Chapter 22

Part G

VOLUME 2

Noise and Vibration

Overview

The Project route closely follows the existing SH1 and NIMT through both rural and urban areas. A number of PPFs affected by this Project are already subject to high levels of road-traffic noise, and a noise survey has been performed to assist in quantifying this existing exposure. Road-traffic noise computer modelling has been conducted, and an extensive road-traffic noise mitigation options assessment has been undertaken in accordance with the method set by NZS 6806. For each area of the Project, a number of options have been developed and assessed by all relevant members of the Project team to determine the best practicable option best practical option for mitigation for noise mitigation. The mitigation was also reviewed following public open days and feedback in July 2012.

Proposed noise mitigation includes one kilometre of low-noise road surface (open-graded porous asphalt / PA-10 or equivalent) on the Expressway through Ōtaki, and investigation of one PPF for acoustic treatment.

Rail noise and vibration measurements have been undertaken to quantify existing exposure and typical source levels. Rail vibration from the realigned NIMT is predicted to comply with the adopted criteria without the need for specific mitigation. Two additional PPFs will be investigated for acoustic treatment to mitigate rail noise.

With the proposed mitigation, operational noise and vibration from the Project will be restricted to within reasonable levels and effects are considered acceptable.

Construction noise will generally remain within reasonable limits defined by NZS 6803, using standard noise management controls. There are a small number of specific locations where neighbours are closer to the works, and enhanced controls (particularly effective communication) are proposed to manage noise disturbance. The NZTA has well-established processes to manage construction noise and vibration, which comply with the philosophy of NZS 6803. A critical part of these processes is the use of a CNVMP for the Project as a whole, and construction noise and vibration management schedules for individual activities and locations. While no significant night works are anticipated, night works may be required where activities interact with live roads and rail for safety or operational reasons. Continuous pours of concrete may also be required. These night works are to be of limited duration. Effects from construction noise and vibration for this Project will be temporary. There will be some disturbance, but with appropriate management measures the adverse noise and vibration effects are considered reasonable.

22 Noise and Vibration

22.1 Introduction

This chapter summarises the noise and vibration effects of the Project during construction and operation.

The reports detailing the effects of the Project on noise and vibration are:

- Peka Peka to Ōtaki Expressway: Operational noise and vibration assessment (Technical Report 14); and
- Peka Peka to Ōtaki Expressway: Construction noise and vibration assessment (Technical Report 15).

These technical noise and vibration reports are included in Volume 3 of this AEE report.

22.2 Existing Environment

The Project closely follows the existing SH1 and NIMT, with the environments ranging from rural to urban.

For SH1, computer modelling has been used to predict existing road-traffic noise levels. A noise survey has been performed to validate this modelling and to assist in a qualitative assessment of the noise environment. Measurements were taken at two locations over a week to capture temporal variations, and spot measurements at six other locations to capture spatial variations. This modelling also forms the basis for comparisons with modelling of the Project.

The NIMT runs parallel to the existing SH1 from Peka Peka through to Ōtaki, before diverging. A noise survey has included measurements of rail noise and vibration from freight and passenger trains.

Most PPFs are currently exposed to road-traffic noise from the existing SH1 and rail noise and vibration from the NIMT.

If the Project is not built, traffic growth is still anticipated with an increase in 2031 of approximately 30% of total vehicles, with a greater proportion of HCVs. Road-traffic noise from the existing SH1 is expected to increase by 2-3 dB in most locations, which generally would not be noticed as the slight increase is gradual over two decades.

22.3 Operational Noise Effects

NZS 6806: 2010 Accoustics - Road-traffic noise - new and altered road (NZS 6806) sets the criteria for reasonable road-traffic noise levels, taking into account health issues associated with noise and other matters (see below). Therefore, road-traffic noise levels in compliance with NZS 6806 Category A should generally result in acceptable noise effects.

NZS 6806 noise criteria

Category	Criterion	Altered roads	New road
A	Primary	64 dB $L_{Aeq(24h)}$	57 dB $L_{Aeq(24h)}$
B	Secondary	67 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$
C	Internal	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$

As the existing environment is heavily influenced by road-traffic noise, compliance with Category B may also represent acceptable noise levels. This is particularly so for the new road criteria where Category B is the same road-traffic noise level as Category A for altered roads.

