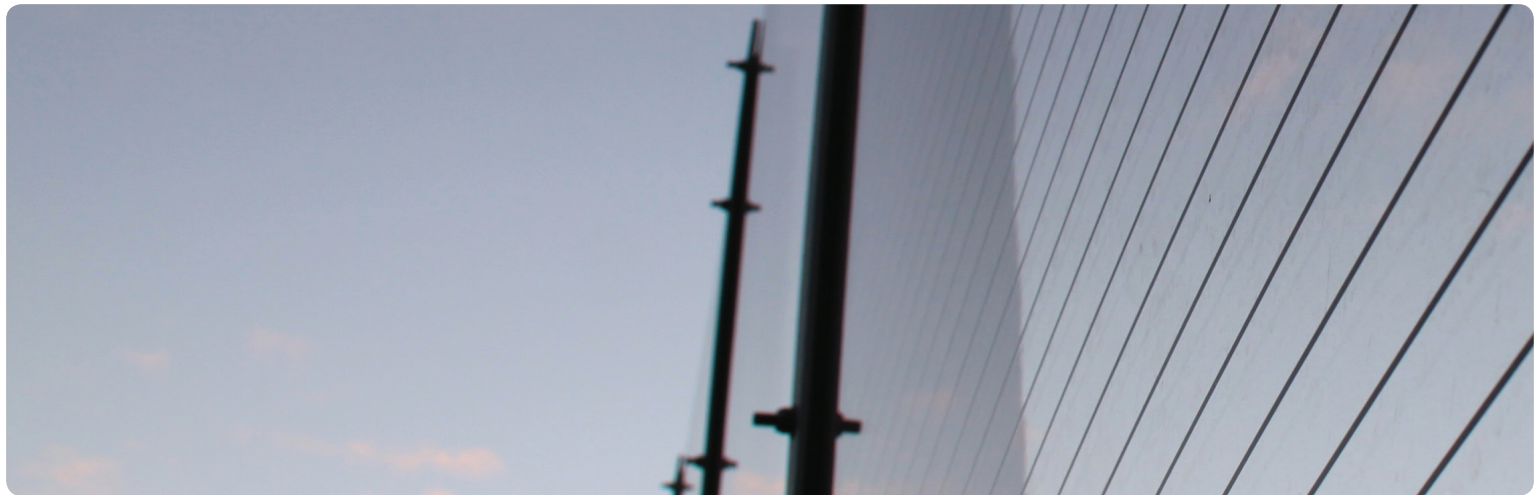




Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects

Version 1.0, October 2011

This guide describes the processes to be used on NZTA asset improvement projects for assessing and, where required, determining appropriate mitigation for road-traffic noise. These processes are based on NZS 6806:2010. The guide also gives effect to the NZTA's state highway project development and delivery standards, in particular SM030 minimum standard Z/19 - Social and Environmental Management.



NZ TRANSPORT AGENCY
WAKA KOTAHI

Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects v1.0

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Front cover image:
Transparent noise barrier by SH1 at St Mary's Bay, Auckland

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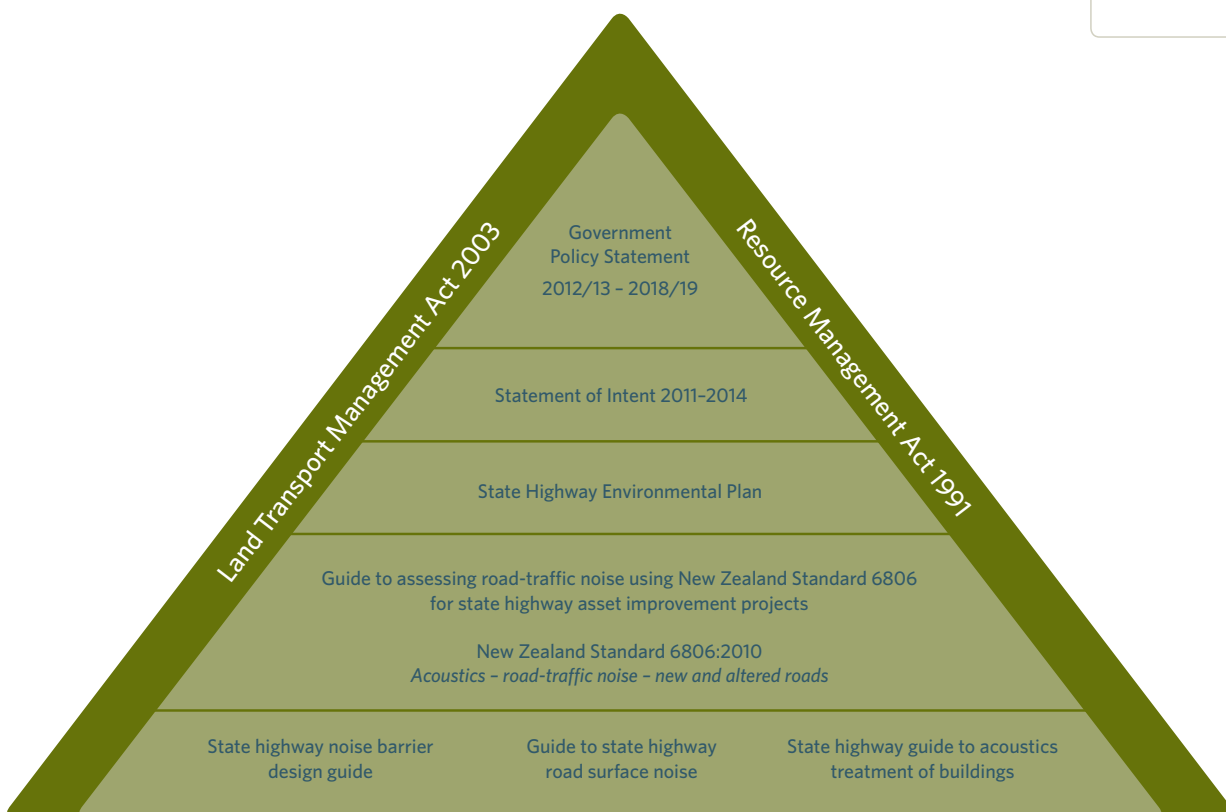
Introduction

Background

The NZ Transport Agency (NZTA) aims to be a good neighbour, taking social and environmental responsibility seriously, including management of noise. This is reflected in external and internal strategy and policy documents that the NZTA is required to implement, including the NZTA's *Environmental plan*¹. These documents are consistent with the requirements of the Land Transport Management Act 2003 and Resource Management Act 1991 (refer to figure 1).

¹ Transit New Zealand (2008) *Environmental plan*, version 2. www.nzta.govt.nz

FIGURE 1 Relationship of this guide to key NZTA policy and strategy documents and other guides



The NZTA's *Environmental plan* sets formal objectives regarding noise from the state highway network, including:

N2 - Determine reasonable noise requirements when seeking new or altering existing designations including when designating existing local roads by using RMA procedures

New Zealand Standard (NZS) 6806² prescribes the methods and criteria that the NZTA uses to fulfil this objective (except where existing designation conditions require compliance with another standard).

NZS 6806 was published by Standards New Zealand on 30 April 2010 and is a process-based standard for measuring, predicting, assessing and, where required, determining appropriate mitigation for road-traffic noise.

² Standards New Zealand (2010) NZS 6806:2010 *Acoustics - road-traffic noise - new and altered roads*. www.standards.co.nz

Purpose of this document

This guide describes the processes to be used on NZTA projects for assessing and, where required determining appropriate mitigation for, road-traffic noise, based on NZS 6806. The aim is to consistently and efficiently apply NZS 6806, within the framework of the NTZA's *Project management manual* (SMO11)³, *State highway professional services contract proforma manual* (SMO30)⁴, and minimum standards Z/6⁵, Z/18⁶, Z/19⁷, Z/20⁸, Z/21⁹ and PSG/13¹⁰. Specifically, this guide is to be used for road-traffic noise assessment as required by Z/19. Some of the minimum standards are to be updated for consistency with this noise assessment process. This guide should be read in conjunction with NZS 6806.

NZS 6806 should result in better social and environmental outcomes for stakeholders, with integrated design of noise mitigation measures. However, for high-risk improvement works (refer to page 7 and the *Risk management process manual*¹¹), significantly more effort is needed from the project team at an earlier stage in the process, compared with previous assessments using the Transit guidelines¹². This guide is aimed in particular at NZTA project managers, acoustics specialists and planners:

- NZTA **project managers** now need to schedule and budget for the different processes brought about by NZS 6806.
- **Acoustics specialists** need to adopt new assessment methods, and are now required to prepare information about mitigation options in new formats and provide analysis of the acoustics benefit-cost ratio (BCR).
- **Planners** need to adapt the way designation conditions for noise are drafted.
- For each project, a **suitably qualified expert** (such as an environmental manager, planner or other person with a holistic viewpoint) now has responsibility for the final determination of the best practicable option (BPO) for noise mitigation.

