Before a Board of Inquiry
Transmission Gully
Notices of Requirement and Consents

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under: the Resource Management Act 1991

in the matter of: Notices of requirement for designations and resource consent applications by the NZ Transport Agency, Porirua City Council and Transpower New Zealand Limited for the Transmission Gully Proposal

between: **NZ Transport Agency**
Requiring Authority and Applicant

and: **Porirua City Council**
Local Authority and Applicant

and: **Transpower New Zealand Limited**
Applicant

Statement of supplementary evidence of Stephen Gordon Chiles (Acoustics assessment) for the NZ Transport Agency and Porirua City Council

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Dated: 9 February 2012

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CHAPMAN TRIPP

STATEMENT OF SUPPLEMENTARY EVIDENCE OF STEPHEN GORDON CHILES FOR THE NZ TRANSPORT AGENCY AND PORIRUA CITY COUNCIL

INTRODUCTION

1 My full name is Stephen Gordon Chiles.

2 I have the qualifications and experience set out at paragraphs 2 to 5 of my statement of evidence in chief, dated 15 November 2011 (*EIC*).

3 I repeat the confirmation given in my EIC that I have read, and agree to comply with, the Code of Conduct for Expert Witnesses (Consolidated Practice Note 2011).

4 In this statement of supplementary evidence, I provide further information as requested by the Board in the Minute dated 2 February 2012. Specifically, in this evidence I address:

4.1 Interpretation of NZS 6806:2010[1], including the implication of use of an $L_{Aeq(24h)}$ standard,

4.2 Why it is contended that NZS 6806 provides a suitable basis for consideration of operational noise effects,

4.3 Relevant District Plan noise rules, and

4.4 The comments made by the Board of Inquiry into the Waterview Connection regarding NZS 6806:2010.

5 Consistent with my EIC, in this statement of evidence when referring collectively to the NZ Transport Agency (*the NZTA*) Project[2] and the Porirua City Council (*PCC*) Project[3] I will use the term "Transmission Gully Project" (and hereafter, *the TGP* or *the Project*).

SUMMARY

6 I have attached a guidance document to my evidence that provides an introduction to NZS 6806, and in particular it includes a description of the process used to arrive at the Best Practicable Option. NZS 6806 uses the $L_{Aeq(24h)}$ parameter which is a daily average noise level. I consider this to be an appropriate control for a

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1 NZS 6806:2010 Acoustics – Road-traffic noise – new and altered roads.

2 The 'NZTA Project' refers to the construction, operation and maintenance of the Main Alignment and the Kenepuru Link Road by the NZTA.

3 The 'PCC Project' refers to the construction, operation and maintenance of the Porirua Link Roads (being the Whitby Link Road and the Waitangirua Link Road) by PCC.

source with the characteristics of road-traffic noise, although I note that it does not control noise from particularly noisy individual vehicles. In general, individual vehicles can only be controlled through other processes, primarily at a national level.

7 NZS 6806 was developed by an independent technical committee of Standards New Zealand. It overcomes several weaknesses in the 'Transit Guidelines'[4], which had been used previously. In my opinion the robust and considered independent process for producing NZS 6806 has resulted in an assessment method and criteria that will maintain reasonable amenity from road-traffic noise and protect against health effects such as sleep disturbance. In the last two years I have led the use of NZS 6806 on two projects and witnessed it as a peer reviewer on other projects. In all cases I consider that it has resulted in appropriate noise mitigation design. I am not aware of a better alternative method or criteria available for making the assessment for this Project.

8 The proposed designation conditions for road-traffic noise are relatively complex. These conditions require detailed design of the noise mitigation, subject to additional approvals if the mitigation and predicted noise exposure change from that specified in my assessment. Several of the conditions are due to the requirement for treatment of individual houses, and the need to specify the iterative interactions between the NZTA and building owners.

9 The Wellington City, Porirua City and Upper Hutt City District Plans do not include rules for road-traffic noise. For their general noise rules they all specify an assessment method that is not appropriate for road-traffic noise assessment. The Kapiti Coast District Plan includes a specific rule for road-traffic noise as a controlled activity, copied from the Transit Guidelines. My assessment of noise from the Project in the Kapiti Coast District included consideration of these criteria, but I found that they did not accord with the Best Practicable Option. The selected mitigation results in noise levels slightly above the District Plan criteria.

10 The Board of Inquiry for the Waterview Connection Project had concerns about certain aspects of the application of NZS 6806 in that location. I have attached a detailed paper to my evidence discussing those issues. I consider that there was an unusual situation in 'Sector 9' of the Waterview Connection Project in that for a new road with 80,000 vehicles per day NZS 6806 allows more lenient criteria. In my opinion, the tight timeframes and complex issues in the Waterview Connection Project hindered understanding of NZS 6806, which had only just been published.

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[4] NZTA (1999) 'Appendix 6: Guidelines for the management of road traffic noise – state highway improvements' in Planning policy manual. http://www.nzta.govt.nz/resources/planning-policy-manual/docs/planning-policy-manual-noise-guidelines-1999.pdf

NZTA GUIDE

11 I have attached to my evidence as **Annexure A** the NZTA *Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects (the Guide),* as this provides a succinct introduction to NZS 6806. In my capacity as an Independent Professional Advisor to the NZTA, I provided advice on the technical content in the Guide and was responsible for its production. My own professional opinion as to the appropriate interpretation of NZS 6806 is the same as presented in the Guide.

12 Within the Guide relevant sections are the introduction on pages 1 and 2, assessment method on page 3, terminology on pages 4 and 5, and in particular the development of the Best Practicable Option on pages 12 to 15. Pages 6 to 11 describe NZTA processes, which are primarily aimed at screening of minor works. At this stage of the TGP the screening processes are not relevant as a full (Tier 3) assessment under NZS 6806 has been conducted.

DEVELOPMENT OF NZS 6806

13 There is no National Environmental Standard for road-traffic noise and most district plans exclude road-traffic noise from zone noise limits and do not include alternative criteria (I will address the specific district plans for this Project later in my evidence). In the absence of other criteria, virtually all significant state highway projects prior to NZS 6806 were subject to noise assessment under the Transit Guidelines.

14 The Transit Guidelines were an internal document produced by Transit New Zealand (now the NZTA). They were widely accepted and were used for over a decade almost as if they were a National Environmental Standard. However, from projects I have seen and from discussions with other acoustic experts I understand that this extensive use of the Transit Guidelines revealed four key challenges:

14.1 They did not encourage integrated design. For example, the required performance of a noise barrier could take precedence over the adverse visual effects it might create.

14.2 There was no requirement to mitigate unreasonable existing noise levels when altering a state highway. If the levels were already say 80 dB $L_{Aeq(24)}$ prior to a project then they could remain at that level under the Transit Guidelines.

14.3 The criteria for new roads could be prohibitive.

14.4 Mitigation could be required to meet the noise limit even though the reduction achieved by the mitigation was

imperceptible. For example, I have been conducting an independent review of the Victoria Park Tunnel Project in Auckland where an expensive barrier was installed, which in places is designed to provide an insignificant improvement of only 1 dB.

15 Rather than attempt to revise the internal Transit Guidelines to address these issues, I understand that the NZTA opted to participate in an independent process initiated by the Ministry of Transport and run by Standards New Zealand to create a new national standard: NZS 6806. I was not directly involved in the production of NZS 6806 so cannot provide detailed information about its development. However, having recently been on the technical committees revising NZS 6801[5], NZS 6802[6] and NZS 6808[7] I am familiar with the Standards New Zealand process.

16 For each project Standards New Zealand appoints experts to a technical committee from organisations which should include representatives of all stakeholders. In the case of NZS 6806, the organisations were: Department of Building and Housing, INGENIUM, Local Government New Zealand, Ministry of Health, Ministry of Transport, New Zealand Acoustical Society, New Zealand Institute of Environmental Health, New Zealand Transport Agency, Road Controlling Authorities New Zealand, and Roading New Zealand. I know several of the acoustics experts representing these organisations and, in my opinion, within the committee for NZS 6806 there was extensive and comprehensive knowledge of road-traffic noise and its effects on people.

17 During the development of NZS 6806, the NZTA tested the proposed new criteria on a range of different projects. As part of that process I was engaged by the NZTA to test the criteria on the Christchurch Southern Motorway Project. On that project I found that while the assessment methodology was significantly improved, the resulting noise mitigation was similar to that determined using the Transit Guidelines.

18 Draft New Zealand Standards are made available for public comments, and as a member of the public I critically reviewed the draft NZS 6806 and made a detailed submission. Many of my comments were incorporated in the final version of NZS 6806. While I consider that there are still areas where the final version could be refined, in my opinion it provides a robust method for the assessment of road-traffic noise and provides appropriate criteria to maintain reasonable amenity and to protect against health effects such as sleep disturbance.

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[5] NZS 6801:2008, Acoustics – Measurement of environmental sound.

[6] NZS 6802:2008, Acoustics – Environmental noise

[7] NZS 6808:2010, Acoustics – Wind farm noise

ACOUSTICS PARAMETERS

19 Both the Transit Guidelines and NZS 6806 use the $L_{Aeq(24h)}$ parameter. In effect this is a daily average level. Within New Zealand Standards, criteria for other sound sources is either in terms of the $L_{Aeq(15\ min)}$, $L_{A90(10\ min)}$, L_{dn} or L_{AFmax}. There are several other legacy criteria in district plans and existing conditions, but these will gradually be phased out. I will describe the main reasons for each of these criteria, which will provide the background as to why the $L_{Aeq(24h)}$ parameter is appropriate for road-traffic noise:

19.1 The $L_{Aeq(15\ min)}$ is an average level over 15 minutes and is used for all general environmental sound sources. For many activities, assessment over a whole day would not relate to the potential noise effects. For example, a bar operating in the evening, or vehicle movements occurring only on a site at the start and end of the day. Assessment over 15 minutes allows the effects of the activity to be related to the period when it is occurring. This parameter is also used for construction noise although the averaging time can be between 10 minutes and one hour.

