A16.2 Noise and Vibration Policy

This appendix provides a copy the Noise and Vibration Policy (NVP) that has been prepared for the Forth Replacement Crossing, relating to the operation of the proposed scheme. The NVP is referred to in Chapter 16 (Noise and Vibration).

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1 Introduction

1.1 Purpose of the Policy Statement

1.1.1 This policy statement ('Policy') sets out the approach the Promoter, the Scottish Ministers, intends to adopt to mitigate noise and vibration from the operation of the Forth Replacement Crossing ('the Project') which is proposed to be authorised by the Forth Crossing Bill ('the Bill'). The Policy sets out the commitments relevant to noise and vibration made by the Scottish Ministers in the Environmental Statement published in November 2009, of which this Policy also forms an appendix. The approach proposed to mitigate the effects of noise and vibration during construction of the Project is set out in the Code of Construction Practice (CoCP) which is contained in the Environmental Statement.

1.1.2 This Policy uses some technical language which is required to describe noise and vibration. A full explanation of what constitutes traffic noise and vibration and a glossary of terms is included in Chapter 16 of the Environmental Statement. A glossary of terms used in this Policy is provided in Appendix A of this Policy.

1.2 Statutory Obligations and Mitigation of Noise Effects

1.2.1 The Promoter recognises that potential noise effects are of concern to the communities adjacent to the Project and proposes to use the principle of best practicable means[1] in the design and construction of the Project, including the design of mitigation measures, to reduce potentially significant adverse noise effects. The approach that the Promoter proposes to follow with regards to mitigation of noise impacts is described in Section 2 of this Policy.

1.2.2 The assessment methodology used by the Promoter to assess noise impacts, including the process used to determine potentially significant adverse effects, is set out in the Environmental Statement and in Section 3 of this Policy.

1.2.3 It is important to recognise that there are practical limitations as to what can be achieved regarding mitigation of noise effects. This Policy clarifies how these circumstances will be addressed.

1.2.4 In addition to the policy of using best practicable means through the design of the Project and provision of mitigation measures, the Promoter will also comply with The Noise Insulation (Scotland) Regulations 1975 ('NISR') which impose a duty on roads authorities to carry out or make a grant in respect of carrying out noise insulation work in or to eligible buildings.

1.2.5 There are various specific conditions set out in the NISR covering the assessment of noise levels and provision of noise insulation and these are set out in Section 2 of this Policy.

1.2.6 After using best practicable means through the design of the Project including mitigation measures to be provided, there may be locations where it may not be practicable to provide measures to reduce noise levels from the expected use of the Project to levels below those set out in the regulations. Where this is the case, the Promoter will offer to carry out or make a grant in respect of carrying out noise insulation work to the occupiers of eligible properties in accordance with the requirements of the NISR where it is reasonably practicable to so do.

[1] Best Practicable Means are defined in Section 72 of the Control of Pollution Act 1974 and Section 79 of the Environmental Protection Act 1990 as those measures which are 'reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications'.

1.3 Vibration Impacts

1.3.1 The Promoter recognises that potential vibration impacts are of concern to the communities adjacent to the Project.

1.3.2 The Promoter will undertake the design and construction of the Project so that significant levels of ground-borne vibration which could cause disturbance, and which could also give rise to concerns about damage to buildings[2], do not occur during operation of the Project. The approach that the Promoter proposes to follow with regards to the mitigation of potential ground-borne vibration impacts is described in Section 2 of this Policy.

1.3.3 Airborne noise generated by traffic can lead to vibration nuisance in certain instances and the approach set out in this Policy to mitigate significant noise effects will also reduce potential impacts associated with airborne vibration nuisance. The levels at which this may occur are explained further in Section 3 of this Policy.

2 Mitigation Approach

2.1 Mitigation of Noise Effects

2.1.1 The Promoter proposes to use the principle of best practicable means in the design and construction of the Project, including the design of mitigation measures, to reduce potentially significant adverse noise effects as described in the Environmental Statement for residents and other noise and vibration sensitive receptors in the vicinity of the Project. Noise mitigation measures will be applied in line with the principle of best practicable means using the hierarchal approach set out below to remove or reduce significant adverse noise effects identified in the Environmental Statement. Noise mitigation will also be provided so that, where reasonably practicable, predicted noise levels at dwellings alongside the scheme are below the qualifying thresholds for noise insulation work set out in the NISR.

