6	54	31.3	Substantial Adverse	Substantial Adverse
69b, Culter House Road	Residential	50.9	61.9	48	60.9	47.3	Substantial Adverse	Substantial Adverse
Kippie Lodge, North Deeside Road	Commercial/Industrial	51.7	60.7	48.1	59.7	47.6	Moderate/ Substantial Adverse	Moderate/ Substantial Adverse
Camphill**	Residential	44.8	60.7	44.8	59.7	44.8	Substantial Adverse	Substantial Adverse
The Gables, Milltimber Brae	Residential	66.1	66.9	64.2	65.9	63.5	Moderate Adverse	Moderate Adverse
Kingcausie	Residential	53.3	61.9	51.1	60.9	50.4	Substantial Adverse	Substantial Adverse
2 Eastland House	Residential	33.3	67.1	31.1	66.1	30.5	Substantial Adverse	Substantial Adverse
Burnhead Cottage**	Residential	22.5	61.3	22.5	59.9	22.5	Substantial Adverse	Substantial Adverse
Sunnyside Auchlunies Cottage**	Residential	29.9	63.3	29.9	61.9	29.9	Substantial Adverse	Substantial Adverse
The Beeches	Residential	45.7	61.3	48.7	59.9	47	Substantial Adverse	Substantial Adverse
Turnamiddle House	Residential	43.9	60.9	44.7	59.5	44.3	Substantial Adverse	Substantial Adverse
Whistlebrae Farmhouse	Residential	53.6	60.9	54.2	59.5	53.8	Substantial Adverse	Substantial Adverse

Property	Building Type	Noise Levels $L_{A10(18hr)}$					Significance of Impact	
		Base Year	Year of Opening		Design Year		Year of Opening	Design Year
			DS	DM	DS	DM		
Novara	Residential	55.7	66.5	55.7	65.1	55.3	Substantial Adverse	Substantial Adverse

Table 30.6(b) – Predicted Noise Impacts at Sample Properties at First Floor (receiver height=4.5m, ** = $L_{A90(T)}$)

Property	Building Type	Noise Levels $L_{A10(18hr)}$					Significance of Impact	
		Base Year	Year of Opening		Design Year		Year of Opening	Design Year
			DS	DM	DS	DM		
Westholme	Residential	51.9	61.8	51.5	60.8	52.1	Substantial Adverse	Substantial Adverse
Clark & Sutherland, Smiddy Brae	Commercial/Industrial	62	73.2	58.8	72.2	60.5	Moderate/ Substantial Adverse	Moderate/ Substantial Adverse
Tigh-Na-Bruaich	Residential	48.3	69.7	45.5	68.7	46.7	Substantial Adverse	Substantial Adverse
Gairn Farm, Blacktop	Residential	35.8	68	34.1	67.0	34.0	Substantial Adverse	Substantial Adverse
Ardnamoine	Residential	51.1	66.7	49	65.7	48.5	Substantial Adverse	Substantial Adverse
Beanshill Lodge	Residential	35.3	55.4	32.6	54.4	31.8	Substantial Adverse	Substantial Adverse
69b, Culter House Road	Residential	51.9	62.8	48	61.8	48.1	Substantial Adverse	Substantial Adverse
Kippie Lodge, North Deeside Road	Commercial/Industrial	52.9	62.6	48.1	61.6	48.9	Moderate/ Substantial Adverse	Moderate/ Substantial Adverse
Camphill**	Residential	44.8	61.3	44.8	60.3	44.8	Substantial Adverse	Substantial Adverse
The Gables, Milltimber Brae	Residential	68.5	67.9	64.2	66.9	65.8	Moderate/ Substantial Adverse	Moderate Adverse
Kingcausie	Residential	53.9	63.5	51.1	62.5	51.0	Substantial Adverse	Substantial Adverse
2 Eastland House	Residential	35.9	67.8	31.1	66.8	33.1	Substantial Adverse	Substantial Adverse
Burnhead Cottage**	Residential	22.25	62.5	22.25	61.1	22.25	Substantial Adverse	Substantial Adverse
Sunnyside Auchlunies Cottage**	Residential	29.9	64.6	29.9	63.2	29.9	Substantial Adverse	Substantial Adverse
The Beeches	Residential	46.4	61.9	48.7	60.5	47.8	Substantial Adverse	Substantial Adverse
Turnamiddle House	Residential	45.9	61.5	44.7	60.1	46.3	Substantial Adverse	Substantial Adverse
Whistlebrae Farmhouse	Residential	54.5	61.4	54.2	60	54.8	Substantial Adverse	Substantial Adverse