19.2 The $L_{A90(10\ min)}$ is the level exceeded for 90% of a 10 minute period. It is used solely for wind farms to measure the continuous/background sound levels representative of wind turbines, at times when the wind is blowing, which distorts the average levels. For all other sources the measurements are taken in relatively calm conditions so the average level is valid.

19.3 The L_{dn} is the day/night average level. It is used for airports, heliports and ports. The L_{dn} is exactly the same as the $L_{Aeq(24h)}$, except that noise levels at night are increased by a 10 dB penalty before they are included in the daily average. The reason for the use of a daily average for ports, airports and heliports is that the sources are variable during the day and between days, and a 15 minute assessment period would give a poor representation of the noise exposure. Also, the L_{dn} is useful as significant published research into human response to these sources has been with respect to that parameter. The night-time penalty is relevant for these sources as it allows operational flexibility while accounting for the increased potential noise effects at night. For example, if for operational reasons an airport wishes to have 1 night-time flight movement then this would be equivalent to 10 daytime movements in terms of the contribution to the L_{dn} 'noise bucket'. This provides an incentive to avoid noise at night unless operationally important.

19.4 The L_{AFmax} is the maximum sound level during a measurement. It is used for noise limits from general sources and port operations at night, and for construction noise. Single loud events can cause sleep disturbance and these noise limits seek to control that effect.

20 Road-traffic noise is the only source for which the $L_{Aeq(24h)}$ parameter is used in New Zealand. However, as noted above, it is the same as the L_{dn} parameter used for other transportation sources but without the night-time penalty. The main reason for this difference is that the diurnal variation of road-traffic for a particular type of road does not change significantly, and compared to say an airport operator, the road controlling authority has no influence on this variation. A road will be subject to increased traffic during daytime peak periods and reduced traffic at night, but that pattern is reasonably consistent. Another factor in the use of the $L_{Aeq(24h)}$ parameter is that the road-traffic noise prediction algorithm currently used in New Zealand does not allow for the application of a night-time penalty as day and night levels are not separately calculated. While an approximation could be made, it would reduce the accuracy of the procedure.

21 Although there is not a night-time penalty for road-traffic noise, this is irrelevant as the criteria are set for human response to the 24 hour average levels, without the night-time penalty. In New Zealand, all experience in the human response of how people react to road-traffic noise during both day and night has been related to the levels quantified in terms of the $L_{Aeq(24h)}$ parameter. For most sources there are a number of different parameters that could potentially be used, but the important factor is that the criteria should based on human response to the parameter chosen, as is the case with NZS 6806.

NZS 6806 CRITERIA

22 As described in the Guide, the $L_{Aeq(24h)}$ criteria in NZS 6806 are used to provide a framework for the determination of the BPO. There is a lower threshold (Category A), below which road-traffic noise is considered reasonable, and if all houses are in this category no mitigation is investigated. While road-traffic noise below this threshold may still control the aural environment, particularly for an altered road, it would be at a level that would allow normal domestic activity and should not result in sleep disturbance. In the case of altered roads this is based on the fact that houses by roads are generally constructed or adapt over time so that sensitive spaces do not have windows essential for ventilation directly facing the road.

23 The criteria are set with respect to human response to road-traffic noise, for which there is generally more tolerance than for many other sources. This is partly as continuous road-traffic noise has a

relatively bland unobtrusive characteristic, but also as our perception is altered by almost universal daily reliance on the road network as a whole, even if not necessarily the immediately adjacent section of state highway to us.

24 For noise levels above the Category A criteria, NZS 6806 requires investigation of mitigation options in Category B, and multidisciplinary assessment as described in the Guide. These mitigation options are aimed at reducing the noise at source to improve both indoor and outdoor amenity at houses. Where such mitigation is not practicable, or does not achieve a sufficient noise reduction, NZS 6806 also has upper criteria (Category C), beyond which acoustics treatment of individual houses should be investigated. Treatment (such as provision of ventilation systems which allow windows to be kept closed) can reduce indoor levels to avoid effects such as sleep disturbance.

INDIVIDUAL VEHICLES

25 Road-traffic noise assessed using a 24 hour average level provides a good representation of the effects of continuous traffic flow on state highways, and correlates with human response. However, the 24 hour average level is not representative of sporadic individual vehicles using noisy engine brakes for example, or clanking from a poorly secured load, or a loud modified exhaust. Such sounds are best represented by the maximum (L_{AFmax}) noise level, but the road controlling authority has limited powers to influence this level. Standard mitigation measures such as low-noise road surfaces and noise barriers either have no effect or limited effect on maximum noise level events, as the sound generally emanates from the vehicle body or exhaust and not at the road surface.

26 There are controls for maximum noise level events in the Land Transport Rules for new vehicles, and changes made in 2007 to tighten these rules will improve the vehicle fleet over time.

27 Given that the Project includes steep gradients where engine braking is possible, in my acoustics assessment I specifically considered engine braking noise using the L_{AFmax} parameter, beyond the scope of NZS 6806. I found that due to the distance of steep sections of the proposed alignment from houses, maximum noise level events should remain within reasonable limits.

WHY NZS 6806?

28 There is not an exact science to the setting of a noise limit to result in an acceptable or reasonable level of noise. Responses to noise are variable and subjective, and can be influenced by non-acoustic factors. However, there is a body of international research that relates noise levels to adverse health effects, and there are also

numerous studies of average population subjective response to different noise exposures. Within the Standards New Zealand process for NZS 6806, all of these factors were considered and balanced by an independent committee of well qualified experts who were able to explore and test criteria during a development process of several years. This was also informed by their practical experience in New Zealand of the Transit Guidelines. Developing a new standard the committee were not constrained in any way as to the choice or structure of criteria. I consider that this process has resulted in noise criteria that provide an appropriate benchmark as to acceptable levels of road-traffic noise in New Zealand, in line with my own experience.

29 As I have discussed above, NZS 6806 is not a National Environmental Standard and is not referenced by any of the district plans. There is no compulsion for NZS 6806 to be adopted in this instance. All New Zealand acoustics professionals that I am aware of having worked on recent roading projects support the use of NZS 6806. For example, on the Waterview Connection Project all experts agreed on the use of NZS 6806. Likewise, for this Project the completeness check reviewer for the EPA, Malcolm Hunt, when previously engaged by the RATAG, supported the scope of my assessment using NZS 6806 before I commenced my work. He was also an observer at the noise mitigation workshop for selecting the Best Practicable Option *(BPO)*.

30 As I have also discussed above, the criteria in NZS 6806 have been developed based on population average responses to noise. I do not consider that there are any local factors around the Project area that would justify use of alternative more stringent or more lenient criteria. I therefore consider that the criteria in NZS 6806 are appropriate to determine acceptable and reasonable noise levels for the Project. I do not consider that there is a better alternative method or criteria available for making this assessment.

31 In the last two years I have had first hand experience leading the application of NZS 6806 on this Project and the Peka Peka to Otaki Project. I have also worked in a peer review capacity on the Waterview Connection Project, Waikato Expressway Cambridge Section, and other projects. On all these projects I have witnessed project teams focussed on determining the BPO and committed to holistic design outcomes minimising environmental effects. This exercise is conducted transparently, and in both the projects I have led I have ensured there is an independent expert from the regulatory authority observing at the mitigation workshop. The process now allows project teams to balance, for example, an imperceptible reduction of 1 dB against the visual effects of a 5 m high barrier, and numerous other considerations. Similar integrated design processes have always occurred for decisions in other disciplines to arrive at a project proposed design, but the noise

assessment has previously been constrained by the Transit Guidelines.

32 While I appreciate that this balancing of effects must ultimately be approved by the Board of Inquiry in this hearing process, I consider it is extremely valuable for the Project team to have considered the noise effects holistically, taking into account the views of different experts (for example on visual amenity or social effects) and views expressed by stakeholders, and then put forward what it considers to be the BPO for the community's and the Board's consideration. From my experience of working on other projects, I am aware that, in practice, similar holistic processes are followed for other disciplines such as with stormwater treatment or bridge design.

33 Because NZS 6806 sets out a process rather than a noise limit it takes longer to understand, and unlike the Transit Guidelines it cannot be subject to simplistic performance standards in designation conditions. However, I consider that while this makes the regulatory approvals and designation conditions significantly more complex, this is justified by the improved environmental outcome.

DISTRICT PLANS

34 As requested I will summarise the relevant noise rules of each of the four district plans. While the old designation is recorded in the district plans I have addressed this question as if that designation did not exist. Nevertheless, in my acoustics assessment I have discussed the noise limits associated with the existing designation, which were based on an early draft of the Transit Guidelines.

35 The Wellington City District Plan *(the WCDP)* includes noise limits for general activities in different zones. In common with many district plans, road-traffic noise is explicitly excluded from these limits. The definition of 'noise emission level' in the WCDP states:

> *The following activities and specific noise sources are not appropriately controlled using assessment by NZS6802:1991 Assessment of Environmental Sound and noise rules in this Plan, unless the rule states to the contrary:*
>
> > *- vehicles driven on a road (within the meaning of s.2(1) of the Transport Act 1962) or vehicular movements on any sites which are in keeping with normal residential activity*

36 The Porirua City District Plan *(PCDP)* includes the following text as part of the noise rules in various zones, and also specifies NZS 6802:1991[8] in the definition of the term 'noise'.