2.1.2 The Promoter will consult with those parties who may be affected by significant noise effects or who may qualify for noise insulation work in accordance with the NISR due to operation of the Project and will take consideration of the views of affected parties and the circumstances of each location in the provision and design of mitigation measures.

2.1.3 The Promoter will implement a hierarchal approach to reduce potentially significant noise effects, as set out below:

- The Promoter will use all reasonably practicable measures to reduce noise at source in the design of the roads forming part of the Project (e.g. the Promoter will use a lower noise road surfacing material on the main carriageways of the new roads which will become trunk roads to be provided as part of the Project) and will consider other reasonably practicable noise attenuation measures between the road and sensitive receivers. Such mitigation will include noise screening structures such as barriers and/or earth bunds adjacent to the roads which form part of the Project, or where these measures are not sufficient to mitigate significant noise effects, the Promoter will consider providing noise attenuating structures adjacent to affected properties where it has powers to do so.. The anticipated dimensions (length and height) and form of each structure for the proposed scheme are reported in the Environmental Statement. Any changes to the dimensions of noise attenuating structures necessitated by changes through detailed design would be determined using the noise assessment methodology described in Section 3 of this Policy.

[2] As explained in paragraph 3.3.2, DMRB advises that on the basis of research carried out, no evidence has been found to support the theory that traffic induced ground borne vibration is a source of damage to buildings.

- Where residual noise levels exceed or are expected to exceed statutory thresholds set out in the NISR after all reasonably practicable mitigation measures have been provided (or discounted), the Promoter will offer to carry out or make a grant in respect of carrying out noise insulation work to eligible buildings in accordance with the requirements of NISR.

2.1.4 In defining what is reasonably practicable (i.e. what constitutes best practicable means), the Promoter will have regard to the definitions included within the Control of Pollution Act 1974 and Environmental Protection Act 1990 and to factors including, but not limited to, local conditions and circumstances, the current state of technical knowledge and to financial implications. This means that the Promoter will take into account a number of factors, including but not limited to:

- engineering feasibility;
- compliance with engineering design standards;
- safety matters such as the safe operation of the road, safe interaction of road and pedestrian traffic, the safety of non-motorised users (including pedestrians, cyclists and equestrians) adjacent to the road, and security and crime considerations;
- for residential properties and communities, the nature of the noise effect including the number of receptors subject to the noise impact and the proportion of the community subject to the impact;
- other potential environmental effects that may occur due to the provision of measures to reduce noise impacts (e.g. loss of light or adverse effects on the landscape); and
- the cost of any proposed mitigation measure and the level of benefit achieved in terms of the number of properties affected, the degree of noise reduction and the reduction in noise levels or vibration magnitude, such that costs are not disproportionate to the benefits achieved.

2.1.5 The Promoter will use standard noise assessment and prediction methodologies to assess potential noise impacts from the scheme to inform the application of the approach set out in this Policy and in compliance with the regulations. The assessment methodology and the definition of what is considered to constitute a significant effect are set out in Section 3 of this Policy and in the Environmental Statement.

2.2 Noise Insulation

2.2.1 The Noise Insulation (Scotland) Regulations 1975 ('NISR') and the Memorandum on the Noise Insulation (Scotland) Regulations 1975 set out the statutory obligation for roads authorities to carry out or make a grant in respect of carrying out noise insulation work in or to eligible properties.

2.2.2 There are various specific conditions set out in the NISR covering the measurement of the above noise levels and offer of carrying out or making a grant in respect of carrying out noise insulation work. In summary these are:

- A property must be an eligible building as defined in Regulation 6 of the NISR. This includes dwellings and other buildings used for residential purposes.
- The building must be within 300m from the nearest point on the carriageway of a road to which regulations 3(1) or 4(1) of the NISR applies.
- The noise level is assessed using the methodology defined in the Memorandum on the Noise Insulation (Scotland) Regulations 1975. The point at which the noise level is assessed is a point at the most exposed of any doors and windows in a façade from which a straight line can be drawn to a point on the carriageway of such a road without passing through another building.
- The use of a road to which the NISR applies causes, or is expected to cause, noise at a level not less than 68dBLA10,18h one metre in front of the most exposed of any doors and windows in a façade.
- The use of a road causes or is expected to cause noise at a level not less than 68dBLA10,18h if the calculated noise level, in accordance with advice under Regulation 6 of the NISR is greater

by at least 1dB(A) than the prevailing noise level immediately before works for the construction of a highway were begun and is not less than 68dBLA10,18h.