The assessment of operational noise effects is described in full in Technical Report 14, but broadly involved:

- Identifying PPFs within the vicinity of the proposed roads;
- Modelling predicted noise levels without any specific form of mitigation at each PPF;
- Investigating potential noise mitigation options, where appropriate; and
- Evaluating the mitigation options with the assistance for the Project team to determine the best practicable option (best practical option for mitigation).

In addition to compliance with the NZS 6806 criteria, actual and potential noise effects have been explicitly considered in developing the proposed mitigation, and a further qualitative assessment made before the proposed mitigation recommendation is then finalised.

Comparison with existing and do-nothing noise levels formed the operational noise assessment, the cumulative effect of the Project and the existing SH1.

22.3.1 Protected Premises and Facilities

This assessment has considered all noise sensitive locations within set distances from the Project. PPFs include existing houses, schools, marae and various other land uses defined

in the NZS 6806. The distance from the road within which PPFs are considered is defined as 100 metres from the edge of the nearside traffic lane for urban areas and 200 metres from the edge of the nearside traffic lane for rural areas.

NZS 6806 has been applied to evaluate noise effects.

NZS 6806 also states that, for any PPFs that are significantly affected by noise from another existing road in the vicinity, it may be appropriate to apply different criteria. These altered road criteria have been applied to a sub-group of PPFs within 100 metres of the existing SH1 in Ōtaki, which is being altered as part of the Project, and where the existing road-traffic noise level is assessed to be 64 dB or greater.

Therefore, Technical Report 14 considered two groups:

(a) PPFs where the new road criteria were applied; and

(b) PPFs where the altered road criteria were applied.

However, this distinction is not critical as the criteria from NZS 6806 only guides the selection of the best practical option for mitigation.

The predicted noise level at each PPF for the best practical option for mitigation and other scenarios are listed in Table 4-5 of Technical Report 14.

22.3.2 **Modelling**

Modelling of road-traffic noise was completed to predict operational noise effects.

The noise model took into account predicted traffic volumes, topography, existing buildings, road alignments, road surfaces, safety barriers and bridges. Noise levels were evaluated for:

- the existing environment; and
- the do-nothing scenario - the existing roads with 2031 traffic without the Project constructed; and
- the do-minimum scenario - the existing roads with 2031 traffic with the Project constructed, but with no specific noise mitigation.

Comparison of do-nothing and do-minimum noise levels showed that the Project meets the threshold criteria to be considered as both a new and altered road depending on the assessment area.

Initial modelling was completed to determine in which areas noise mitigation should be considered. All PPFs in NZS 6806 categories B and C in the do-minimum scenario were identified and split into seven assessment areas as follows:

A: North of Ōtaki Ramp;

B: Main Highway, Ōtaki;

C: 230 Main Highway, Ōtaki;

D: East Ōtaki;

E: Ōtaki Gorge to Te Horo (West);

F: Ōtaki Gorge to Te Horo (East); and

G: South of Mary Crest.

Noise mitigation options were modelled for each of these areas, and the road-traffic noise at each PPF predicted.

22.3.3 Operational Rail Noise and Vibration Effects

To accommodate the Project, the NIMT alignment will move west in Ōtaki.

The increase in curve radius in Ōtaki will result in potential increase in speed, which has been considered in the assessment. Rail noise is predicted to exceed the nominated criteria at two PPFs (Ōtaki Motel and 230 Main Highway) and mitigation has been considered and is proposed for these locations.

It should be noted that the Project will result in the level crossing at Rahui Road being removed, therefore trains will no longer need to use their horn at the approach to Rahui Road. The measurements of vibration from the railway on its existing alignment and in its current condition indicate that the design criterion might be exceeded at PPFs 60 metres or less from the track. There are a number of PPFs closer than this distance to the current SH1. With the re-alignment of the track, a new track will be constructed and the vertical alignment and ballast condition improved compared to the current SH1. This will result in a significant reduction in vibration levels generated by trains, which will offset the reduction in distance between the track and nearest PPFs.

Vibration levels are predicted to comply with the nominated criterion without specific mitigation.

22.3.4 Measures to Avoid, Remedy or Mitigate Operational Noise and Vibration Effects

Road-traffic noise was modelled and, for all areas where NZS 6808 Category A was exceeded, a number of mitigation options were tested. Each mitigation option was assessed against the following acoustics factors:

- Compliance with NZS 6806 categories, attenuation provided by structural mitigation, requirements for building modifications, effect of changes to the noise environment and value for money.
- A graded assessment was also provided by specialists including urban design, heritage, ecology, social impacts; need to acquire land, safety and visual amenity.
- Each option was then assessed at a noise mitigation workshop with other relevant disciplines. For each area the workshop participants selected an option that represented the best practical option for mitigation. Further evaluation was completed where necessary to determine the best practical option for mitigation. The mitigation was also reviewed following public open days and feedback in July 2012.

