

24. Operational noise

The Operational Noise Assessment Report provides an assessment of actual and potential noise effects relating to the operational phase of the Project, namely the potential effects generated by road traffic noise from the new motorway. The existing noise environment and receivers within the Project area, results of noise modelling and potential noise effects at specific locations are described in detail in the Operational Noise Assessment Report.

The following is a summary of the issues and potential effects identified in the Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

24.1 Noise assessment criteria

Road traffic noise effects can be assessed by applying various standards and guidelines. The Noise team has reviewed the methodologies most commonly used in New Zealand and considered New Zealand Standard NZS 6806:2010 *Acoustics – Road-traffic noise – New and altered roads* to be the most appropriate and applicable New Zealand document to guide the Noise team's assessment of the Project. The Standard has been tested in several Council and Board of Inquiry hearings and has, with minor modifications, been accepted and applied to all recent major roading projects.

The relevant noise criteria categories under NZS 6806:2010 are shown in Table 24-1.

Table 24-1: NZS 6808:2010 noise criteria categories

Category	Altered Roads	New Roads with a predicted traffic volume of 2,000 to 75,000 AADT at the design year
	dB L _{Aeq(24h)}	dB L _{Aeq(24h)}
A primary external noise criterion	64	57
B secondary external noise criterion	67	64
C internal noise criterion*	40	40

* This criterion is triggered if habitable rooms would receive internal noise levels greater than 45 dB L_{Aeq(24h)} despite external mitigation such as bunds, barriers and low-noise road surface materials being used.

Compliance with NZS 6806:2010 will achieve reasonable noise levels for all affected residents in the vicinity of the Project. The methodologies for noise level measurement, prediction and assessment set out in this Standard ensure an equitable management of noise effects for all assessment positions. The Standard is based on the BPO approach, which aligns with the duty to avoid unreasonable noise in section 16 of the RMA.

The Noise team has assessed traffic noise effects on residents by interpreting the general subjective response of people based on international research, to predicted noise level changes, both along the Project alignment and along SH1 (where a reduction in noise level would occur). The Noise team compared the percentage of people predicted to be 'highly annoyed'¹²⁷ by traffic noise along the new alignment and the existing SH1 for the existing and predicted future circumstances. This comparison allowed the Noise team to weigh potential positive and negative effects based on their significance and the number of people affected.

24.2 Existing environment

The existing ambient noise environment provides a base for assessing noise effects due to noise level changes in terms of the RMA. For the Project, existing noise levels along the indicative alignment were measured and predicted. Measurements included both short and long-duration surveys. The Noise team also used the results of the surveys to verify and calibrate the computer noise model.

Ambient noise measurements show that noise levels extend over a wide range. Beside the existing SH1, noise levels are elevated, generally above 60 dB $L_{Aeq(24h)}$. In areas removed from SH1 and other noise sources, eg Pūhoi Township and to the west of Warkworth, noise levels are low (generally between 43 and 50 dB $L_{Aeq(24h)}$).

The long-duration unattended noise measurements (provided in Appendix B of the Operational Noise Assessment Report) show that $L_{Aeq(24h)}$ levels are around 50 dB at the four survey locations at 8 Pūhoi Close, 87 Perry Road, 40 Wyllie Road and 815 SH1.

24.3 Assessment methodology

Computer noise modelling allowed the Noise team to take into account many factors that affect the propagation of road traffic noise. The computer noise model includes information on the form of the terrain, the road alignment and dwelling locations. The road information includes traffic volume, speed, road surface material, gradient and percentage of heavy vehicles. The model outputs are specific noise levels at individual receivers and noise contours over a larger area. The individual receiver noise levels are used to assess compliance with NZS 6806:2010 and to determine the noise level change at each dwelling assessed. The noise level contours provide a wider picture of the road noise effects of the Project. The Noise team uses the contours to determine the number of people that may be highly annoyed by road traffic noise, and to visually represent the extent of road traffic noise in the wider area.

The Noise team's assessment is three-pronged:

- Assessment of compliance with NZS 6806:2010 following the BPO process and focussing on achieving the most stringent Noise Criteria Category A, where applicable;
- Assessment of noise effects through determination of noise level changes and likely annoyance of people; and

¹²⁷ The percentage of people predicted to be highly annoyed (%HA) based on the Miedema & Oudshoorn dose-response relationship curve applied to the number of persons within each relevant noise bracket. Refer to Section 2.3 of the Operational Noise Assessment Report for further details on annoyance effects.