Supporting tools, templates and examples for the application of NZS 6806 are available on the NZTA's Transport Noise website: www.acoustics.nzta.govt.nz. This includes an online eLearning training module on road-traffic noise, including application of NZS 6806.

3 NZTA (2010) *Project management manual* (SMO11). www.nzta.govt.nz

4 NZTA (2011) *State highway professional services contract proforma manual* (SMO30). www.nzta.govt.nz

5 NZTA (2009) *Minimum standard Z/6 – Scheme Assessment Report*. www.nzta.govt.nz

6 NZTA (2009) *Minimum standard Z/18 – Scoping Report*. www.nzta.govt.nz

7 NZTA (2010) *Minimum standard Z/19 – Social and Environmental Management*. www.nzta.govt.nz

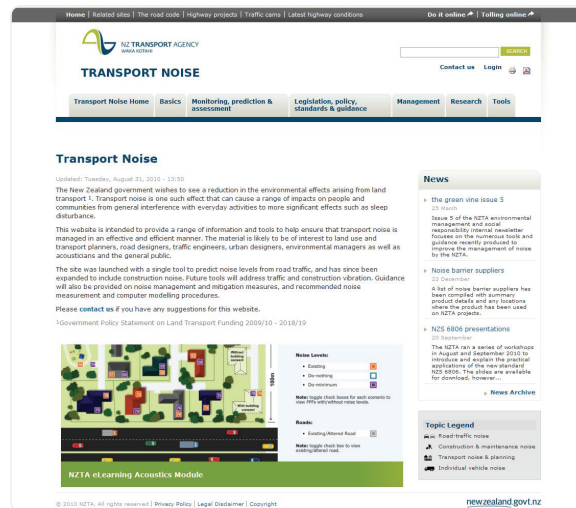
8 NZTA (2009) *Minimum standard Z/20 – Project Feasibility Reports*. www.nzta.govt.nz

9 NZTA (2009) *Minimum standard Z/21 – Large and Complex Projects I&R to D&PD Phase Handover Checklist*. www.nzta.govt.nz

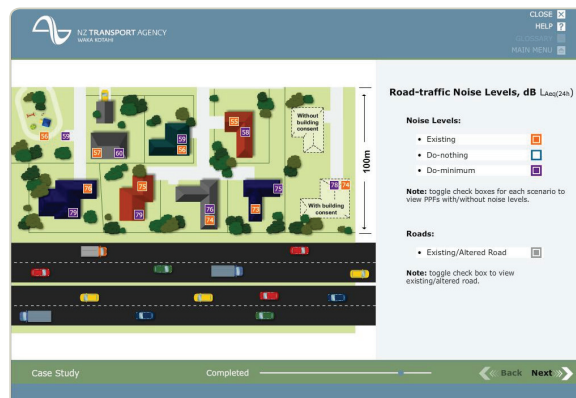
10 NZTA (2010) *Standard Professional Services Guideline PSG/13 – Social and Environmental Management*. www.nzta.govt.nz

11 NZTA (2004) *Risk management process manual*. www.nzta.govt.nz

12 NZTA (1999) 'Appendix 6: Guidelines for the management of road traffic noise – state highway improvements' in *Planning policy manual*. www.nzta.govt.nz



NZTA Transport Noise website



NZTA eLearning NZS 6806 case study

Assessment method

Background

Road-traffic noise from state highways has previously been assessed using the Transit guidelines (appendix 6 in the NZTA's *Planning policy manual*). One of the weaknesses of the Transit guidelines is that they often led to noise mitigation solutions to achieve perfect compliance with the specified noise limits, resulting in poorly integrated designs and at the expense of value-for-money. In some instances this has resulted in poor visual and urban design outcomes, and construction of substantial barriers for the sake of 1 dB attenuation, which is an insignificant benefit.

The NZTA's Value Assurance Committee¹³ has provisionally adopted NZS 6806 for all new and altered state highway projects (except where existing designation conditions require compliance with another standard). NZS 6806 is to be used in place of the Transit guidelines. This decision is subject to review following further verification that value-for-money solutions do result from NZS 6806 when tested against an extended range of projects.

¹³ Value Assurance Committee minutes, 28 January 2010.

The assessment method in NZS 6806 requires consideration of a number of noise mitigation options depending on the scale of a project. **For a transitional period of two years until May 2012, the NZTA requires that assessments using NZS 6806 include consideration of a noise mitigation option complying with the Transit guidelines.**

Criteria

Unlike the Transit guidelines, NZS 6806 does not set rigid noise limits. It gives categories (A, B and C) of noise criteria, and requires that the best practicable option (BPO) be identified to mitigate road-traffic noise. This process promotes integrated design encompassing a wide range of factors as well as noise levels. The upper category (C) provides a backstop against adverse health effects such as sleep disturbance, by requiring the insulation of houses if the external noise would not be sufficiently reduced using the BPO.

TABLE 1 NZS 6806 criteria

Category	Criterion	Altered roads	New road	New road > 75,000 AADT (ie in Auckland)
A	Primary	64 dB $L_{Aeq(24h)}$	57 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$
B	Secondary	67 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$	67 dB $L_{Aeq(24h)}$
C	Internal	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$

Noise mitigation options are to be assessed and, if practicable, the category A criterion should be achieved. If this is not practicable, then mitigation should be assessed against category B. However, if it is still not practicable to comply with categories A or B then mitigation should be implemented to ensure the internal criterion in category C is achieved.

Mitigation costs

Mitigation options determined using NZS 6806 will typically comprise low-noise road surfaces and noise barriers. If these are not sufficient, then building-modification such as mechanical ventilation may be required so windows can remain closed. Use of the new criteria in NZS 6806 to date (September 2011) has shown:

- noise mitigation costs for new roads in urban areas are generally less than the noise mitigation costs that would arise if the Transit guidelines were applied
- depending on the BPO, noise mitigation costs for major alterations to existing roads (altered roads) in urban areas may be more than the noise mitigation costs that would arise if the Transit guidelines were applied.

Terminology

NZS 6806 introduces several new terms. A summary of key terms is provided here, but many have complex definitions and reference to NZS 6806 is essential.

Altered road

An existing road that is subject to a change in the horizontal or vertical alignment that without specific noise mitigation would cause an increase in road-traffic noise above thresholds defined in NZS 6806.

NZS 6806 applies to new and altered roads. It does not apply to existing roads that are not being 'altered'. An online screening tool to help determine whether or not NZS 6806 applies to a particular project is provided on the Transport Noise website (www.acoustics.nzta.govt.nz). Maintenance works such as resurfacing are not classified as an altered road project.

Building-modification mitigation

Measures to reduce the effects of internal traffic noise levels in buildings include:

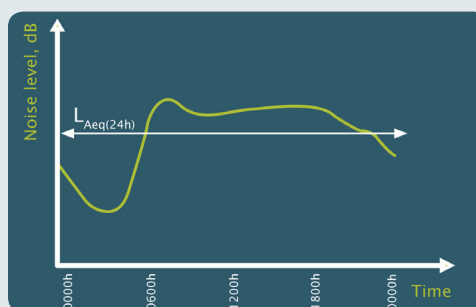
- acoustic insulation
- voice amplification systems
- building relocation.

Cluster

Any teaching or medical facility; or a minimum of three protected premises and facilities (PPFs) that are on the same side of the road being assessed, and are not more than 100m from another PPF in that group.

Decibels (dB $L_{Aeq(24h)}$)

Road-traffic noise levels under NZS 6806 are measured in decibels (dB) as the A-frequency-weighted, time-average level over 24 hours ($L_{Aeq(24h)}$). This is the same unit as the old Transit guidelines.



Design year

10 to 20 years after the opening of a new or altered road.

Do-nothing

The scenario of no change to the existing road, but with traffic growth that would have occurred at the design year.

Do-minimum

The scenario at the design year of a new or altered road having been constructed, but with no specific noise mitigation measures implemented.

Free-field

The assessment position for road-traffic noise has changed. Under the Transit guidelines, road-traffic noise is assessed outside at 1m in front of a building, including noise reflected from the building itself (a facade level). Under NZS 6806 road-traffic noise is now assessed at the position of the building facade excluding noise reflected from the building, as if it wasn't there (a free-field level). A free-field level (NZS 6806) is approximately 2.5 dB less than a facade level (Transit guidelines). To provide consistency within future assessments, the noise limits from the Transit guidelines will be reduced by 2.5 dB so that they can then be applied directly to free-field levels under NZS 6806.

Protected premises and facilities (PPFs)

Spaces in buildings used for:

- residential activities
- marae
- overnight medical care
- teaching (and sleeping) in educational facilities
- playgrounds that are part of educational facilities that are within 20m of buildings used for teaching purposes.

PPFs are the locations where road-traffic noise is assessed and for which noise mitigation measures may be required. NZS 6806 does not apply to PPFs in urban areas that are located more than 100m from the edge of the closest traffic lane for the new or altered road, or PPFs in rural areas located more than 200m from the edge of the closest traffic lane.