> *All sound levels shall be measured in accordance with NZS 6801:1991 Acoustics – "Measurement of Sound". Where NZS 6802:1991 does not include assessment of the type of noise in question, the appropriate New Zealand Standards may be used.*

37 In Section 1.2 of NZS 6802:1991 it is stated that:

> *Assessment of specific sources of transportation, construction, and impulsive sound (such as gunfire, and blasting), requires special measurement and assessment techniques that are generally outside the scope of this Standard, but within the scope of others.*

38 NZS 6802:1991 does not provide methods suitable for the assessment of road-traffic noise, and I therefore consider that Section 1.2 applies. This is explicitly stated in the current 2008 version of NZS 6802. My interpretation is that the above text from NZS 6802:1991 and the PCDP mean that road-traffic noise is excluded from the general noise rules in the PCDP. However, as NZS 6806 was not published at the time of NZS 6802:1991 or this part of the PCDP, these references cannot be taken to imply a direct link from the PCDP to NZS 6806. If anything a strict interpretation of the PCDP appears to result in a rule vacuum for addressing road-traffic noise. Although not providing exact references, the PCDP does give a clear direction that New Zealand Standards should be used where applicable. There have been no other New Zealand Standards relating to road-traffic noise so a pragmatic interpretation is that the noise rules in the PCDP require the use of NZS 6806.

39 The Upper Hutt City District Plan *(UHCDP)* sets noise limits for permitted activities at site boundaries in the rural zone for all activities as: 50 dBA L_{10} (daytime), 40 dB L_{10} (night-time), and 70 dBA L_{max} (night-time). The L_{10} parameter is the predecessor to $L_{Aeq(15\ min)}$, and although defined differently the values are often within a few decibels. These noise limits are typical for rural areas throughout New Zealand and represent a standard degree of amenity.

40 The UHCDP also requires noise to be assessed in accordance with NZS 6802:1991. Therefore, for the same reasons I have set out above with respect to the PCDP, I do not consider that the general noise limits I have just described in the UHCDP are applicable to road-traffic noise. However, unlike the PCDP, the UHCDP does not

[8] NZS 6802:1991 Assessment of environmental sound

provide a direction to alternative assessment methods, which creates another rule vacuum.

41 In summary, I do not consider that there are any relevant noise rules in the WCDP, PCDP or UHCDP.

42 The Kapiti Coast District Plan *(KCDP)* does explicitly include noise limits for new roads as controlled activities in the rural zone. This noise rule is copied directly from the Transit Guidelines, although does not explicitly make reference to them.

43 In my analysis of the MacKays Crossing area which is within Kapiti Coast District, I included investigation of a mitigation option to achieve compliance with the Transit Guidelines and KCDP. For five houses I found that this would require 4 km of low-noise road surface across all lanes and 850 metres total length of noise barriers and bunds. Without this mitigation the noise levels would be 1 to 2 dB above the noise limits at 3 houses and 4 dB above the noise limit at 2 houses. This excludes 2 houses owned by the Crown, at least one of which will be demolished.

44 In this area the main alignment is significantly elevated above the most affected houses, and the required barrier would create an adverse visual effect. Without any specific mitigation (do-minimum) the predicted noise levels are in NZS 6806 category A at all houses except one house which is in category B. At that one Category B house the KCDP noise limits are actually achieved as the existing noise level is high, due to the closer proximity of the existing state highway. Through the noise mitigation workshop it was decided that as the noise levels are reasonable without mitigation, and as a barrier creates adverse visual effects for only a small reduction in noise levels, the BPO is the do-minimum option. There were other factors which contributed to this decision including the poor benefit gained from the substantial mitigation and the maintenance issues associated with an isolated area of low-noise surface.

45 While this discussion has arisen in the context of the KCDP noise limits, it provides another example of the benefits of NZS 6806. There are two issues that occurred here:

45.1 Adverse visual effects were avoided, while not significantly altering the noise effect, and

45.2 The most affected house complies with the KCDP noise limits due to the high existing noise level and no action was required, but under NZS 6806 mitigation options for this house were investigated in detail.

46 The noise rule in the KCDP, which is the same as the Transit Guidelines, is relevant. The mitigation proposed in the MacKays

Crossing area does not comply with these noise limits by a small margin. However, for the same reasons that I have discussed above I consider that in accordance with NZS 6806 the resulting noise levels are reasonable in this environment.

DESIGNATION CONDITIONS

47 Given the relative complexity of the designation conditions under NZS 6806, I will briefly describe the function of the proposed conditions NZTA.21 to NZTA.31 for operational noise. These conditions require detailed design of the noise mitigation, subject to additional approvals if the mitigation and predicted noise exposure change from that specified in my assessment. Five of the conditions relate solely to the provision of acoustics treatment to three individual houses, setting out the process for investigation and design, and also the permutations of possible responses from building owners at different stages.

48 NZTA.21 sets out definitions for terms used in the other operational noise conditions.

49 NZTA.22 requires the mitigation detailed in my assessment report to be implemented. That is, the noise barriers, low-noise road surfaces and building-modification that have been determined to be the BPO are required to be constructed.

50 The Project as a whole has not yet been subject to detailed design. When that occurs NZTA.23 requires the detailed design of the noise barriers and low-noise surfaces to be undertaken by a suitably qualified acoustics specialist. The effect of any changes to the road alignment and earthworks for example might need to be verified in an acoustics model.

51 During the detailed design of noise barriers there may be a reason for the predicted noise exposure to change. An extreme example could be that the barrier has to be stopped or moved due to discovery of a historic site that should not be disturbed; but a more realistic case might be adjusting barrier heights slightly to fit standard panel modules above undulating ground. NZTA.24 allows for changes to predicted noise exposure, subject to two tiers of approval to confirm that the revised mitigation remains the BPO. For minor changes where the same noise categories are maintained the approval is by a planner who is in turn approved by the Council. Although it is not specified, it is envisaged that this would typically be the planner engaged by the NZTA project team. For more significant changes that cause a change of noise exposure of a house to the highest exposure category C, then the approval is to be directly by the Council.

52 NZTA.25 requires the mitigation to be constructed before the project is completed. There is an exception for low-noise road surfaces, which have to be implemented within 12 months of opening. The reason for this is that there is minor settling and compaction by traffic on new roads. A chipseal surface can accommodate the resulting movement, whereas a low-noise porous asphalt surface may crack. Allowing up to 12 months before the porous asphalt is laid can prevent this issue. I note that the design year for the road-traffic noise assessment and all predicted levels is 2031. In the first year of the Project opening the traffic will be less, which will partly offset the increase due to a temporary chipseal surface at that time.

53 NZTA.26 to NZTA.30 all relate to treatment of individual houses. As part of a guide about acoustics treatment of buildings that I am producing for the NZTA as an Independent Professional Advisor, I have drawn these conditions as an annotated flow chart. I have attached that draft flow chart as **Annexure B** to my evidence.

54 NZTA.31 requires the Detailed Mitigation Options (e.g. the noise barriers and low-noise road surfaces) to be maintained. For the Waterview Connection Project it was proposed that this condition include a time limit for the first 10 years of operation, corresponding to the noise assessment design year. However, I understand that as a result of issues raised during the Board of Inquiry the time limit was removed. Therefore, for this Project no time limit has been included.

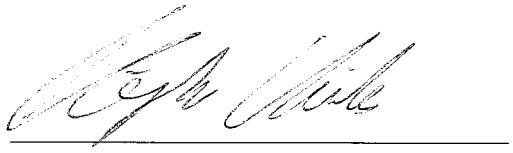
WATERVIEW CONNECTION PROJECT

55 The Board of Inquiry for the Waterview Connection Project had concerns about certain aspects of the application of NZS 6806 in that location. I have attached to my evidence as **Annexure C** a paper which discusses these issues in detail and sets out the NZTA position on them. As an Independent Professional Advisor, I reviewed this matter for the NZTA and provided technical advice during the preparation of the paper. The paper includes both legal and acoustics matters. I do not claim legal expertise, but in terms of the technical acoustics matters and interpretation of NZS 6806, my own opinions about the Waterview Connection Project decision and conditions are the same as the position set out in the paper.

56 One of the issues particular to the Waterview Connection Project relates to a new motorway with more than 80,000 vehicles per day passing through a dense residential area ('Sector 9'). In these circumstances NZS 6806 provides more lenient noise criteria than for other new roads. Conversely, for the TGP the standard criteria apply as all parts of the Project have less than the threshold of 75,000 vehicles per day.

57 It appears that a factor in some of the other issues raised by the Board of Inquiry for the Waterview Connection Project, was simply the lack of sufficient time in the consenting process, given the scale and complexity of the project, for both some of the experts involved giving evidence and the Board itself to gain sufficient understanding of NZS 6806, which had only just been published. Also, unlike the process I have run for the TGP, the acoustics expert appointed by the EPA for the Waterview Connection Project did not have the benefit of observing all the noise mitigation workshops.

58 For the reasons set out in the paper and above, the issues raised by the Board of Inquiry for the Waterview Connection Project do not alter my opinion that NZS 6806 is the appropriate assessment standard for the TGP.