- Assessment of effects over the wider area affected by the Project. This assessment is completed by comparing the number of people that may be highly annoyed by traffic noise with and without the Project. This comparison takes into account noise level reductions and increases in the overall area.

The design year is a concept that is used for several engineering disciplines. It requires that the design of a road is based on a future year, making an allowance for increase in traffic volumes over that time. The Standard requires that the design year shall be between 10 and 20 years after the opening of a new road to the public. The year 2031 has been selected as the design year for the Project, which allows for an opening year up to 2021.

24.4 Actual and potential noise effects

The Project area is sparsely populated. More densely populated areas exist around Pūhoi, Perry Road and Wyllie Road through to SH1. The Noise team assessed the receivers against 'new' or 'altered' road criteria of NZS 6806:2010, depending on the influence of the existing SH1 on the receivers. Approximately half of the Protected Premises and Facilities (PPFs)¹²⁸ were assessed against 'new' and the other half against 'altered' NZS 6806:2010 criteria.

The do-nothing scenario (where the Project is not built) showed that noise levels would increase by approximately 3 decibels along SH1 as at the design year due to traffic volume increase. The do-minimum scenario (where the Project is built with no noise mitigation) allowed for a chip seal road surface on the entire alignment. A number of receivers would fall into Categories B and C, which is not a desirable outcome.

The main mitigation option considered involved the use of Open Grade Porous Asphalt (OGPA) road surfacing on those sections of the Project where several receivers would benefit from it, ie at the southern and northern ends of the Project. This option achieved effective mitigation for almost all receivers. Most receivers would experience noise levels from the Project only within the most stringent noise criteria Category A. The Noise team considers that noise levels within Category A are appropriate for residential use and will not result in sleep disturbance or adverse effects on noise sensitive activities such as watching TV.

The Noise team also considered other mitigation options, namely the use of road-side or boundary barriers. However, due to the difficult terrain, the distance of receivers from the road and the low population density, these barriers would not present the BPO for mitigation for this Project. Barriers would need to be very high (5m and more) and relatively long to achieve any noticeable noise level reduction at individual receivers only, which would create visual and urban design problems for only marginal acoustic benefit.

Therefore, the selected mitigation option is the use of OGPA at either end of the alignment, where higher population density will benefit from its noise reduction properties.

Notwithstanding that the selected mitigation would bring most receivers into the most stringent Category A, for some currently quiet areas the introduction of the Project will result in a significant increase in noise level. This is particularly the case for dwellings along Wyllie Road. While the

¹²⁸ Refer to Section 2.1.1 of the Operational Noise Assessment Report

predicted noise level increase is over 10 decibels for a small number of receivers (equivalent to a perceived doubling in noise level), the Noise team considered that the resultant noise levels at these receivers will be appropriate for residential use.

24.5 Overall effects of operational noise

The Noise team has assessed the overall traffic noise effects of the Project by comparing existing and do-nothing noise levels with the predicted noise levels of the Project when implemented (including mitigation). The results of this comparison showed that with the Project in operation, the number of people experiencing traffic noise levels that have been shown to cause high annoyance would decrease. This reduction is due to the fact that traffic will be moved away from the densely populated areas of Warkworth township to sparsely populated areas. The modest decrease in noise level from traffic reduction on SH1 will benefit many residents.

The Noise team concluded that the Project can be operated so as to achieve reasonable noise levels at affected dwellings, while reducing the overall noise level for a large number of dwellings.

24.6 Recommendations and mitigation

The Noise team recommends application of an OGPA road surface on the motorway from its southern end to approximately chainage 62360 (north of Pūhoi) and again from chainage 50840 to the Project's tie-in with SH1 at Warkworth to mitigate the effects of motorway traffic noise. The use of OGPA will result in most receivers being subject to noise levels in the most stringent Category A of NZS 6806 and will provide effective and noticeable noise level reductions when compared with the base situation of chip seal being used.

In order to ensure that appropriate traffic noise outcomes are achieved, the Noise team recommends that designation conditions cover the following issues:

- the application of the NZS 6806: 2010 methodology in determining the most appropriate traffic noise mitigation;
- A requirement to install, where appropriate, noise mitigation measures prior to opening of the Project to the public; and
- a requirement to maintain noise mitigation measures to the degree practicable to retain their noise reducing capabilities.

I support these recommendations.