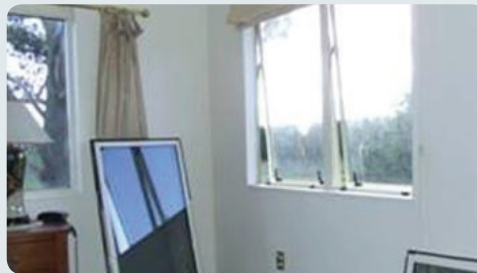
Structural mitigation

Measures to reduce noise such as:

- low-noise road surface materials
- noise barriers (including walls, fences and bunds).

Urban/rural

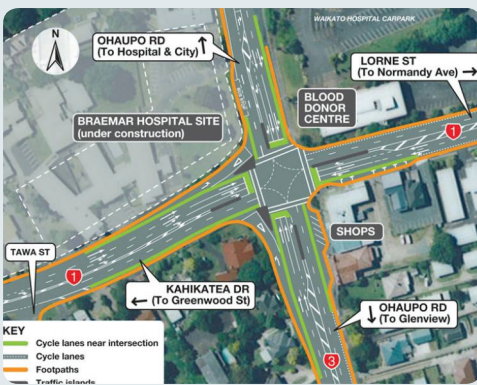
An urban environment is a main urban area, a satellite urban community or an independent urban community (Statistics New Zealand). Any area that is not urban is classified as a rural environment for the purposes of NZS 6806. Details of these areas are available from Statistics New Zealand (www.stats.govt.nz) and the NZTA's Spatial Viewer (<https://spatialviewer.nzta.govt.nz/>).



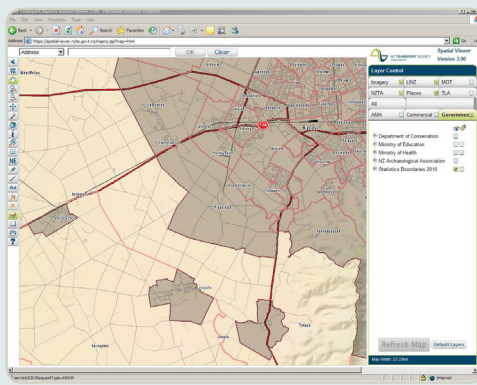
Building-modification mitigation



Structural mitigation



Altered road



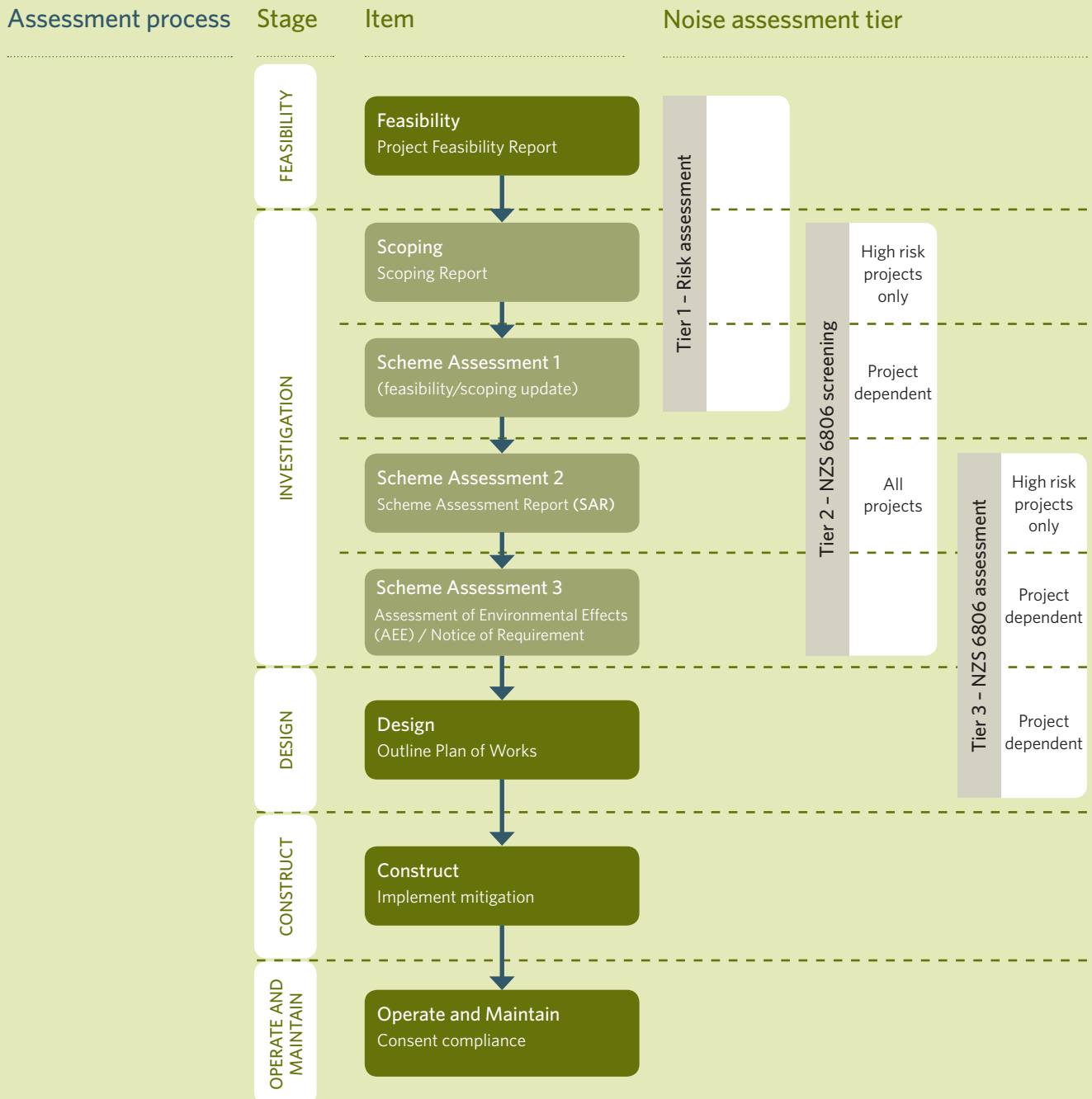
NZTA Spatial Viewer showing urban and rural areas

NZTA processes

The full assessment process detailed in NZS 6806 requires significantly more effort than previous assessments using the Transit guidelines. However, for many routine NZTA projects, noise mitigation is not warranted and neither is a full assessment using NZS 6806. To determine where NZS 6806 requires mitigation, the NZTA has adopted a three-tiered approach to noise assessment, as shown in figure 2. For many projects the Tier 1 and 2 assessments can be quickly and simply conducted by NZTA project staff without the need for acoustics specialists. Tier 3 assessments are not required on all projects, but do require the use of acoustics specialists.

The left-hand side of figure 2 shows NZTA state highway project stages. The appropriate tier of noise assessment varies for each stage, depending on the risk associated with the project. Generally, for larger higher-risk projects, the more detailed Tier 2 and 3 assessments will be required in earlier stages. The 'noise risk' associated with the project is determined from the Tier 1 assessment. The Tier 1 and 2 noise assessments are conducted separately for each project option. The Tier 3 noise assessment is only conducted for the preferred option determined in the Scheme Assessment.

FIGURE 2



Projects do not always exactly follow the progression of stages shown in figure 2. For example, a project might progress straight from Feasibility to Scheme Assessment with no Scoping stage, or there might be a period of several years between Scoping and Scheme Assessment. In these cases, all relevant tiers of the noise assessment should be completed or reviewed when commencing the next project stage. For the purposes of noise assessment the Scheme Assessment has been split into three stages, although the division is not a formal part of NZTA processes.

Tier 1 – Noise risk assessment

A Tier 1 assessment indicates the ‘noise risk’ associated with a project option. The assessment is a simple process that can be completed in a matter of minutes by a non-specialist. It is based solely on the volume of traffic at the opening year and the number of protected premises and facilities (PPFs) within 200m of the proposed alignment. An estimate of these parameters will usually be sufficient to determine the appropriate category in table 2.

The Tier 1 assessment forms part of the Social and Environmental Screen (SES) required by minimum standard Z/19. The results of the assessment for each project option are to be reported on separate copies of form PSF/13¹⁴, together with the assessments of other potential social and environmental effects required by Z/19. As the project progresses through Feasibility, Scoping and the beginning of Scheme Assessment, the assessment for each current option should be reviewed and updated as necessary. No reporting other than PSF/13 is required for Tier 1 assessments.

Beside each flowchart on the following pages is a list of the tools available to NZTA staff and consultants. Many of these tools are on the Transport Noise website (www.acoustics.nzta.govt.nz). Within the website, results from tools can be saved in a central location for each project. Instructions for doing this are provided on the website.