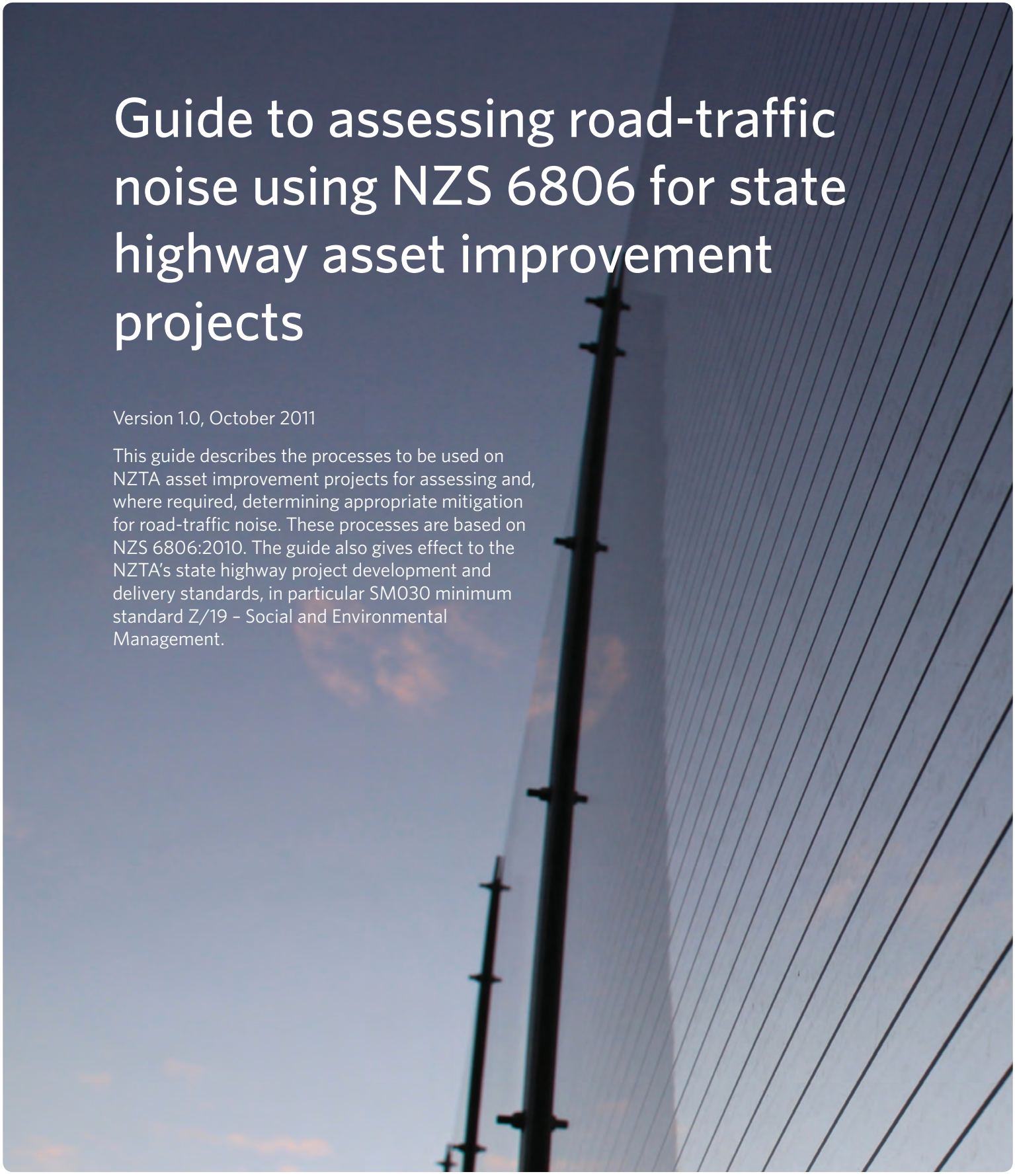


Stephen Gordon Chiles
9 February 2012

ANNEXURE A

NZTA Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects, Version 1.0, October 2011

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

New Zealand Government

NZ TRANSPORT AGENCY
WAKA KOTAHI

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

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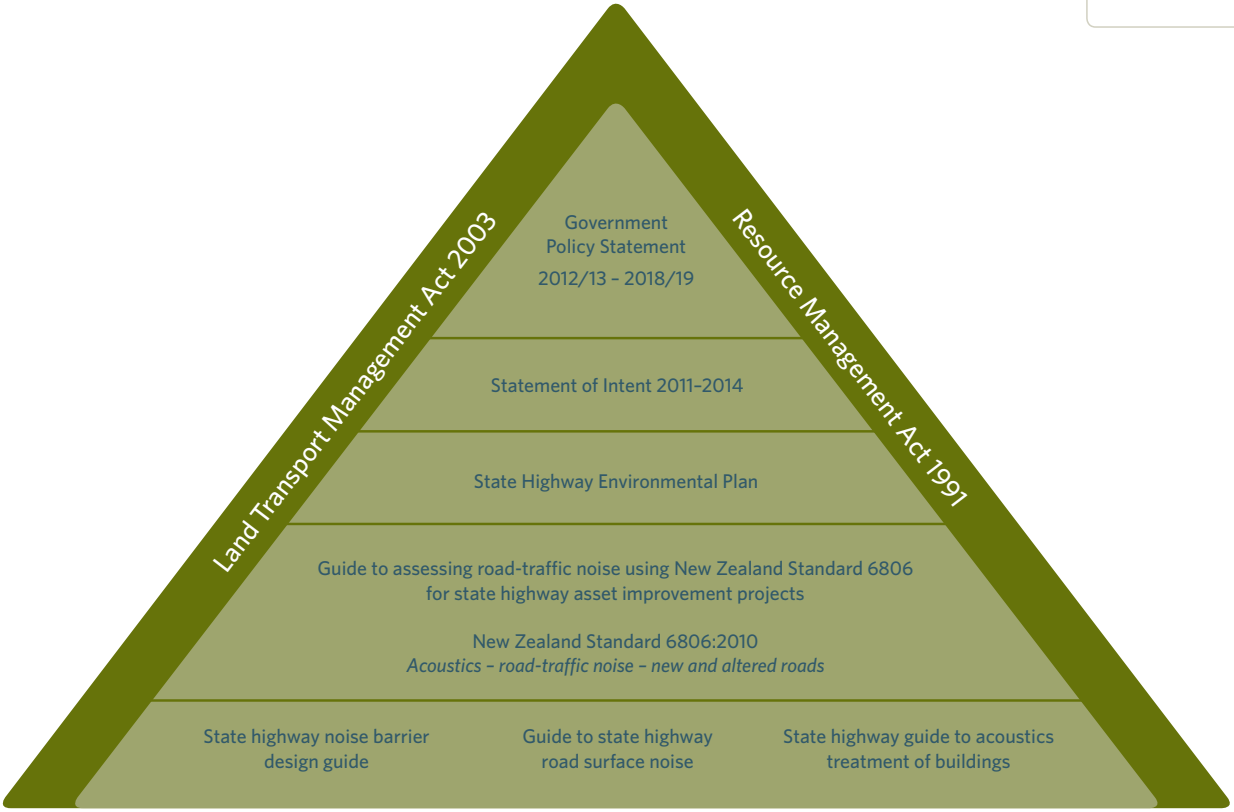
Introduction

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) 6806[2] 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* (SM011)[3], *State highway professional services contract proforma manual* (SMO30)[4], and minimum standards Z/6[5], Z/18[6], Z/19[7], Z/20[8], Z/21[9] and PSG/13[10]. 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 guidelines[12]. 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.

NZTA Transport Noise website

NZTA eLearning NZS 6806 case study

3 NZTA (2010) *Project management manual* (SM011). www.nzta.govt.nz

4 NZTA (2011) *State highway professional services contract proforma manual* (SM030). 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

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 Committee[13] 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:

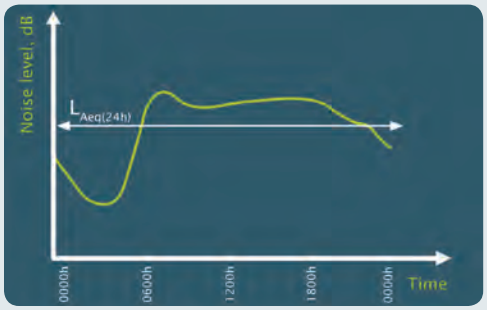
- acoustic insulation
- voice amplification systems
- building relocation.

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.