Property	Building Type	Noise Levels $L_{A10(18hr)}$					Significance of Impact	
		Base Year	Year of Opening		Design Year		Year of Opening	Design Year
			DS	DM	DS	DM		
Novara	Residential	57.6	68.2	55.7	66.8	57.2	Substantial Adverse	Substantial Adverse

30.4.2 The results show that without additional mitigation being incorporated into the Southern Leg section of the proposed scheme, the majority of residential properties within the Core Study Area would be subject to Substantial adverse impacts. Only two will be subject to lesser impacts at ground floor, where there would be Moderate to Moderate/Substantial adverse impacts. Similarly, there would be a Substantial impact on all but three of the first floor locations, and Moderate/Substantial impacts on those three. This is because the properties are, to a large extent, remote from significant road traffic noise at present. Possible generic mitigation for the properties affected is discussed in the following section.

30.4.3 Based on the threshold for incorporation of additional mitigation into the scheme, as described in paragraph 30.2.46, the properties listed below would have to be considered for mitigation (at ground floor) where practicable. Given the strategic nature of this assessment the noise predictions are likely to be an overestimate. The case for mitigation will be assessed more fully once the more detailed ground model becomes available.

- Westholme
- Tigh-Na-Bruaich
- Gairn Farm, Blacktop
- Ardnamoine
- 69b, Culter House Road
- Kippie Lodge, North Deeside Road
- Camphill
- The Gables, Milltimber Brae
- Kingcausie
- 2 Eastland House
- Burnhead Cottage
- Sunnyside Auchlunies Cottage
- The Beeches
- Turnamiddle House
- Whistlebrae Farmhouse
- Novara

30.5 Noise and Vibration Nuisance

30.5.1 An assessment of noise nuisance has been carried out for selected properties in accordance with the predictive technique presented in DMRB. Although the method has limitations as discussed in paragraphs 30.2.33 – 30.2.35, it is a useful comparison of effects.

30.5.2 All changes in terms of noise and nuisance levels are reported in Tables 30.7(a)-(c) for each of the DMRB defined ambient noise bands at ground floor. Assessments at first floor were not provided because this is a strategic assessment. It is acknowledged that in assessing nuisance changes of residual impacts the DMRB nuisance assessment method is based on surveys of noise changes caused by changes in traffic flow. Therefore, it will not necessarily give a good prediction of traffic noise changes were brought about by some other means, such as, barriers or low noise road surfaces. However, it is used here for the purposes of illustration.

Table 30.7(a) – Summary of Noise Changes at Ground Floor According to Noise Bands (<50dB)

Ambient Noise Band <50dB	$L_{A10(18hr)}$ dB	Residential		Commercial/Industrial		Community Facilities	
		Do Something	Do Minimum	Do Something	Do Minimum	Do Something	Do Minimum
Increase In Noise Level $L_{A10,(18hr)}$ dB	1 < 3	-	-	-	-	-	-
	3 < 5	-	1	-	-	-	-
	5 < 10	-	-	-	-	-	-
	10 < 15	-	-	-	-	-	-
	≥ 15	10	-	-	-	-	-
Increase In Nuisance Level	< 10%	-	3	-	-	-	-
	10 < 20%	-	-	-	-	-	-
	20 < 30%	-	-	-	-	-	-
	30 < 40%	-	-	-	-	-	-
	≥ 40%	10	-	-	-	-	-
Decrease In Noise Level $L_{A10(18hr)}$ dB	1 < 3	-	3	-	-	-	-
	3 < 5	-	-	-	-	-	-
	5 < 10	-	-	-	-	-	-
	10 < 15	-	-	-	-	-	-
	≥ 15	-	-	-	-	-	-
Decrease In Nuisance Level	< 10%	-	2	-	-	-	-
	10 < 20%	-	-	-	-	-	-
	20 < 30%	-	-	-	-	-	-
	30 < 40%	-	-	-	-	-	-
	≥ 40%	-	-	-	-	-	-

Table 30.7(b) – Summary of Noise Changes at Ground Floor According to Noise Bands (50-60dB)