¹⁴ NZTA (2010) *Social and Environmental Management Form, PSF/13*. www.nzta.govt.nz

FIGURE 3 Tier 1

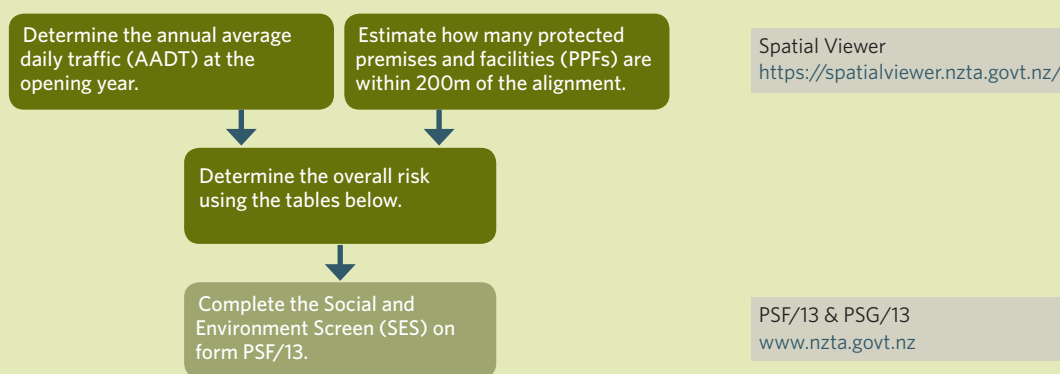


TABLE 2 Risk rating

Individual rating	Annual average daily traffic (AADT)	Protected premises and facilities (PPFs)
Not applicable (NA)	<2000 vehicles per day (vpd)	0 PPFs
Low risk (L)	2000–10,000vpd	< 50 PPFs
Medium risk (M)	10,000–50,000vpd	50–200 PPFs
High risk (H)	>50,000vpd	> 200 PPFs

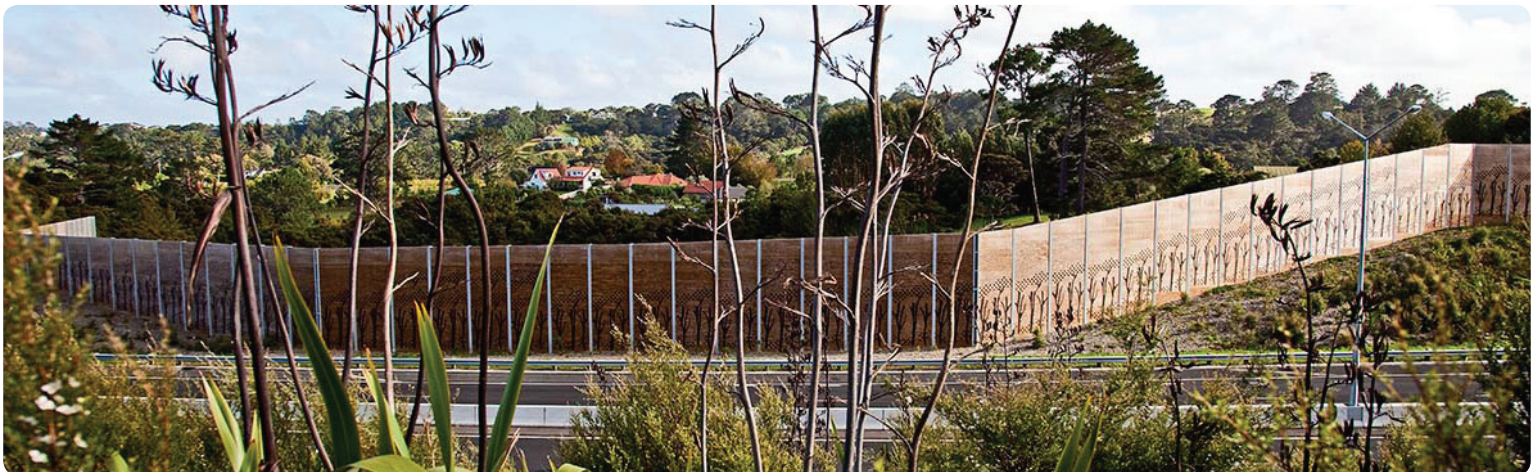
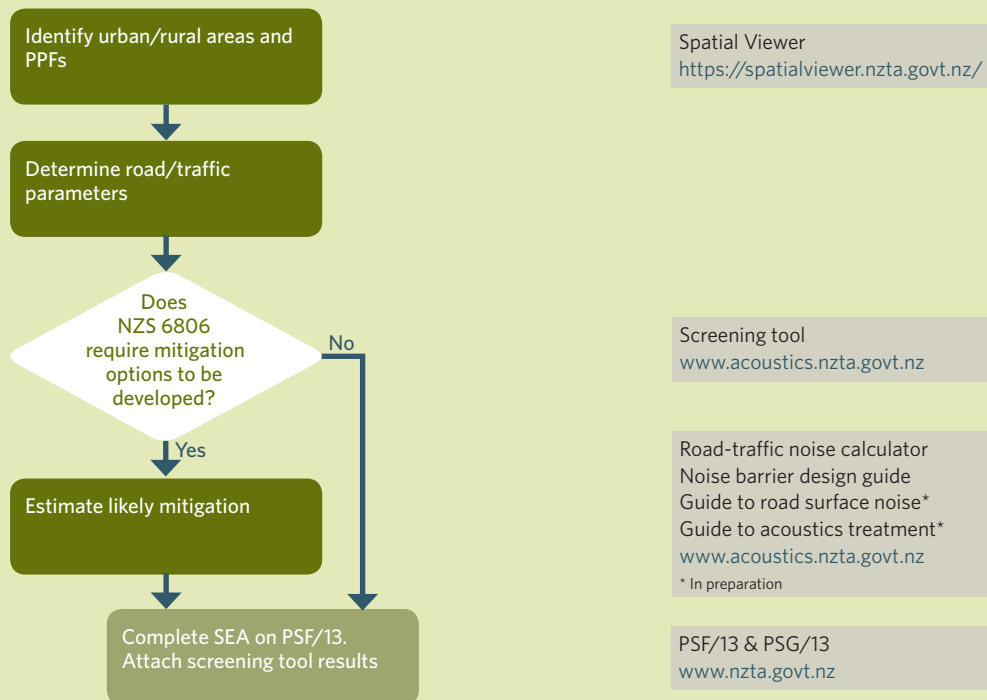
Overall rating	Individual ratings (AADT/PPFs)
Not applicable (NA)	Either NA
Low risk (L)	Both L
Medium risk (M)	One M and one L or M
High risk (H)	One H and one L, M or H

Tier 2 - NZS 6806 screening assessment

NZS 6806 only requires mitigation to be considered in clearly defined circumstances. The purpose of the Tier 2 assessment is to screen out those project options where mitigation is definitely not required. The Tier 2 assessment for each project option should take no more than 5 to 10 minutes to complete by a non-specialist using the screening tool on the Transport Noise website. The assessment is made on the basis of estimated details of the project (AADT, surface, gradient) and the relationship to the nearest PPF.

The Tier 2 noise assessment forms part of the Social and Environmental Assessment (SEA) required by minimum standard Z/19. For each project option, the one-page results sheet from the NZS 6806 screening tool should be appended to form PSF/13. The form and screening assessment should be reviewed and updated as necessary as the project progresses. For Scoping Reports and Scheme Assessment Reports the Tier 2 noise assessment should comprise just PSF/13 and the appended results sheets. For a project where no mitigation is required then for statutory approvals a Road-traffic Noise Assessment Report should be prepared based on the screening report template provided on the Transport Noise website.

FIGURE 4 Tier 2



Tier 3 - NZS 6806 assessment

A Tier 3 assessment determines the BPO for noise mitigation. This requires an acoustics specialist.