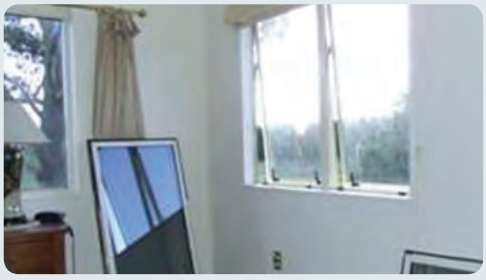
Structural mitigation

Measures to reduce noise such as:

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

Urban/rural

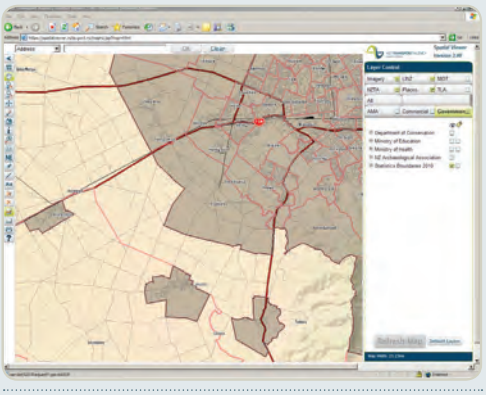
An urban environment is a main urban area, a satellite urban community or an independent urban community (Statistics New Zealand). Any area that is not urban is classified as a rural environment for the purposes of NZS 6806. Details of these areas are available from Statistics New Zealand (www.stats.govt.nz)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



Building-modification mitigation

Structural mitigation

Altered road



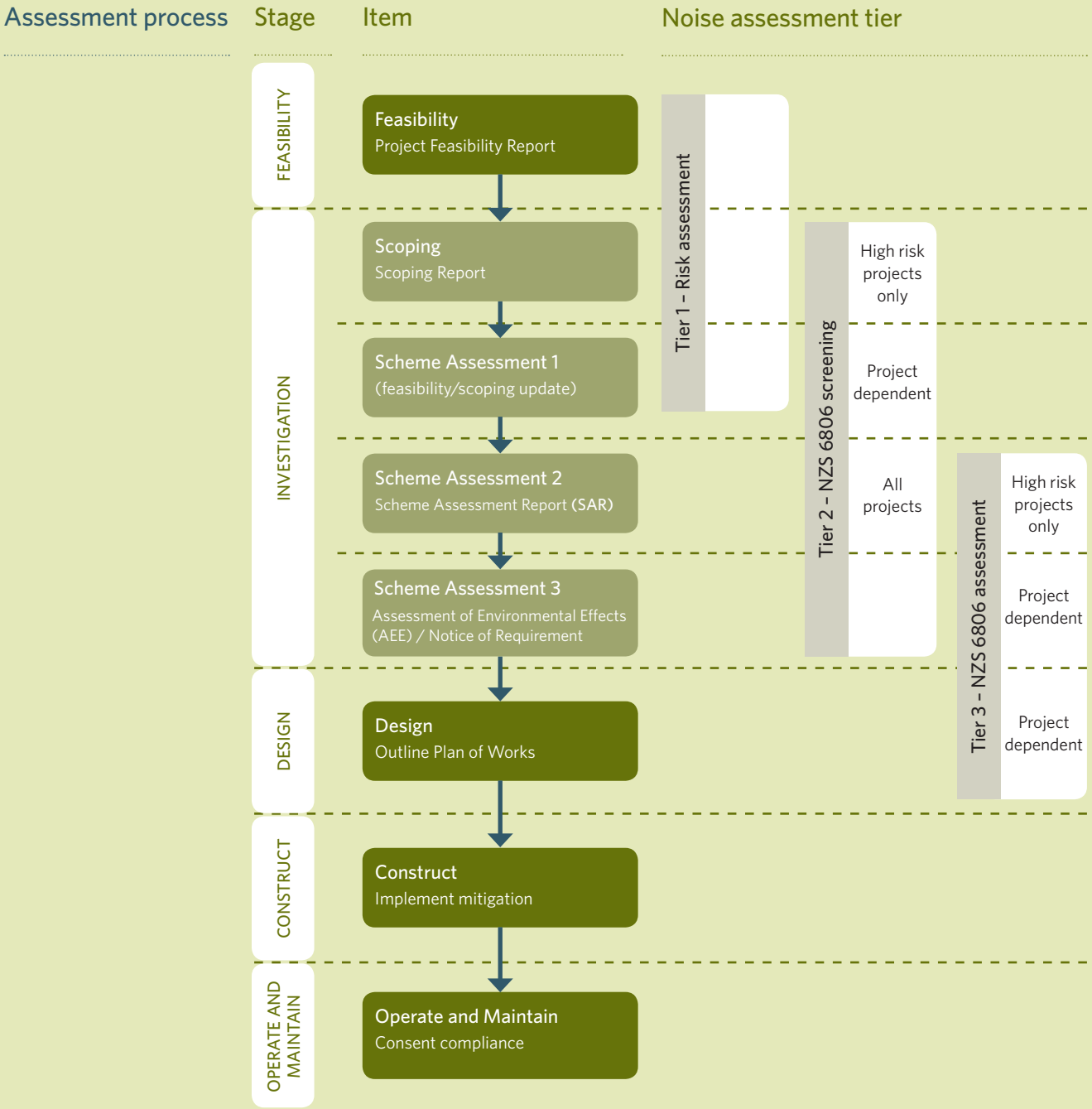
NZTA Spatial Viewer showing urban and rural areas

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/13[14], 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

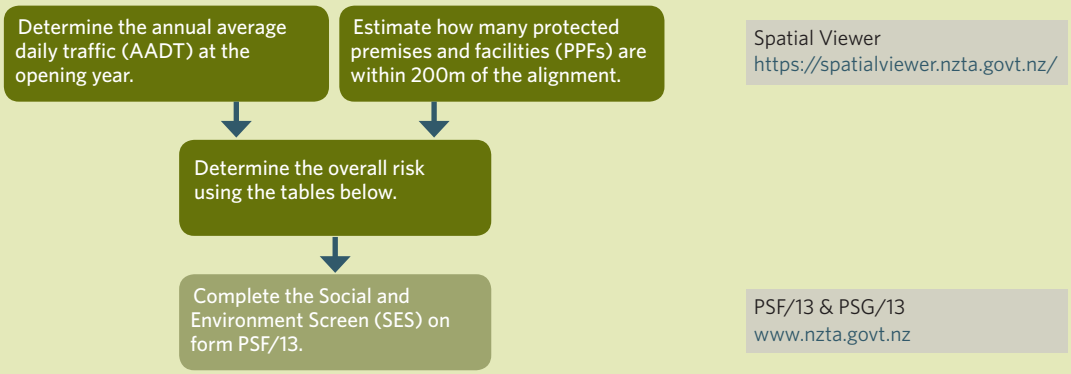


TABLE 2 Risk rating

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

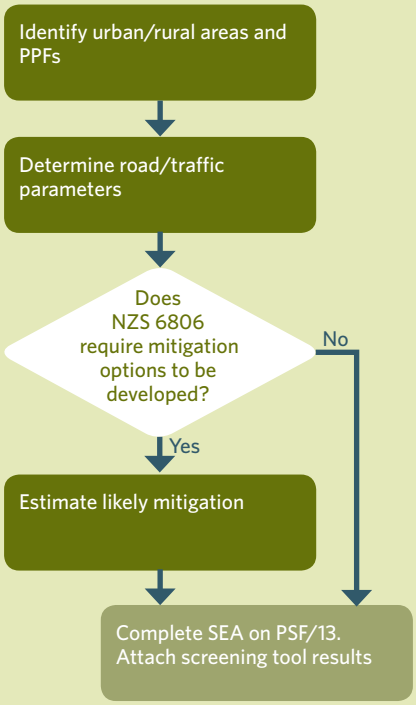
Overall rating	Individual ratings (AADT/PPFs)
Not applicable (NA)	Either NA
Low risk (L)	Both L
Medium risk (M)	One M and one L or M
High risk (H)	One H and one L, M or H

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



Spatial Viewer
https://spatialviewer.nzta.govt.nz/

Screening tool
www.acoustics.nzta.govt.nz

Road-traffic noise calculator
Noise barrier design guide
Guide to road surface noise*
Guide to acoustics treatment*
www.acoustics.nzta.govt.nz
* In preparation