2.2.3 The nature and extent of any noise insulation work that may be undertaken is set out in regulation 9 and the schedules to the NISR.

2.2.4 The Promoter has made an initial assessment of the number of properties that are likely to qualify for noise insulation under the terms of NISR. This is described in the Environmental Statement. The number of properties that qualify for noise insulation will be confirmed in accordance with the NISR shortly before or after the road comes in to use based on the final design and construction of the Project.

2.3 Mitigation of Vibration Impacts

2.3.1 DMRB (Highways Agency et al., 2008) explains that perceptible ground-borne vibration associated with the operation of a road can occur if heavy vehicles pass over irregularities in the road surface and that higher risks of ground-borne vibration could occur on heavily trafficked roads with poor surfaces and sub-grade (foundation) conditions.

2.3.2 The Promoter will undertake the design and construction of the Project in accordance with current standards so that poor road surfaces and sub-grade conditions do not exist when the Project is opened to traffic. In defining current standards, the Promoter will undertake the design and construction of the Project in accordance with the DMRB, any local authority standards and the Manual of Contract Documents for Highway Works (MCHW), as appropriate. These documents set out the standards and specifications to be met for road design and construction, including, but not limited to the road foundations, earthworks, bridges and road pavement.

2.3.3 The Promoter will define appropriate design requirements for the new bridge, including the expansion joints in the deck.

2.3.4 The Promoter will also maintain the new trunk roads provided as part of the Project to acceptable standards in line with the maintenance requirements for the trunk road network in Scotland.

2.3.5 The DMRB advises that '…*for a given level of noise exposure the percentage of people bothered very much or quite a lot by vibration is 10% lower than the corresponding figure for noise nuisance. On average traffic induced vibration is expected to affect a very small percentage of people at exposure levels below 58L_{A10} dB and therefore zero per cent should be assumed in these cases…*'. Screening measures proposed to reduce significant noise effects will also reduce potential nuisance associated with airborne vibration and no additional mitigation is therefore proposed by the Promoter in relation to potential airborne vibration impacts.

3 Assessment Methodology

3.1 Assessment of Noise Impacts

3.1.1 The Promoter has undertaken an assessment of potential noise impacts and resulting significant effects that may occur due to the Project and this is described in the Environmental Statement in Chapter 16. The Promoter has used the following established prediction and assessment methodologies:

- the noise assessment guidance provided in DMRB, Volume 11, Section 3 Part 7, HA213/08 Noise and Vibration (Highways Agency et al., 2008). DMRB is used for the design and assessment of trunk road projects; and
- the calculation methodology defined in the Calculation of Road Traffic Noise (CRTN) produced by the Department of Transport and Welsh Office (1998). CRTN is the method recommended in DMRB for predicting traffic noise.

3.1.2 The assessment reported in the Environmental Statement has been undertaken by identifying noise sensitive locations (receptors) adjacent to the line of the Project and by using the noise prediction methodology described in CRTN to assess existing noise levels and those that are expected to occur due to the Project.

3.1.3 The Promoter will continue to use the above prediction and assessment methodologies in the design and implementation of the Project. The Promoter will use the prediction and assessment methodologies set out in the Memorandum on the Noise Insulation (Scotland) Regulations 1975 to estimate which properties which may become eligible for noise insulation work or a grant in accordance with the NISR. Properties that may qualify under the regulations are indicated in the Environmental Statement.

3.2 Definition of a Significant Noise Effect

3.2.1 There are no definitive criteria set out in regulatory standards or legislation for the rating of significant noise effects. The Promoter has considerable experience in the design and assessment of trunk road projects, including the preparation of Environmental Statements in accordance with relevant legislation[3], and has used this experience to define how significant noise effects will be determined. This is explained in full within the Environmental Statement and is summarised in the following paragraphs.

3.2.2 The identification of significant noise effects is dependent on an assessment of likely noise levels, an understanding of communities and within them an understanding of individual receptors and their use (hence the receptor's sensitivity to any noise impact which may be experienced).

3.2.3 The approach the Promoter has used in determining the significance of any noise effects due to the proposed scheme is set out below. The application of this approach is described in the Environmental Statement.