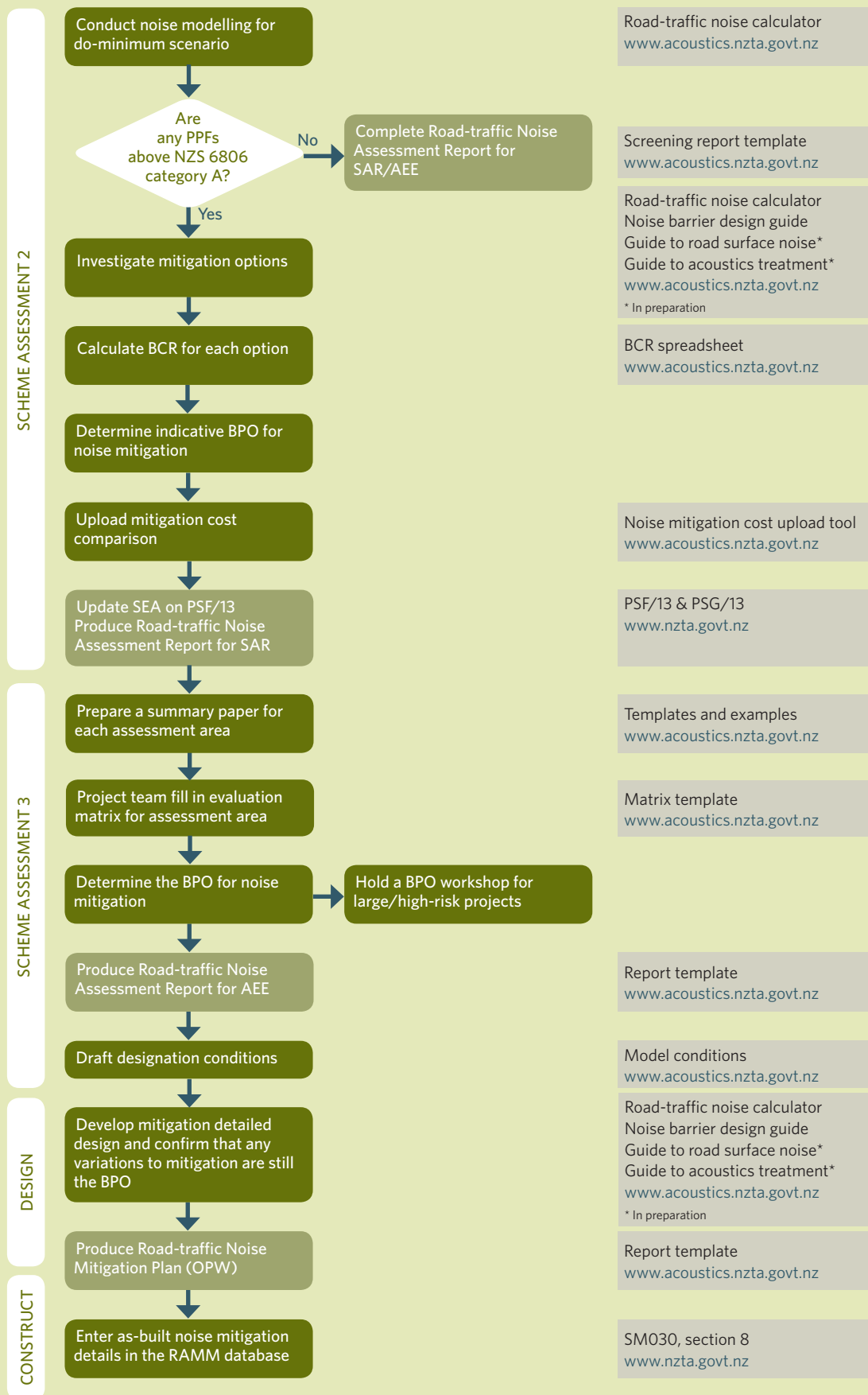


FIGURE 5
Tier 3

Reporting

Minimum standard Z/19 Social and Environmental Management (within SM030) will be updated to provide outline details of the requirements for Tier 1 and 2 noise assessments for NZTA projects. This includes the use of form PSF/13 to document the Tier 1 assessment as part of the Social Environmental Screen, and the Tier 2 assessment as part of the Social Environmental Assessment. The flowcharts on the previous pages indicate when results from the noise assessment should be recorded on PSF/13. The following provides guidance and examples of how to use that information to complete PSF/13. More detailed guidance can be found in PSG/13.

Social and Environmental Screen (SES)

The Tier 1 noise assessment is part of the SES for each option. The assessment is limited to the identification of PPFs and consideration of the opening year traffic. At this stage, the first three columns of PSF/13 should be completed separately **for each alignment option**.

Issue

The default text in column A for the row 'noise' should remain unchanged. The following guidance for the remaining columns only relates to road-traffic noise, but additional information may also be required for construction noise.

Effects

The opening year AADT and approximate number of PPFs should be recorded. A brief summary should be given of the PPFs (urban/rural area), the existing noise environment and a qualitative description of the predicted new road-traffic noise.

Degree of effect

The degree of effect should be reported as the overall risk obtained from table 2.

TABLE 3 Social and Environmental Screen – example 'Project X'

Option description		
Social and Environmental Screen		
Issue	Effects	Degree of effect
<i>Social and environmental issues</i>	<i>Describe the potential social and environmental effects of the option, including where the option may improve social and environmental outcomes</i>	<i>H / M / L / NA</i>
Noise <i>eg construction noise, traffic noise, maintenance noise, presence of sensitive receivers (homes, schools, hospitals).</i>	Opening year AADT – 18,000vpd PPFs within 200m – 40 houses The project is a new road in an urban residential area. There are no significant existing noise sources in close proximity to the PPFs and the new road would introduce a clearly noticeable new noise source.	M

¹⁵ NZTA (in preparation) *State highway construction noise guide*.
www.acoustics.nzta.govt.nz

This example only shows road-traffic or 'operational' noise effects. The NZTA guide to state highway construction noise¹⁵ provides similar examples for construction noise effects.

Social and Environmental Assessment (SEA)

The Tier 2 noise assessment is part of the SEA. At this stage the second three columns of PSF/13 should be completed for each option, building on or updating the SES completed previously. The SEA should occur before detailed acoustics computer modelling and determination of the BPO for noise mitigation are undertaken. The SEA should be updated once the noise mitigation has been determined.

Requirements

If a designation exists and has noise conditions, the CSVue¹⁵ reference should be given with a brief summary of the conditions. Objective N2 in the NZTA's *Environmental plan* should always be listed, as shown in the example below.

Addressing effects and meeting requirements

The specific action, if mitigation is required, will usually be to undertake a Tier 3 assessment to determine the BPO in accordance with NZS 6806. However, if the analysis is advanced at the time the SEA is completed then more specific details for mitigation should be provided. The estimated cost for mitigation cannot be given prior to analysis of options. If from experience it is considered likely that mitigation will be required then the estimated cost should be marked 'TBC' (to be confirmed). Once the BPO has been identified then the approximate cost for noise mitigation can be determined using the BCR spreadsheet on the Transport Noise website.

In the example below, noise barriers and low-noise road surfaces have been identified as being the likely noise mitigation options. Detailed analysis to identify the BPO for noise mitigation is not expected at this stage. Indicative calculations or professional judgement based on knowledge of similar projects are acceptable to determine likely noise mitigation when the SEA is first completed.

¹⁵ CSVue (www.csvue.com) is the online database used by the NZTA for consent management. Contact the Environment and Urban Design Team (environment@nzta.govt.nz).

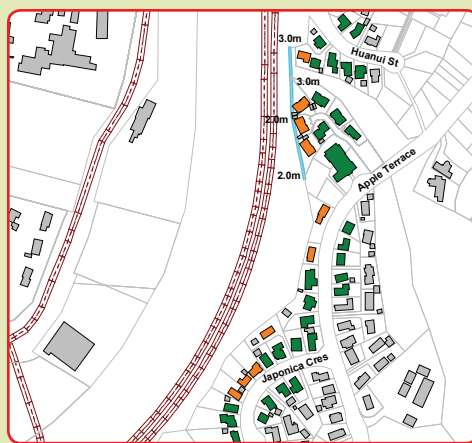
TABLE 4 Social and Environmental Assessment – example 'Project X'

Option description		
Social and Environmental Assessment		
Requirements	Addressing effects and meeting requirements	
<i>List all legal requirements and relevant NZTA social and environmental objectives</i>	<i>List actions to be taken to meet specific social and environmental requirements and objectives and address all effects identified. Include an estimated cost.</i>	
	Specific actions	Estimated cost (\$)
<p>Designation conditions: (CSVue 12345, condition 5) Assessment in accordance with NZS 6806.</p> <p>Specific NZTA objectives: (<i>Environmental plan N2</i>) Determine reasonable noise requirements when seeking new or altering existing designations, including when designating existing local roads by using RMA procedures.</p>	<p>Conduct noise monitoring of the existing environment.</p> <p>Construct an acoustics computer model and calculate noise levels for: existing, do-nothing, do-minimum and mitigation options (including an option to comply with the Transit guidelines).</p> <p>Determine the BPO in accordance with NZS 6806.</p> <p>The BPO is likely to include noise barriers and low-noise road surfaces, but the cost of these cannot be reliably estimated at this stage.</p>	TBC

Best practicable option

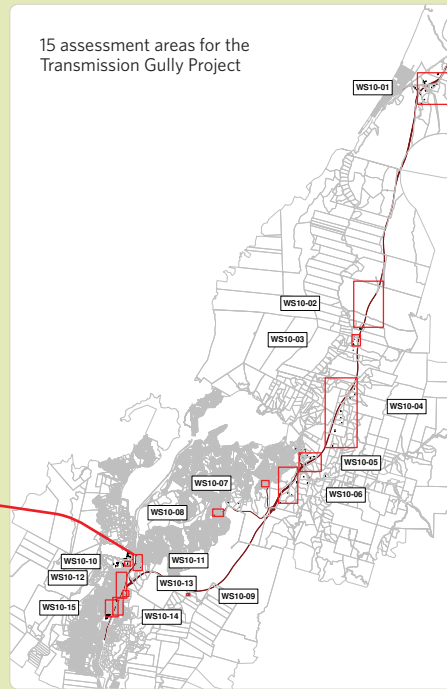
Key to the NZS 6806 process is the determination of the BPO for noise mitigation. The following provides more detailed guidance on the actions required for NZTA projects during the determination of the BPO. This process should ensure the BPO is determined in a robust and consistent manner.

1. The project should be split into discrete assessment areas. In urban environments separate assessment areas should be used for each side of the state highway.