PSF/13 & PSG/13
www.nzta.govt.nz

Tier 3 – NZS 6806 assessment

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

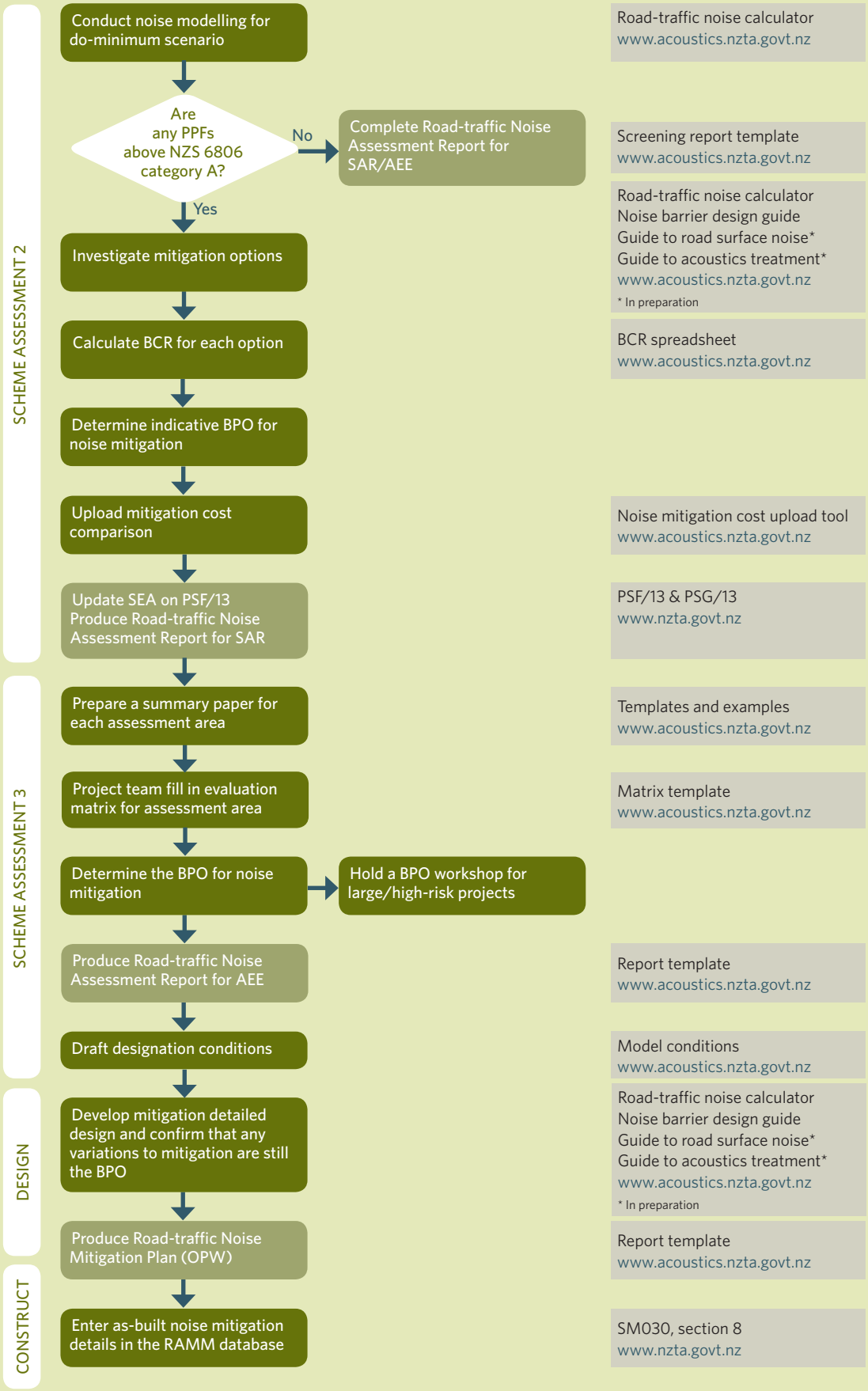


FIGURE 5
Tier 3

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 *Social and environmental issues*	**Effects** *Describe the potential social and environmental effects of the option, including where the option may improve social and environmental outcomes*	**Degree of effect** *H / M / L / NA*
Noise *eg construction noise, traffic noise, maintenance noise, presence of sensitive receivers (homes, schools, hospitals).*	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

This example only shows road-traffic or 'operational' noise effects. The NZTA guide to state highway construction noise[15] provides similar examples for construction noise effects.

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

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 CSVue[15] 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.

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).

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.

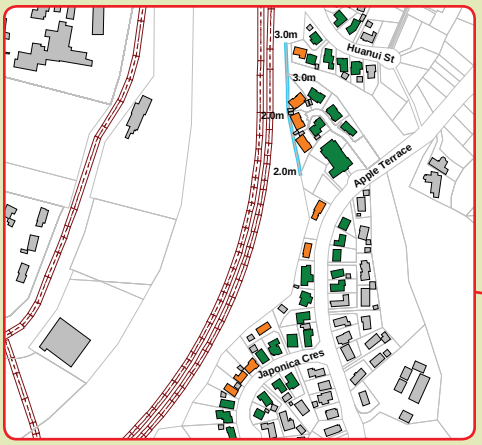
TABLE 4 Social and Environmental Assessment – example 'Project X'

Option description		
Social and Environmental Assessment		
Requirements *List all legal requirements and relevant NZTA social and environmental objectives*	**Addressing effects and meeting requirements** *List actions to be taken to meet specific social and environmental requirements and objectives and address all effects identified. Include an estimated cost.*	
	Specific actions	**Estimated cost ($)**
Designation conditions: (CSVue 12345, condition 5) Assessment in accordance with NZS 6806. **Specific NZTA objectives:** (*Environmental plan* N2) Determine reasonable noise requirements when seeking new or altering existing designations, including when designating existing local roads by using RMA procedures.	Conduct noise monitoring of the existing environment. 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). Determine the BPO in accordance with NZS 6806. 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.	TBC

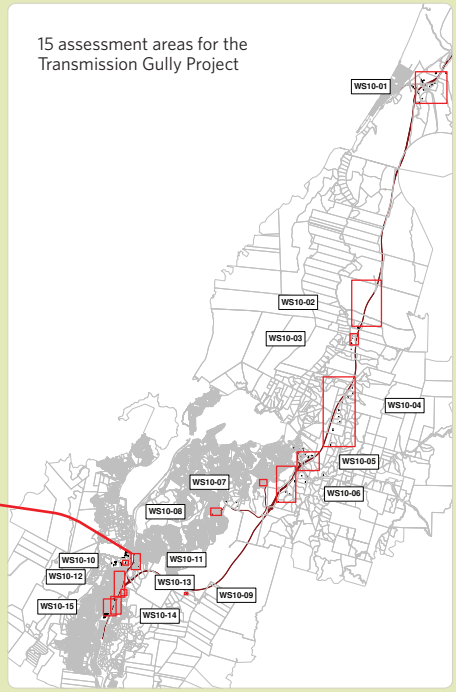
Best practicable option

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



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

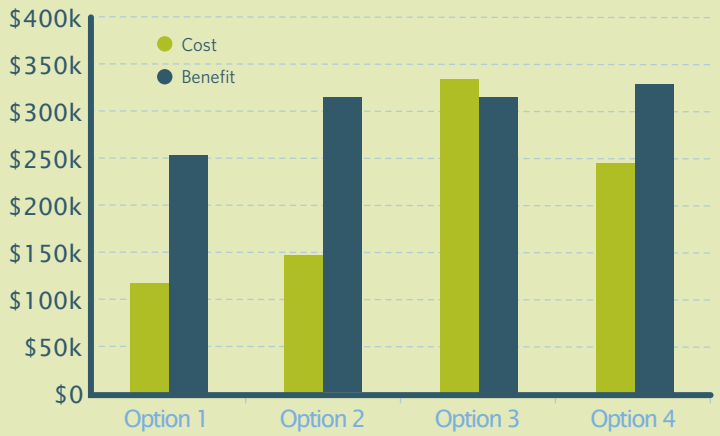
Waterview Connection, Sector 1 South, option 1

Waterview Connection, Sector 1 North, option 2

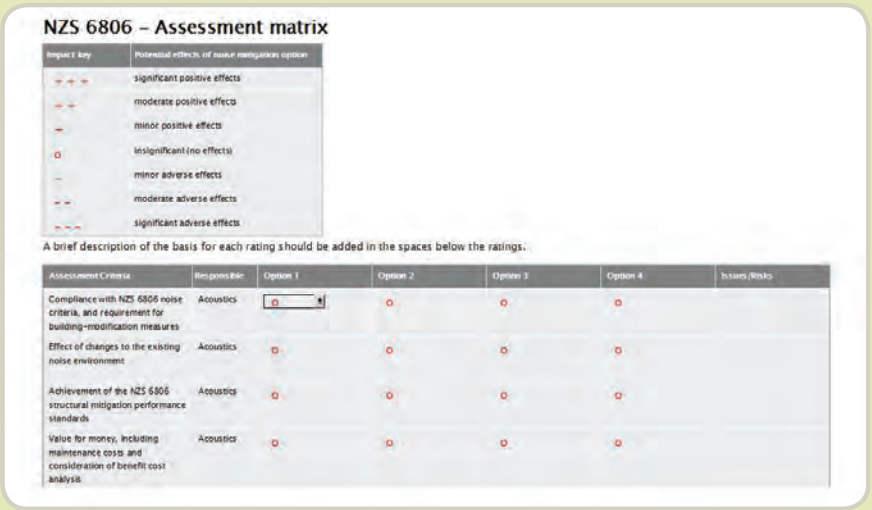
Waterview Connection, Sector 1 South, option 2

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

3. 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.



4. 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.

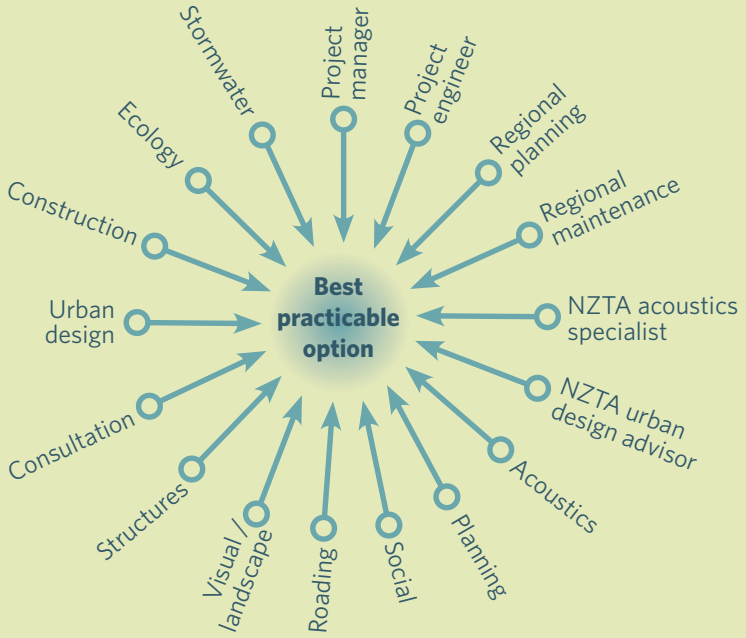
Assessment Criteria	Responsible	Option 1	Option 2	Option 3	Option 4	Issues/Risks
Compliance with NZS 6806 noise criteria, and requirement for building-modification measures	Acoustics	0	0	0	0	
Effect of changes to the existing noise environment	Acoustics	0	0	0	0	
Achievement of the NZS 6806 structural 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	

5. 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 approprite 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 dB $L_{Aeq(24h)}$, 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.