A summary of the currently proposed noise mitigation resulting from Technical Report 14 is provided in each of the seven assessment areas below in Table 22-1.

Table 22-1: Selected Options - Road Surfaces

Location	Currently proposed noise mitigation
A: North of Ōtaki Ramp	Open graded porous asphalt (PA-10)*
B: Main Highway, Ōtaki	No mitigation proposed – Maintain existing asphaltic concrete (AC) surface
C: 230 Main Highway, Ōtaki	Open graded porous asphalt (PA-10)*
D: East Ōtaki	Open graded porous asphalt (PA-10)*
E: Ōtaki Gorge to Te Horo (West)	No mitigation proposed
F: Ōtaki Gorge to Te Horo (East)	Building modification for one Category C PPF (14 Old Hautere Road)
G: South of Mary Crest	No mitigation proposed

With the structural mitigation detailed in Table 22-1, the total numbers of PPFs in the Project area each of the NZS 6806 categories are shown in Table 22-2.

Table 22-2: Number of PPFs in NZS 6806 Categories

Category A	Category B	Category C
132 PPFs	15 PPFs	1 PPFs

A set of plans with building references and noise contours are presented in drawings N-001 to N 008 (refer Volume 5: Plan Set). Buildings are colour-coded according to their NZS 6806 category.

Building modification is to be investigated at two PPFs (Ōtaki Motel and 230 Main Highway), to mitigate rail noise (e.g. mechanical ventilation, updated glazing). Building modification mitigation is subject to detailed design and agreement with the landowner.

No specific mitigation is required for rail vibration. Vibration will decrease due to the new rail track and ballast. This will however be partly counteracted by the railway being closer to the two PPFs.

22.4 Construction Noise

22.4.1 Methodology

NZS 6803 provides a framework for managing construction noise. NZS 6803 provides different guideline noise limits for different activity durations.

Due to the proximity of the existing SH1, ambient noise levels are already elevated and intermittent exposure to daytime noise resulting from multiple construction activities is not expected to have a significant effect.

For this reason the short term criteria (less than 20 weeks) provided in NZS 6803 is considered to be appropriate.

Construction noise has been assessed for all residential and commercial receivers within 100 metres of any earthworks, which represents the extent to which heavy machinery will be operating.

22.4.2 Construction Activities

Construction activities predicted to generate noise have been assessed. The most significant activity in terms of timeframe and extent are the actual road works including bulk earthworks, transporting fill, grading, levelling and compaction.

- Nine bridges will be built along the route. Bored piles will be used in preference to vibratory or driven piles.
- The existing SH1 bridge in Ōtaki (known as 'the Ramp') will be demolished (and replaced nearby).
- The NIMT will be diverted west of the existing alignment in Ōtaki to allow for the Project.
- The rail works will consist of earthworks which are similar in nature to those required for the roads, in addition to the laying of the ballast, sleepers and rail delivery and fixing.
- Vehicle movements will be required to transport soil around the Project or imported from elsewhere; the vast majority resulting from internal movements.
- Vehicle movements will mostly take place on the existing SH1 or the Expressway, while vehicle movements on local roads are expected to be largely avoided.

22.4.3 **Construction Noise Effects**

From the types of equipment and duration of works envisaged, a conservative assessment has been made for typical activities using the construction noise calculator on the NZTA's Transport Noise website[43]. From these calculations, buffer distances required from construction activities to comply with guideline noise limits in NZS 6803 have been determined.

The majority of the construction is separated from neighbours and while it will be audible at many places, construction noise will remain within reasonable limits determined by NZS 6803, using standard noise management controls.

- The receivers on Main Highway north of the new ramp and along County Road are in close proximity to the alignment, and noise from earthworks and surfacing will be in the order of 70–80 dB, although this would vary during the day.
- Several receivers are within 50 metres of both the Project and the Old Hautere Road extension, and may experience noise levels in the order of 70–80 dB. At these levels, some disturbance to daytime activities is expected.
- For the remainder of the Project north of Mary Crest, the Expressway and the new local arterial road run parallel to the existing SH1. The PPFs to the east of the Project are in general at least 50–100 metres from the Expressway. Construction noise will be audible and there may be some annoyance.