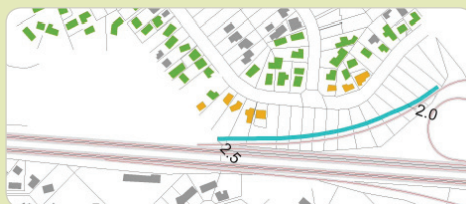


Close-up of one assessment area

15 assessment areas for the Transmission Gully Project



2. The project acoustics specialist should develop a number of noise mitigation options for each assessment area. These should be documented in a summary paper for each assessment area using the formats provided on the Transport Noise website (actual project examples are also provided on the website). One of the mitigation options must be designed to comply with the Transit guidelines.



Waterview Connection, Sector 1 North, option 1



Waterview Connection, Sector 1 South, option 1



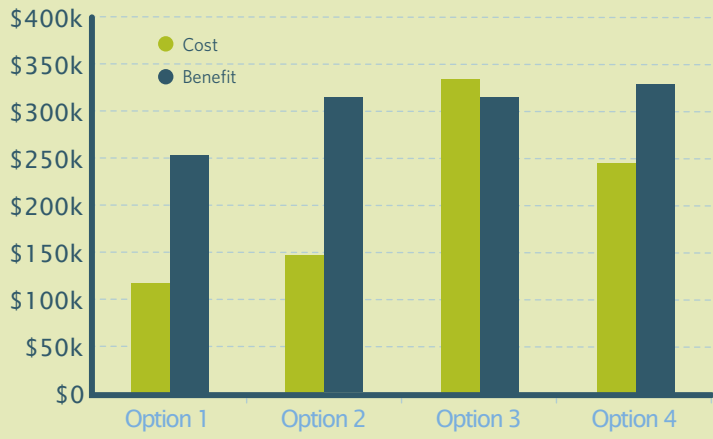
Waterview Connection, Sector 1 North, option 2



Waterview Connection, Sector 1 South, option 2

KEY
■ Category A PPF
■ Category B PPF
■ Category C PPF
■ Barrier (with height in m)

- The project acoustics specialist should calculate the BCR for each mitigation option using the spreadsheet template available on the Transport Noise website. The relative merits should be added to the assessment area summary paper.



- The project acoustics specialist should prepare an assessment matrix for each assessment area using the template on the Transport Noise website. The acoustics specialist should fill in the assessment for the acoustics criteria and then circulate the matrices with the options summary papers to the project team. For each assessment criteria the matrices include a seven-point qualitative rating from triple-plus to triple-minus. Early trials proved that a quantitative scoring system could not correctly balance the different criteria in the matrix, as the appropriate weightings change in each assessment area. The template allows the assessment criteria to be customised so that they are relevant to the specific project and location. As a minimum the criteria should cover the factors listed in section 6.3 of NZS 6806.

NZS 6806 – Assessment matrix

Impact key	Potential effects of noise mitigation option
+++	significant positive effects
++	moderate positive effects
+	minor positive effects
0	insignificant (no effects)
-	minor adverse effects
--	moderate adverse effects
---	significant adverse effects

A brief description of the basis for each rating should be added in the spaces below the ratings.

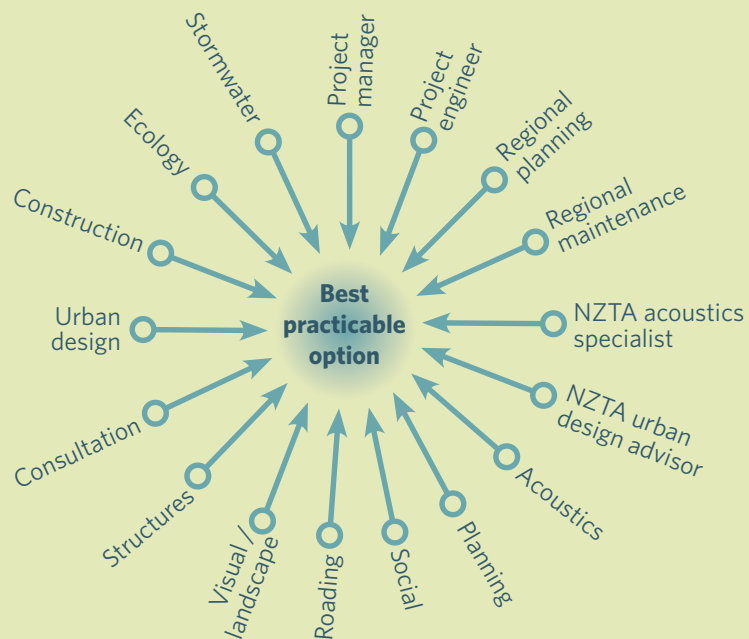
Assessment Criteria	Responsible	Option 1	Option 2	Option 3	Option 4	Issues/Risks
Compliance with NZS 6806 noise criteria, and requirement for building-modification measures	Acoustics	0	0	0	0	
Effect of changes to the existing noise environment	Acoustics	0	0	0	0	
Achievement of the NZS 6806 structural mitigation performance standards	Acoustics	0	0	0	0	
Value for money, including maintenance costs and consideration of benefit cost analysis	Acoustics	0	0	0	0	

- All relevant project team members should complete the matrix. The key responses in addition to acoustics will usually be the landscape/visual and urban design, although all other disciplines are important in determining the BPO. The NZTA Asset Manager should contribute to the matrix to ensure operation and maintenance issues are adequately considered.

6. The responses to the matrices should be collated and reviewed by the project manager, planner and acoustics specialist. If the choice of noise mitigation options is clear-cut on the basis of the assessment matrices then these may be selected as the BPO. For simple projects it is envisaged that this will often be the case. For large, complex and high-risk projects it will usually be necessary to hold one or more noise mitigation workshops to review the matrices before determining the BPO.

7. If necessary, hold a noise mitigation workshop. Precirculate the completed assessment matrices to all attendees. Attendees may include:

- facilitator
- NZTA project staff
- consultant team: acoustics, planning, social, consultation, roading, structures, visual/landscape, urban design, construction, ecology, stormwater
- NZTA national office: acoustics, urban design
- NZTA regional office: planning, maintenance (regional maintenance staff are critical contributors as the long-term performance of the mitigation depends on practicable maintenance)
- acoustics advisors from the council or the Environmental Protection Authority (EPA) (observer only – as NZS 6806 is a process rather than performance based standard, it is beneficial for the regulatory authority’s acoustics advisor to be able to witness the process so that they can verify it was correctly implemented).



Not all of these people will be needed for every noise mitigation workshop, and the appropriate attendees should be determined by the NZTA project manager.

8. Ideally the BPO will be determined by consensus at the noise mitigation workshop. In many cases, minor variants to mitigation options will need to be remodelled following the workshop and reviewed by specific workshop participants. If consensus cannot be achieved then a suitably qualified expert with a holistic view is responsible for balancing the different considerations and judging which option constitutes the BPO.

Stakeholder engagement

Stakeholder input is required in this process, including from those people living adjacent to proposed barriers. Ideally, community opinions will be known when completing assessment matrices and prior to any noise mitigation workshop. Otherwise, the selected options should remain subject to confirmation following community consultation after the workshop.

Noise mitigation workshops

To give effect to the process detailed on the previous pages, a noise mitigation workshop needs to be well planned and organised. This should include the following:

- The acoustics specialist should complete the noise modelling and prepare a summary paper and draft assessment matrix for each area at least one month before the workshop.
- All team members should complete their parts of the assessment matrices at least two weeks before the workshop.
- Complete assessment matrices with collated responses should be circulated at least one week before the workshop.
- The room used for the workshop should be configured for a round-table discussion, with a projection screen to display the options being discussed.
- The workshop should be led by a facilitator/integrator with a holistic view.
- The BPO and reasons for it agreed at the workshop should be documented and circulated.
- Any subsequent alterations to the BPO should be reviewed and confirmed by the relevant team members.

Case study – Transmission Gully Project

The Transmission Gully Project is a proposed new 27km expressway providing an inland route between Wellington (Linden) and the Kapiti Coast (MacKays Crossing). An assessment of future road-traffic noise in accordance with NZS 6806 was conducted for the project in 2010. As a large project affecting a significant number of PPFs, a half-day noise mitigation workshop was held to determine the BPO for each of the assessment areas. In accordance with the procedures detailed in this guide, mitigation options were circulated and assessment matrices completed by the project team prior to the workshop. Participants at the workshop included all those shown in the diagram opposite, and the EPA acoustics advisor was present to witness the process. In several cases the BPO was identified as being a modification to one of the options that had been prepared. The proposed modifications were tested in the noise model after the workshop and reviewed/confirmed by the affected team members at a follow-up meeting the next day.

Following the workshop the project acoustics specialist and a member of the planning team visited all building owners adjacent to proposed noise barriers. This included around 30 households, a primary school, a preschool, a teen-parent unit and a marae. Wherever practicable, wishes of neighbours were considered. Individual site inspections also allowed building heights to be refined in the noise model. Any alterations that materially affected the BPO identified at the noise mitigation workshop were then reviewed with the relevant team members.