3.3 Significance Criteria

3.3.1 Long term and short term noise levels will be calculated with and without the scheme. The predicted noise levels will be compared to the evaluation criteria, which are summarised in this section, to identify whether there is a potential impact and if so, the magnitude of the impact.

3.3.2 Identifying significant noise effects requires consideration of noise impact (e.g. change in the noise environment around receptors) and the effect of any noise impact on the exposed community and receptors.

3.3.3 As a first step the DMRB provides guidance on noise impact magnitudes and paragraph 3.42 of HA213/08 Noise and Vibration states that '…a change of 1dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term a 3dB(A) change is considered perceptible, and such an increase should be mitigated if possible…'.

3.3.4 The criteria the Promoter will use for quantifying significant noise effects are defined in Table 3.1 and are based on the noise impact criteria in the DMRB and information about the receptors and communities subject to a noise impact.

[3] The Environmental Impact Assessment (Scotland) Regulations 1999 (as amended)

Table 3.1: Criteria for Quantifying Significant Noise Effects

Long-term Change in Noise Level $L_{A10,18h}$ (dB)	Magnitude of Impact	Initial Indicator of Significance	Criteria to Confirm Significant Effects
> 5.0	Major adverse	Potentially significant	Refer to A) and B) below
3.0 to 4.9	Moderate adverse		
1.0 to 2.9	Minor adverse	Unlikely to be significant	
0.1 to 0.9	Negligible	Not significant	
0	No Change		
-0.9 to -0.1	Negligible		
-2.9 to -1.0	Minor beneficial	Unlikely to be significant	Refer to A) and B) below
-4.9 to -3.0	Moderate beneficial	Potentially significant	
> -5.0	Major beneficial		

A) Significant Effect Criteria – Residential

3.3.5 Significant effects on residential receptors will be identified using professional judgement based on the following criteria:

- number of receptors subject to the noise impact;
- the proportion of the community within which the receptors reside subject to the impact;
- the magnitude of the impact; and
- existing absolute noise levels (particularly very noisy and quiet / tranquil areas).

3.3.6 The Promoter will, in this regard, consider for residential properties whether a moderate magnitude of impact or greater would give rise to a significant noise effect and also whether noise impacts due to the Project which are considered to be of less than moderate magnitude could lead to a significant noise effect. In relation to this latter point, for example, in locations where the existing environment is very noisy, potentially significant effects (which will trigger the requirement to consider mitigation) will be identified where, whilst the noise change may be less than 3 dB(A), absolute noise levels for the scheme in the assessment years are predicted to exceed the threshold defined in the NISR. This also provides consistency with the Action Plans being prepared for existing roads under the Environmental Noise (Scotland) Regulations 2006.

B) Significant Effect Criteria – Non Residential

3.3.7 Significant effects on non-residential receptors will be identified using professional judgement based on the following criteria:

- receptor use (e.g. educational, healthcare, religious buildings or community uses) and hence relevant guidance on noise (that will also take account of the sensitivity of the occupants);
- the times of use;
- the design of the receptor (especially windows, doors and ventilation systems) and hence ability of receptor to experience changes in external noise environment without significant change in internal noise conditions);
- the magnitude of the impact; and
- ambient noise levels (internal and external).

3.4 Assessment of Vibration Impacts

3.4.1 In terms of potential impacts on buildings due to ground-borne vibration, the DMRB advises that the risk of damage to buildings can occur when vibration levels (Peak Particle velocities) are above 10mm/s but that the levels in buildings close to heavily trafficked roads rarely exceed 2mm/s and are typically below 1mm/s.

3.4.2 The DMRB advises that on the basis of research carried out, no evidence has been found to support the theory that traffic induced ground borne vibration is a source of significant damage to buildings. The DMRB also advises that such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances. No such exceptional circumstances are considered by the Promoter to exist on the Project in relation to vibration which may occur from the operation of the scheme.

4 Monitoring and Maintenance

4.1 Monitoring

4.1.1 The Promoter will undertake the following monitoring to enable the verification of the effectiveness of the mitigation measures provided:

- baseline monitoring prior to the Project being opened to traffic to verify the existing noise environment; and
- monitoring at areas and properties adjacent to the Project one year following the road being opened to traffic and five years following the road being opened to traffic.

4.1.2 The Promoter will, as necessary, also use the prediction and assessment methodologies set out in Section 3.1 of this Policy to support verification of the effectiveness of mitigation measures.