Ambient Noise Band 50-60dB	$L_{A10(18hr)}$ dB	Residential		Commercial/Industrial		Community Facilities	
		Do Something	Do Minimum	Do Something	Do Minimum	Do Something	Do Minimum
Increase In Noise Level $L_{A10(18hr)}$ dB	1 < 3	-	-	-	-	-	-
	3 < 5	-	-	-	-	-	-
	5 < 10	3	-	1	-	-	-
	10 < 15	2	-	1	-	-	-
	≥ 15	-	-	-	-	-	-
Increase In Nuisance Level	< 10%	-	3	-	2	-	-
	10 < 20%	-	-	-	-	-	-
	20 < 30%	-	-	-	-	-	-
	30 < 40%	1	-	-	-	-	-
	≥ 40%	4	-	-	-	-	-
Decrease In Noise Level $L_{A10,(18hr)}$ dB	1 < 3	-	2	-	1	-	-
	3 < 5	-	-	-	1	-	-
	5 < 10	-	-	-	-	-	-
	10 < 15	-	-	-	-	-	-
	≥ 15	-	-	-	-	-	-
Decrease In Nuisance Level	< 10%	-	1	-	-	-	-
	10 < 20%	-	-	-	-	-	-
	20 < 30%	-	-	-	-	-	-
	30 < 40%	-	-	-	-	-	-
	≥ 40%	-	-	-	-	-	-

Table 30.7(c) – Summary of Noise Changes at Ground Floor According to Noise Bands (60-70dB)

Ambient Noise Band 50-60dB	$L_{A10(18hr)}$ dB	Residential		Commercial/Industrial		Community Facilities	
		Do Something	Do Minimum	Do Something	Do Minimum	Do Something	Do Minimum
Increase In Noise Level $L_{A10(18hr)}$ dB	1 < 3	-	-	-	-	-	-
	3 < 5	-	-	-	-	-	-
	5 < 10	-	-	-	-	-	-
	10 < 15	-	-	-	-	-	-
	≥ 15	-	-	-	-	-	-
Increase In Nuisance Level	< 10%	1	1	-	-	-	-
	10 < 20%	-	-	-	-	-	-
	20 < 30%	-	-	-	-	-	-
	30 < 40%	-	-	-	-	-	-
	≥ 40%	-	-	-	-	-	-
Decrease In Noise Level $L_{A10(18hr)}$ dB	1 < 3	-	1	-	-	-	-
	3 < 5	-	-	-	-	-	-
	5 < 10	-	-	-	-	-	-
	10 < 15	-	-	-	-	-	-
	≥ 15	-	-	-	-	-	-
Decrease In Nuisance Level	< 10%	-	-	-	-	-	-
	10 < 20%	-	-	-	-	-	-
	20 < 30%	-	-	-	-	-	-
	30 < 40%	-	-	-	-	-	-
	≥ 40%	-	-	-	-	-	-

30.5.3 The noise nuisance assessment shows that where there is an increase in noise there will be an increase in the number of people likely to be bothered by noise. Also, where there are low levels of noise experienced by properties remote from existing roads the increase in noise levels results in significant increases in the DMRB noise nuisance level as a consequence of the proposed Southern Leg, as evidenced in Table 30.7(a). The higher ambient bands still show that there will be more people subject increased annoyance as a consequence of the scheme than without the scheme in place without additional mitigation measures.

Vibration

30.5.4 To determine the nuisance caused by vibration, DMRB states that the noise nuisance figure should be reduced by 10%. Furthermore, properties experiencing noise levels below 58 dB $L_{A10(18h)}$ will not experience nuisance from vibration. However, as previously stated in paragraph 30.2.39, this is a strategic assessment undertaken with a small sample of properties and it was considered that the incorporation of a note on vibration for this number of properties would not be appropriate because the comparison should not be taken as indicative of responses at individual properties.

30.6 Mitigation

30.6.1 The threshold for incorporation of additional mitigation into the scheme was described in paragraph 30.2.46. The final Southern Leg design will mitigate traffic noise through elements such as sections of embankments/false cutting. These will be developed iteratively through discussion between the engineering team, landscape team and Hamilton & McGregor noise specialists. At the time of assessment, such mitigation measures had not been fully developed, therefore the impact assessment has not taken these measures into account when describing potential impacts.

30.6.2 Noise impacts can be mitigated in two ways: Lower noise surfacing and acoustic screens/ earthworks.

Low Noise Surfacing

30.6.3 Quieter road surfaces such as Stone Mastic Asphalt (SMA), or a pervious material, would be likely to reduce noise levels by approximately 2.5dB $L_{A10(18h)}$ compared with conventional hot rolled asphalt surfacing. This benefit is related to the speed of the traffic on the road, and is likely to be significant at speeds above approximately 50kph.

Acoustic Screens/Earthworks

30.6.4 Mitigation measures may take the form of substantial acoustic screens and some revised earthworks. Noise barriers set close to a road generally provide protection to garden areas as well as the living space of houses. Properties situated further from the road may experience additional noise reduction due to intervening buildings.