As well as balancing noise and visual considerations, other positive urban design outcomes from this process included the maintenance of a community walkway. Initially the noise barriers were proposed on property boundaries. However, an area was identified where this would sever an informal, but heavily used community walkway on crown land. It was determined at the workshop that the barrier could be positioned closer to the road to maintain the walkway behind, but that the walkway would need to be formally established due to the steep slope in the remaining space available. The team liaised with the council, which agreed to accept the land and establish the walkway. The adjacent residents also confirmed their support for the walkway.



Waterview Connection

The Waterview Connection in Auckland is the largest roading project in New Zealand in recent times. It includes 4.5km of new state highway connecting SH20 with SH16, of which 2.5km will be in tunnels, as well as alterations to 7km of the existing SH16. The section between SH20 and SH16 is unique in that the new surface road is expected to carry more than 80,000 vehicles per day and passes through established residential urban areas with relatively low existing noise levels. In contrast, the works to SH16 are on a road carrying around 130,000 vehicles per day through an urban area already subject to high road-traffic noise levels.



In 2010, the Waterview Connection was one of the first projects where NZS 6806 was used for road-traffic noise assessment. It was also the first roading project where the notices of requirement for designations and applications for resource consents were submitted to the Environmental Protection Authority under the RMA national consenting process. This process has a time limit of nine months, which restricted the time available for the Board of Inquiry to consider and analyse the development and implementation of NZS 6806.

In its final report, the Waterview Board of Inquiry stated the following concerns:

- under NZS 6806, PPFs in Categories A and B might experience higher internal noise levels than those in Category C
- a perception that NZS 6806 requires a rigid development of the BPO
- concern regarding the balance struck in NZS 6806 between enabling the community's economic and possibly social wellbeing relative to the social wellbeing and health of directly affected people
- a perception that NZS 6806 does not provide a set test or methodology but offers guidance and recommendations.

It is noted that many Category A and B PPFs in the vicinity of that part of the existing SH16 being altered as part of the project already receive high internal (and external) noise levels as part of the current (2011) existing environment.

Despite referring to the concerns noted above in its final report, in its final decision on the Waterview designation conditions the Board of Inquiry imposed the amended designation conditions proposed by the NZTA (in its comments on the Board's draft decision).

For the majority of the Waterview Connection the operational noise conditions imposed by the Board are completely consistent with NZS 6806. The only significant variation from NZS 6806 is in relation to a specific area (Sector 9) where a section of new surface road expected to carry over 80,000 vehicles per day would be constructed through an established quiet residential neighbourhood. In its comments on the Board's draft report the NZTA accepted that, due to the levels of traffic involved, the situation in relation to Sector 9 is unique in the New Zealand context and, accordingly, the NZTA accepted the imposition of noise conditions that would require more noise mitigation than would be required under NZS 6806.

Under the noise conditions applying to Sector 9 only, regardless of what NZS 6806 category a PPF falls into, road-traffic noise levels inside the PPFs are not to exceed $40 \text{ dB } L_{\text{Aeq}(24\text{h})}$ with building-modification mitigation required if structural mitigation is not sufficient. The NZTA accepts this condition is appropriate to manage adverse road-traffic noise effects in the unique situation affecting Sector 9.

The NZTA considers NZS 6806 is a robust tool to help assess what are reasonable levels of road traffic noise, and to help determine appropriate mitigation of the noise effects of new and altered roads. NZS 6806 was subject to the usual committee process for approval of New Zealand standards and involved a wide range of stakeholders, many with the public's interest as their responsibility, together with science experts, who considered and weighed the available evidence and sought wider input through public submissions.

For future projects, the model conditions on pages 19–21 should be promoted by the NZTA.

Scope of works

For a Tier 3 assessment (refer to figure 5) the following items of work should be performed by an acoustics specialist. The templates and spreadsheet referred to are on the Transport Noise website.

Scheme Assessment 2

- Identify all PPFs, urban/rural areas and applicable criteria from NZS 6806.
- Conduct a site visit and noise survey in accordance with NZS 6806 section 5.2, for the purpose of verifying the noise model for the existing scenario and quantifying the existing environment.
- Submit all survey results to the NZTA's Environment and Urban Design Team (EUDT) using the template.
- Construct a noise model in accordance with NZS 6806 section 5.3 for the existing, do-nothing and do-minimum scenarios, and determine noise levels at each PPF.
- Determine the Transit guidelines design criteria.

If all PPFs are category A for do-minimum, or all levels are within NZS 6806 section 1.5.2 thresholds, use the screening report template to prepare a Road-traffic Noise Assessment Report which will be suitable for both the SAR and AEE. No further work is required.

If any PPFs are in NZS 6806 categories B or C:

- Group PPFs into assessment areas and investigate mitigation options in the do-minimum noise model, in accordance with NZS 6806 section 7. One option must meet the Transit guidelines.
- Using the BCR spreadsheet, calculate the benefit, cost, number of PPFs in each category, and average noise reduction for each mitigation option relative to the do-minimum scenario.
- Determine an indicative BPO for noise mitigation.
- Upload costs of mitigation for NZS 6806 and Transit guidelines onto the website.
- Update form PSF/13 with the indicative mitigation and costs.
- Use the SAR report template to produce a Road-traffic Noise Assessment Report.

Scheme Assessment 3

- Prepare a noise mitigation options summary paper for each assessment area.
- Collate project team responses to complete the evaluation matrix for each assessment area.
- Obtain input from stakeholders directly affected by mitigation options.
- Determine the BPO for noise mitigation in accordance with NZS 6806 section 6.3, using a workshop for large/high risk projects (workshop attendees to include the EUDT).
- Use the AEE report template to produce an updated Road-traffic Noise Assessment Report.
- Prepare/present evidence and conference with other experts as required for the RMA processes.

Design

- Design barriers and confirm low-noise surfaces. Coordinate urban design and other requirements.
- For all PPFs in category C determine appropriate acoustics treatment.
- Confirm variations to mitigation are still the BPO, obtaining approvals as required by the conditions.
- Use the OPW report template to produce a Road-traffic Noise Mitigation Plan.

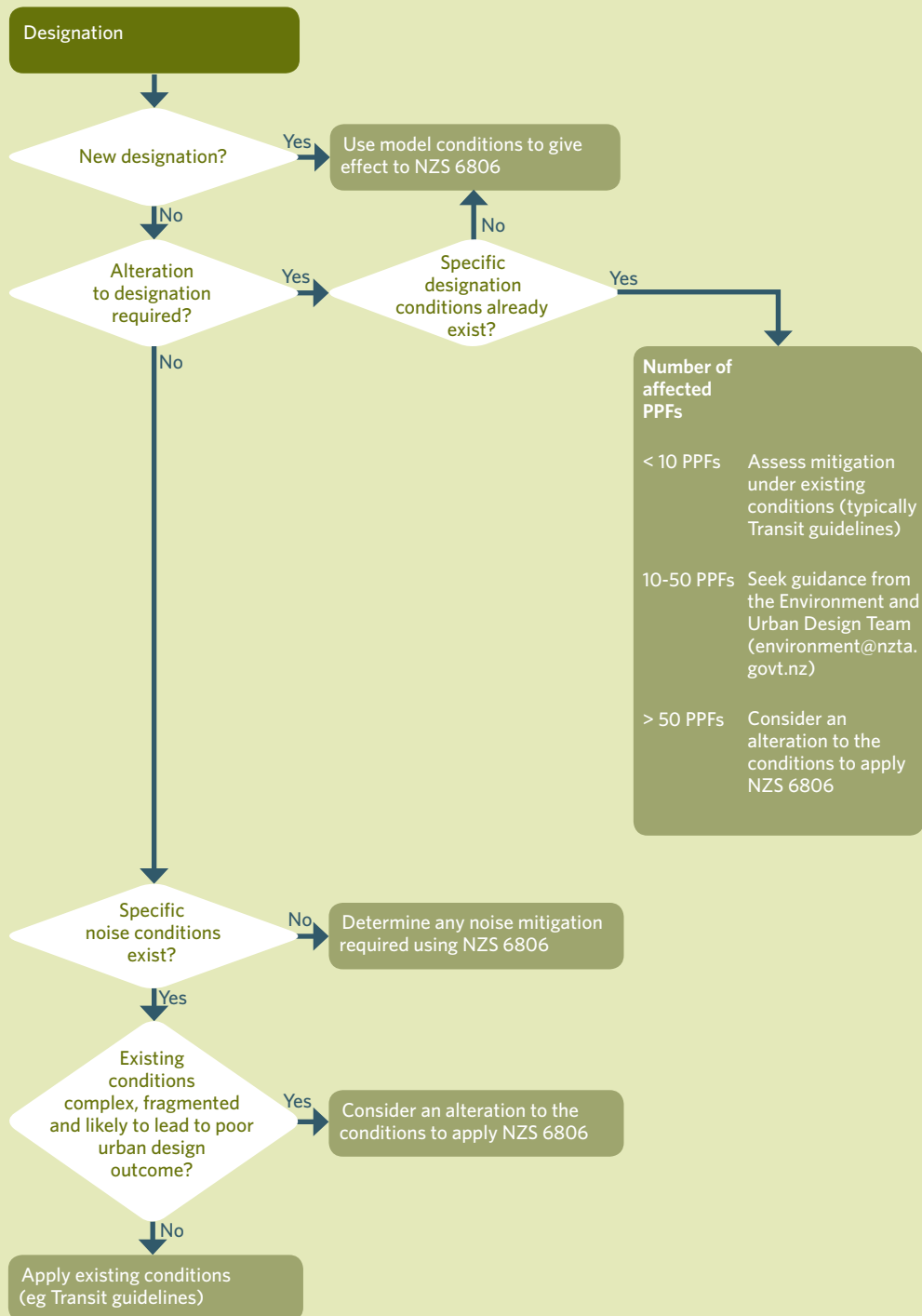
Construct

- Conduct site inspections to verify installation of low-noise road surfaces and noise barriers.
- For all PPFs in category C verify acoustics treatment has been installed as detailed in the Road-traffic Noise Mitigation Plan and individual mitigation agreements.
- Ensure details of all noise barriers and low-noise road surfaces are entered into RAMM.
- Submit details of acoustics treatment of PPFs to the EUDT using the template.