4.1.3 Where access is required onto private land for monitoring purposes, prior consultation will be undertaken with the occupier and appropriate arrangements made to enable the monitoring to be undertaken.

4.1.4 As explained in Section 3 of this Policy, the Promoter as roads authority has a duty under Regulation 6 of the NISR to assess noise levels following the opening of the Project to traffic (termed the relevant date) for the purpose of establishing the buildings which previously did not qualify for an original offer of carrying out or making a grant in respect of carrying out noise insulation work, but which will have become eligible by virtue of increased traffic flow. The Promoter will undertake the assessments in accordance with the obligations set out in the NISR.

4.2 Maintenance Works

4.2.1 The Promoter manages and maintains the trunk road network in accordance with the responsibilities set out in the Section 2 of the Roads (Scotland) Act 1984. This includes carrying out day-to-day inspections, management, maintenance and repairs to the trunk road network.

4.2.2 The Promoter will manage and maintain the trunk roads which form part of the Project, including the bridge crossing the Firth of Forth in accordance with the obligations set out in the Roads (Scotland) Act 1984. Such management and maintenance will include maintaining mitigation measures provided in accordance with this Policy to maintain their effectiveness.

4.2.3 Where mitigation measures provided in accordance with this Policy form part of roads which become the responsibility of local roads authorities, as set out in the Bill, the local roads authority will become responsible for managing and maintaining these parts of the Project in accordance with their responsibilities set out in Section 1 of the Roads (Scotland) Act 1984.

4.2.4 The Promoter will be responsible for rectifying any defects found to be present in roads which are part of the Project which become the responsibility of the local roads authority for a period of five years following the Project being opened to traffic. Should any defects be found during this period, including any defects in mitigation measures provided in accordance with this Policy, these shall be rectified by the Promoter.

5 References

Department of Transport Welsh Office (1988). Calculation of Road Traffic Noise, HMSO

Highways Agency et al. (2008). Design Manual for Roads and Bridges (DMRB) HA 213/08, Volume 11, Part 7. The Highways Agency, Scottish Government, Welsh Assembly Government, The Department for Regional Development Northern Ireland.

Glossary of Terms

'A' Weighting	The human ear does not respond uniformly to different frequencies. The 'A' weighting is commonly used to simulate the frequency responses of the human ear.
Attenuation	Reduction in intensity.
Authorised works	The works which comprise the Forth Replacement Crossing project authorised through the Parliamentary Bill process.
the Bill	For the purposes of this NVP, references to the Bill are references to the Forth Crossing Bill.
Bund	Earth embankment
CRTN	Calculation of Road Traffic Noise
Decibel (dB)	The range of audible sound pressures is approximately 0.00002Pa to 200Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB. A decibel is not an absolute unit of measurement but is a logarithmic ratio of the variation in pressure. It should be noted that because the decibel scale is a logarithmic ratio, the arithmetic sum of more than one decibel does not equate to the corresponding noise level. For example, the combined noise level generated by adding two equal noise levels together is approximately 3dB higher than the individual noise levels i.e. 50dB + 50dB = 53dB Mathematically: Sound pressure Level (dB) = 20 log (pt / p0) where p0 = 2 x 10^{-5} Pa.
DMRB	Design Manual for Roads and Bridges.
Environmental Statement	Document provided by the Developer to the Competent Authority, containing environmental information required under Article 5 of Directive 85/337/EEC as amended. In the context of the Project this refers to the Forth Replacement Crossing Environmental Statement submitted with the Forth Crossing Bill.
L_{A10}	The A-weighted noise level exceeded for 10% of the measurement period. A unit generally used in the assessment of road traffic noise.
$L_{A10, 18h}$	The arithmetic mean of all the hourly values of L_{A10} during the period between the hours of 06:00 and 24:00
MCHW	Manual of Contract Documents for Highway Works
NISR	Noise Insulation (Scotland) Regulations 1975
Noise	The World Health Organisation (WHO) defines noise as unwanted sound. For the purposes of assessment noise impacts are considered as increases or decreases in noise levels relative to existing noise levels due to changes in road traffic.
Peak Particle Velocity (PPV)	Peak Particle Velocity is the maximum speed of movement of a point in the ground during the passage of a vibration. It is normally expressed in the units millimetres per second (mm/s).
the Project	The Forth Replacement Crossing project.
Vibration	A low frequency disturbance which can be transmitted through the ground or air.