30.6.5 To ensure maximum attenuation, acoustic screens will be located as close as possible to the proposed scheme, taking into account alignment requirements, land available, landscape work and visual requirements. Where sufficient land is available and a reduction in noise level is required, the acoustic screen may take the form of an earth bund, or a combination of an earth bund and a noise fence. Acoustic fencing will be of a minimum surface density of 15kg/m^2 with no holes or gaps. Timbers will be overlapped to allow for shrinkage and timber screens will be well bedded in gravel (or equivalent) to avoid soil erosion

30.6.6 As a general, guide where a barrier breaks the line of sight between the receiver and the source there will be an approximate 10dB(A) reduction in the noise level at the receiver location. It is therefore apparent that, in general, barriers will be more effective at ground floor than at first floor.

30.6.7 It should be noted that although acoustic screens/ earthworks are not incorporated into the current road design, low noise road surfacing is recommended for use throughout the proposed scheme, and the noise calculations presented in the potential impacts section of this chapter have taken account of this.

30.6.8 A summary of the proposed mitigation objectives is given in Table 30.8.

Table 30.8 – Summary of General Measures Employed to Address Noise Potential Impacts

Type of Measure	Description
Prevent	None
Reduce	Construction of noise barriers, earthworks bunds and the use of low noise surfacing will reduce the predicted traffic noise levels
Offset	A list of properties that may be eligible for noise insulation due to increase in noise caused by the new road will be drawn up and assessed prior to construction

Type of Measure	Description
Enhance	None

30.7 Residual Impacts

30.7.1 As described above, low noise surfacing forms part of the scheme and has been taken into account in the consideration of potential impacts. Although other mitigation, as described, in paragraphs 30.6.4 to 30.6.7, will be considered where appropriate to reduce impacts, taking consideration of the thresholds described in paragraph 30.2.46, these proposals have not been developed and the effects of these cannot therefore be described. This will be provided in an EAR to be published in 2007.

30.7.2 The residual impacts of the scheme are therefore as set out in the potential impacts section of this chapter.

30.7.3 Of the 18 sample properties considered none will experience benefits as a consequence of the proposed scheme. It is therefore essential that further mitigation measures are evaluated once the detailed ground model becomes available.

Noise Insulation

30.7.4 Regulation 3 of the Noise Insulation (Scotland) Regulations 1975 confers a duty on the roads authorities to offer insulation to eligible residential properties affected by noise from a new road or additional carriageway, where the use of the road causes, or is expected to cause, the relevant noise level to exceed the prevailing noise level by at least 1 dB (A) and is not less than the specific level (68 dB $L_{A10(18h)}$).

30.7.5 A list of properties that may be eligible will be drawn up in advance of the construction stage. Prevailing noise levels will be measured prior to construction for these properties in accordance with the 1975 Regulations. Within 12 months of the opening of the road, further measurements will be undertaken to determine eligibility under the Regulations. The Regulations also require that eligibility for noise insulation is reviewed at defined intervals (5, 10 and 15 years) after the road is opened. The statutory noise insulation assessments will be undertaken by Scottish Executive or its nominated representatives. .

30.7.6 The results of this strategic assessment indicate that the following properties may qualify in terms of the Noise Insulation (Scotland) Regulations 1975 in Design Year, without additional mitigation measures incorporated into the scheme:

- Tigh-Na-Bruaich
- Ardnamoine
- Camphill
- Kingcausie
- The Beeches

30.8 Summary

30.8.1 All of the changes in noise and nuisance levels for the sample properties are reported in Tables 30.7(a)-(c), for each of the DMRB defined ambient noise bands at ground floor.

30.8.2 Without additional mitigation being incorporated into the Southern Leg of the proposed scheme, the majority of properties within the Core Study Area will be subject to substantially adverse impacts. This is because the properties are, to a large extent, remote from road traffic noise at present.

30.8.3 The following sample properties meet the threshold for consideration of mitigation, where practicable:

- Westholme
- Tigh-Na-Bruaich
- Gairn Farm, Blacktop
- Ardnamoine
- 69b, Culter House Road
- Kippie Lodge, North Deeside Road
- Camphill
- The Gables, Milltimber Brae
- Kingcausie
- 2 Eastland House
- Burnhead Cottage
- Sunnyside Auchlunies Cottage
- The Beeches
- Turnamiddle House
- Novara
- Whistlebrae Farmhouse, Banchory Devenick

30.9 References

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