Designation conditions

Figure 6 shows which noise standard should be applied to a particular designation.

FIGURE 6 Designation conditions



Model conditions

It is not possible to prescribe a simplistic performance standard, such as a noise limit, to the NZS 6806 process or the results of the process. The BPO is determined by following the correct process and not by achieving an absolute limit. Recommended designation conditions that encapsulate the NZS 6806 process are shown below. The conditions provide certainty in the noise mitigation outcome to be provided, while allowing for development during normal detailed design processes.

Condition N1

For the purposes of Conditions [N2-N12] the following terms will have the following meanings:

- a) BPO - means the Best Practicable Option.
- b) Building-Modification Mitigation - has the same meaning as in NZS 6806:2010.
- c) Habitable Space - has the same meaning as in NZS 6806:2010.
- d) Noise Assessment

OPTION 1 - Build now designation

- means the Road-traffic Noise Assessment Report [ref] submitted with the NOR.

OPTION 2 - Route protection designation

- means the Road-traffic Noise Assessment Report in accordance with condition [N2].

- e) Noise Criteria Categories - means the groups of preference for time-averaged sound levels established in accordance with NZS 6806:2010 when determining the BPO mitigation option, ie Category A - primary noise criterion, Category B - secondary noise criterion and Category C - internal noise criterion.
- f) NZS 6806:2010 - means New Zealand Standard NZS 6806:2010 Acoustics - Road-traffic noise - New and altered roads.
- g) PPFs

OPTION 1 - Build now designation

- means only the premises and facilities identified in green, orange or red in the Noise Assessment.

OPTION 2 - Route protection designation

- has the same meaning as in NZS 6806:2010 for the purpose of the preparation of the Noise Assessment. Once a Noise Assessment has been prepared in accordance with Condition [N2], PPFs means only the premises and facilities identified in green, orange or red in the Noise Assessment.

- h) Structural Mitigation - has the same meaning as in NZS 6806:2010.

OPTION 1 - Build now designation

Condition N2

The NZTA shall implement the road-traffic noise mitigation measures identified as the 'Selected Options' in the Noise Assessment as part of the Project, in order to achieve the Noise Criteria Categories indicated in the Noise Assessment ('Identified Categories'), where practicable, subject to Conditions [N3-N11] below.

OPTION 2 - Route protection designation

Condition N2

The NZTA shall appoint a suitably qualified acoustics specialist, a suitably qualified planner approved by the Council, and other designers, to determine the BPO for road-traffic noise mitigation in accordance with NZS 6806:2010. No later than 6 months prior to construction starting, the NZTA shall submit to the Council a Road-traffic Noise Assessment Report ('Noise Assessment') detailing the assessment process, 'Selected Options' for noise mitigation, and the Noise Criteria Categories for all PPFs ('Identified Categories'). The NZTA shall implement the Selected Options for noise mitigation identified in the Noise Assessment as part of the Project, in order to achieve the Identified Categories where practicable, subject to Conditions [N3-N11] below.

Condition N3

The detailed design of the Structural Mitigation measures in the Selected Options (the 'Detailed Mitigation Options') shall be undertaken by a suitably qualified acoustics specialist prior to construction of the Project, and, subject to Condition [N4], shall include, as a minimum, the following:

- a) Noise barriers with the location, length and height in general accordance with the Noise Assessment; and
- b) Low-noise road surfaces in general accordance with the Noise Assessment.

Condition N4

Where the design of the Detailed Mitigation Options identifies that it is not practicable to implement a particular Structural Mitigation measure in the location or of the length or height included in the Selected Options either:

- a) if the design of the Structural Mitigation measure could be changed and would still achieve the same Identified Category or Category B at all relevant PPFs, and a suitably qualified planner approved by the Council certifies to the Council that the changed Structural Mitigation would be consistent with adopting the BPO in accordance with NZS 6806:2010, the Detailed Mitigation Options may include the changed mitigation measure; or
- b) if changed design of the Structural Mitigation measure would change the Noise Criteria Category at any relevant PPF from Category A or B to Category C, but the Council confirms that the changed Structural Mitigation would be consistent with adopting BPO in accordance with NZS 6806:2010, the Detailed Mitigation Options may include the changed mitigation measure.

Condition N5

The Detailed Mitigation Options shall be implemented prior to completion of construction of the Project, with the exception of any low-noise road surfaces, which shall be implemented within 12 months of completion of construction.

Condition N6

Prior to construction of the Project, a suitably qualified acoustics specialist shall identify those PPFs which following implementation of all the Structural Mitigation included in the Detailed Mitigation Options are not in Noise Criteria Categories A or B and where Building-Modification Mitigation may be required to achieve 40 dB $L_{Aeq(24h)}$ inside habitable spaces ('Category C Buildings').

Condition N7

- a) Prior to commencement of construction of the Project in the vicinity of a Category C Building, the NZTA shall write to the owner of each Category C Building seeking access to such building for the purpose of measuring internal noise levels and assessing the existing building envelope in relation to noise reduction performance.
- b) If the owner(s) of the Category C Building approves the NZTA's access to the property within 12 months of the date of the NZTA's letter (sent pursuant to Condition [N7(a)]), then no more than 12 months prior to commencement of construction of the Project, the NZTA shall instruct a suitably qualified acoustics specialist to visit the building to measure internal noise levels and assess the existing building envelope in relation to noise reduction performance.

Condition N8

Where a Category C Building is identified, the NZTA shall be deemed to have complied with Condition [N7] above where:

- a) The NZTA (through its acoustics specialist) has visited the building; or
- b) The owner of the Category C Building approved the NZTA's access, but the NZTA could not gain entry for some reason (such as entry denied by a tenant); or
- c) The owner of the Category C Building did not approve the NZTA's access to the property within the time period set out in Condition [N7(b)] (including where the owner(s) did not respond to the NZTA's letter (sent pursuant to Condition [N7(a)] within that period)); or
- d) The owner of the Category C Building cannot, after reasonable enquiry, be found prior to completion of construction of the Project.

If any of (b) to (d) above apply to a particular Category C Building, the NZTA shall not be required to implement any Building-Modification Mitigation at that Category C Building.

Condition N9

Subject to Condition [N8], within six months of the assessment required under Condition [N7(b)], the NZTA shall give written notice to the owner of each Category C Building:

- a) Advising of the options available for Building-Modification Mitigation to the building; and
- b) Advising that the owner has three months within which to decide whether to accept Building-Modification Mitigation for the building, and if the NZTA has advised the owner that more than one option for Building-Modification Mitigation is available, to advise which of those options the owner prefers.

Condition N10

Once an agreement on Building-Modification Mitigation is reached between the NZTA and the owner of an affected building, the mitigation shall be implemented (including the NZTA obtaining any third party authorisations required to implement the mitigation) in a reasonable and practical timeframe agreed between the NZTA and the owner.

Condition N11

Subject to Condition [N8], where Building-Modification Mitigation is required, the NZTA shall be deemed to have complied with Condition [N10] above where:

- a) The NZTA has completed Building-Modification Mitigation to the Category C Building; or
- b) The owner of the Category C Building did not accept the NZTA's offer to implement Building-Modification Mitigation prior to the expiry of the timeframe stated in Condition [N9(b)] above (including where the owner did not respond to the NZTA within that period); or
- c) The owner of the Category C Building cannot, after reasonable enquiry, be found prior to completion of construction of the Project.

Condition N12

The NZTA shall manage and maintain the Detailed Mitigation Options to ensure that, to the extent practicable, those mitigation works retain their noise reduction performance for at least 10 years after the opening of the Project to the public.

A flowchart illustrating application of conditions N6 to N11 is provided in the NZTA's *State highway guide to acoustics treatment of buildings*.

Further information

NZTA Transport Noise website, www.acoustics.nzta.govt.nz

Standards New Zealand (publishers of NZS 6806), www.standards.co.nz

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