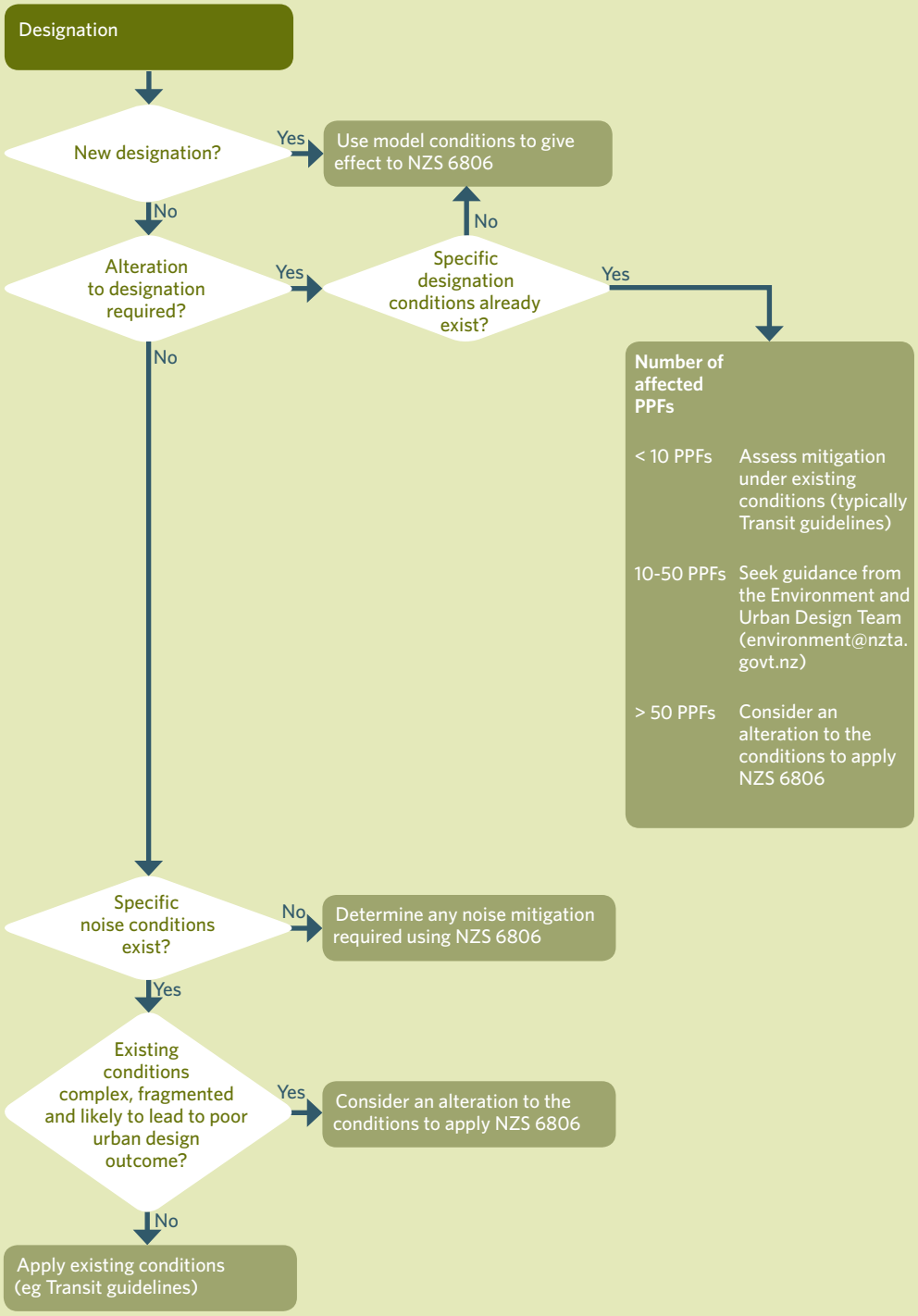
Construct

- 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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NZ TRANSPORT AGENCY
WAKA KOTAHI