There are a small number of specific locations where neighbours are closer to the works and these are listed below. For these locations, enhanced controls and particularly effective communication with neighbours are proposed to manage noise disturbance. With appropriate mitigation (discussed further in Section 22.5), works are not expected to unduly interfere with normal domestic activities.

The Expressway is also 20-40 metres away from the former Rahui Milk Treatment Station and Social Hall and, without mitigation, construction noise levels could be up to 85 dB at times, which would interfere with activities occurring at the time. In addition to effective communication with occupants, a schedule to the CNVMP will be required for all works adjacent to this property, with activities programmed to reduce any disturbance.

Night works will only be required where the Project interacts with the existing SH1, railway and local roads. Their extent and duration will be limited. In these locations, the receivers are likely to already have elevated ambient noise levels due to the proximity to the existing SH1 and NIMT. With appropriate communication with residents, and scheduling to minimise disturbances, construction noise effects from any night works will be acceptable.

22.4.4 **Construction Vibration Effects**

The Expressway is 20 – 40 metres away from the former Rahui Milk Treatment Station and Social Hall. As these two buildings are close to vibration sources (vibratory compaction on the alignment) there is the potential for cosmetic damage to buildings (such as cracking) and annoyance from vibration.

A building condition survey will be required before and after construction works to determine if any cosmetic damage has been caused, so that it can then be repaired. Annoyance will be addressed by accurately communicating the time and duration of vibration in advance, which will generally be during the daytime.

[43] www.acoustics.nzta.govt.nz

With these controls the adverse effects of construction vibration will be acceptable. There are no adverse vibration effects predicted for the remainder of the Expressway route.

22.5 Measures to Avoid, Remedy or Mitigate Construction Noise and Vibration Effects

When the NZTA and KiwiRail submit an outline plan of works to the KCDC for approval, the plan will contain a detailed construction methodology, including a detailed CNVMP. The process for finalising management plans is discussed in Chapter 8, Part D, Volume 7 of this AEE report. The NZTA has a standardised template for this purpose, which is included in Volume 5 of this AEE report. The plan includes:

- Noise targets;
- Summary of assessments/predictions;
- General construction practices, management and mitigation;
- Noise management and mitigation measures specific to activities and/or receiving environments;
- Monitoring and reporting requirements;
- Procedures for handling complaints;
- Procedures for review of the CNVMP throughout the Project; and
- Management schedules to the CNVMP for specific activities and locations where further assessment and control is required.

Indicative mitigation is documented below to illustrate the approximate extent and types of measures likely to be required.

- Roads:
  - noise from bulk earthworks can be reduced by limiting the number of items of equipment operating in parallel, and/or by equipment selection.
  - Potential annoyance can be reduced by avoiding long periods of consecutive activity; the use of alarms rather than standard tonal alarms; and performing routine maintenance such as greasing tracked equipment.
- Bridges:
  - most of the bridges are remote from receivers, and bored piles are being used in preference to driven or vibratory piling.
  - No mitigation will be required for daytime activities greater than 50m from the receivers.
  - If a continuous pour of concrete or beam lifts are required during the bridge formation, then night works may be required.
  - Consideration of noise will be required when selecting equipment and procedures for any night works, and direct consultation with affected properties will be necessary.
- Tie-ins: the tie-ins to the existing SH1 to the north and the M2PP Expressway to the south are likely to be built during the day using standard traffic control techniques, therefore night works will generally not be required.
- Rail: the majority of the rail work can be performed during the day, however some night works may be required when connecting to the existing rail tracks, to minimise disruption. It is anticipated that it would take a weekend to tie in the new alignment with the current alignment, where intensive works will be required.
- Site compound: the Main Contractor's site compound, including any batching required, should be located remote of any receivers. The potential location for this is in the vicinity of the existing concrete plant by the Ōtaki River (between chainages 3200 and

3400). Any site should have direct access to the Project, and vehicles movements on local roads should be discouraged.

For significant activities, CNVMPs will be prepared once details of construction equipment and locations have been confirmed. The CNVMPs will set out specific conditions relating to a defined activity in a pre-determined location. Generally, CNVMPs are developed for activities that have been identified as likely to exceed the Project noise criteria. For example, any activity which will require night works is likely to require a schedule to be prepared.