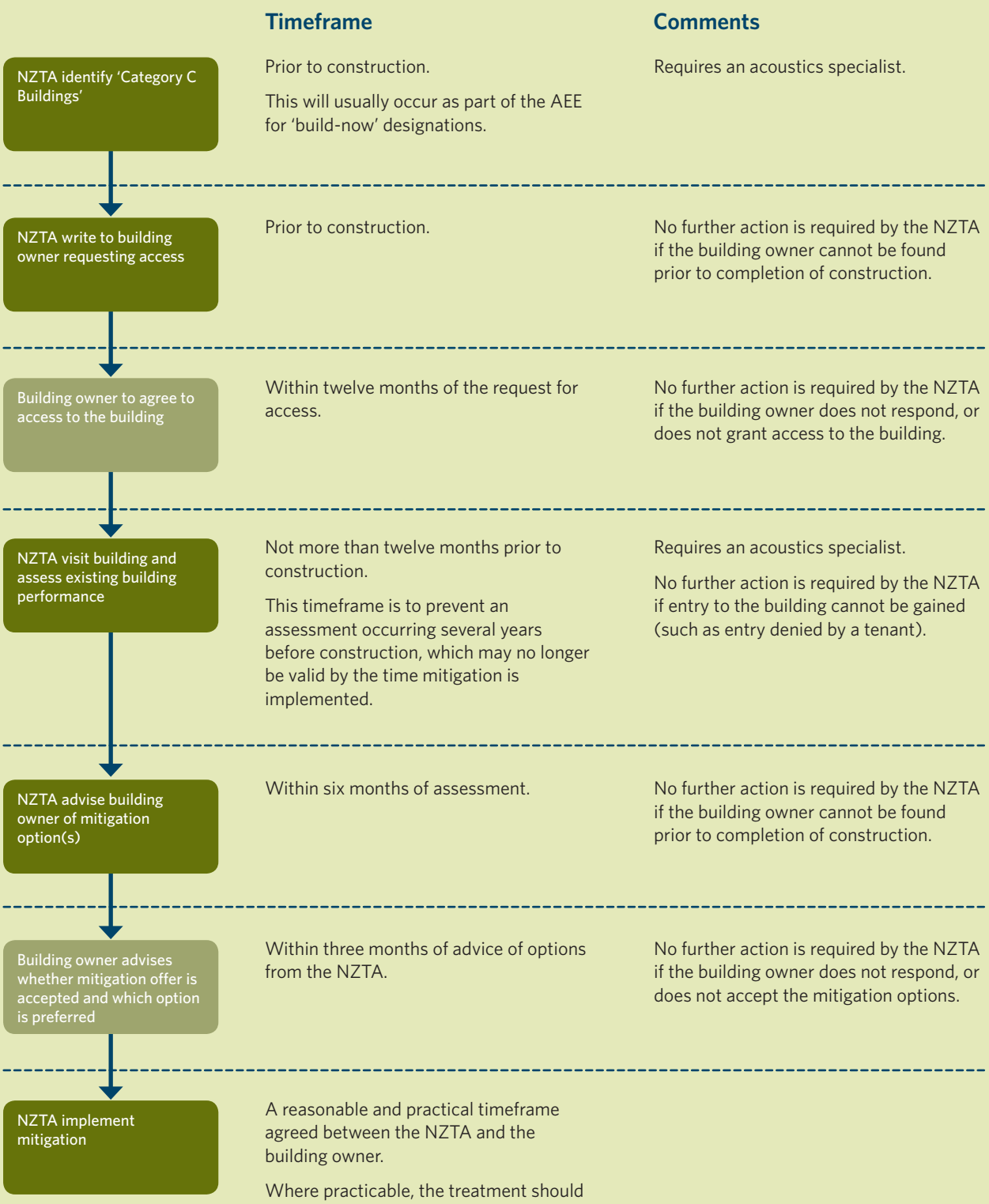
New Zealand Government

October 2011

ANNEXURE B

Flow chart of conditions NZTA.26 to NZTA.30

FIGURE 4.1 | Model conditions process



ANNEXURE C

NZTA Position on the Waterview Connection and NZS 6806:2010, October 2011

20 16 Waterview Connection and NZS 6806: 2010

NZ TRANSPORT AGENCY WAKA KOTAHI

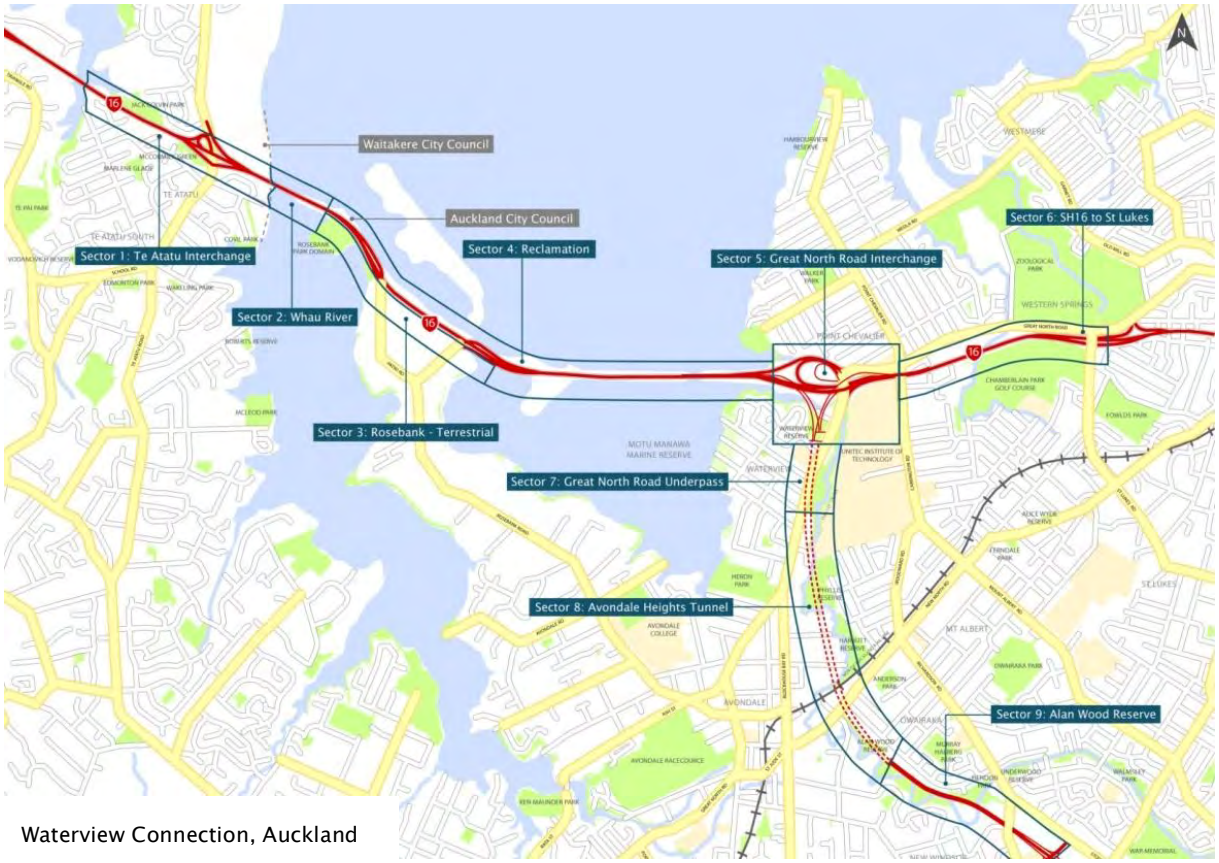
NZTA POSITION October 2011

Introduction

The Waterview Connection in west Auckland is the largest roading project to be undertaken in New Zealand in recent times. It includes 4.5km of new state highway connecting SH20 with SH16 between Mt Roskill and Waterview, of which 2.5km will be in tunnels, as well as alterations to 7km of the existing state highway (SH16) between St Lukes and Te Atatu.

The section of the project between SH20 and SH16 is unique in that it will involve a new surface road being constructed to carry more than 80,000 vehicles per day through a well-established, relatively densely populated, residential urban area that currently has a low existing noise environment (generally less than 50 dB $L_{Aeq(24h)}$)[1].

In contrast, alterations to the existing SH16 will involve capacity improvements to a section of state highway carrying around 130,000 vehicles per day through a similar urban area but one which is currently (2011) subject to a high road-traffic noise environment (up to 71 dB $L_{Aeq(24h)}$).



Waterview Connection, Auckland

In 2010, the Waterview Connection was one of the first state highway projects where NZS 6806[2] 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 as part of the national consenting process under the Resource Management Act 1991 (RMA).

The national consenting 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. The Board's final report[3] discusses NZS 6806, and disagrees with the conclusions in the final expert witness caucusing report[4] agreed by all the acoustics experts involved in the hearing.

Board of Inquiry's concerns with NZS 6806

The Board had the following concerns about the application of NZS 6806 to the Waterview Connection project:

1	Category A and B PPFs 'worse off' than Category C PPFs	The Board considered that there was an inconsistency within NZS 6806 in that protected premises and facilities (PPFs) in Categories A and B with external noise readings of between 64 dB $L_{Aeq(24h)}$ and 67 dB $L_{Aeq(24h)}$ might experience internal noise levels of approximately 44 and 47 dB $L_{Aeq(24h)}$ respectively. As a result the Board considered such PPFs to be worse off than those in Category C which would receive building modification mitigation to achieve an internal target level of 40 dB $L_{Aeq(24h)}$. This was based on the Board's acceptance of oral evidence that there is a 20 dB $L_{Aeq(24h)}$ reduction between external and internal noise levels with windows closed (final report, particularly paragraphs [911] and [912]).
2	Rigid BPO test	The Board had an overarching concern about the adequacy of NZS 6806 being used to manage adverse effects of road noise under the Resource Management Act 1991 (RMA) through implementation of the Best Practicable Option (BPO) because it considered that there was rigidity in the development of the BPO under NZS 6806 (final report, paragraph [925], 6th bullet point).
3	Community economic well-being versus affected persons' social well-being	The Board perceived there to be an imbalance in NZS 6806 between the mitigation of adverse noise effects of a project and the potential benefits of new and altered roads to people and communities. The Board considered that the balancing sought in NZS 6806 placed disproportionate weight on enabling the community's economic and possibly social well-being relative to the social well-being and health of directly affected people. The Board considered that this inadequately addressed those parts of section 5 of the RMA concerned with avoiding, remedying and mitigating adverse effects and failed to engage those parts of section 7 of the RMA concerned with amenities and the quality of the environment likely to be of concern to impacted persons (final decision, paragraph [925]).
4	Not a standard test or methodology	The Board was concerned that NZS 6806 did not provide a set test or methodology and rather, as set out in the foreword to NZS 6806, it offered guidance and recommendations and could constitute a relevant matter to be taken into account when exercising functions and powers under the RMA (final report, paragraph [925], 6th bullet point).

However, despite refering to these concerns in its final report, in its final decision on the designation conditions the Board imposed the revised operational noise designation conditions proposed by the NZTA in its comments[5] on the Board's draft report[6] (see also appendix 1).

The NZTA's response to the Board's concerns with NZS 6806:2010 as identified in the Board's final report is set out below.

Board concern – 1

Category A and B PPFs worse-off than Category C PPFs

The NZTA considers that NZS 6806 imposes appropriate noise criteria for the Category A and B PPFs affected by sectors 1-6 of the Waterview Connection project, particularly given the noise levels that those dwellings currently (2011) receive from SH16 as part of the existing environment.

The requirement to avoid, remedy or mitigate effects under section 5 of the RMA relates solely to the effects:

- of the project (as mitigated by all the mitigation measures that form part of the project)
- on the existing environment, ie the environment that included existing lawful developments (such as the existing SH16) and developments that might be carried out as a permitted activity under the relevant RMA plans.

A Board of Inquiry is required to correctly apply the law as it stands when the applications before it are heard. This includes the case law developed by the Environment Court.[8]. Case law has established[7] that a condition must reasonably relate to what is being authorised. A condition requiring the amelioration of road-traffic noise to below the level experienced before an existing road is altered would not be related to the authorisation of the altered road.

The NZTA does recognise that NZS 6806 describes a process that, in certain circumstances, is intended to ensure that roading projects that involve alterations to existing roads should aim to reduce road-traffic noise below that currently received at a property without the project where there are existing high levels that have the potential to adversely affect the health of people and communities. However, in applying NZS 6806 in such circumstances an applicant, such as the NZTA, is offering to do noise reduction works over and above the level of works that could be imposed on the applicant by a consent authority.

SH16 (St Lukes to Te Atatu) – sectors 1-6 of the Waterview Connection project

The NZTA considers that the conditions originally proposed by the Board for these sectors of the project in its draft report[6] would have meant that the NZTA was being required to go significantly beyond the requirements of both NZS 6806 and section 5 of the RMA.

This is because the NZTA had already offered to do works that would reduce the existing external levels of road-traffic noise (and by default existing internal noise levels) from SH16 received at many PPFs in line with the provisions of NZS 6806 (ie delivering a positive environmental effect). In addition to this reduction, the Board indicated that it considered it could also require the NZTA to provide

additional building modification mitigation to ensure existing internal noise levels were reduced even further to less than 40 dB $L_{Aeq(24h)}$.

However, the conditions imposed in the Board's final report[9] relating to the altered road section of the Waterview Connection, ie sectors 1-6, where the NZTA had already offered to largely improve the noise levels currently being received from SH16, while at variance with the proposed model conditions lodged with the NZTA applications[10] are acceptable to the NZTA on the basis that they retain and reflect the intent of NZS 6806. Under the conditions imposed by the Board the only PPFs affected by the alterations to SH16 that will be eligible for building modification mitigation, following implementation of all structural mitigation measures, are those PPFs where:

- the noise level increases by 3 decibels [dB $L_{Aeq(24h)}$] or more due to road-traffic noise from the project
- habitable spaces are likely to receive road-traffic noise levels in excess of 45 dB $L_{Aeq(24h)}$ from motorway operation noise [SH16] with windows closed in the design year.

SH20 (Maioro Street to Waterview) – sectors 7-9 of the Waterview Connection project

The NZTA accepted in its comments[5] on the Board's draft report[6] that, given the unique nature of the existing environment and the characteristics of the new area of surface road to be constructed between SH20 and SH16 (sector 9 of the project), the NZTA was willing to agree to conditions being imposed in relation to that section of the project which required greater levels of noise mitigation than NZS 6806. Therefore, because of the unique circumstances, the NZTA considers that the noise conditions applying to this section of the project approved by the Board in its final report[9] are an acceptable alternative to the conditions[10] originally proposed by the NZTA.

In sector 9 following implementation of all structural mitigation measures, PPFs will be eligible for building-modification mitigation if they are:

- within 100m of the closest lane of the new road; and
- have habitable spaces which are likely to receive road-traffic noise levels in excess of 40 dB $L_{Aeq(24h)}$ from SH20 with windows closed at the project design year.

Board concern – 2
Rigid BPO test

The Board expressed concerns that what it saw as the 'rigid development of the BPO' provided for in NZS 6806 did not align with the requirements of section 16 [duty to avoid unreasonable noise] or section 2 [definition of BPO] in the RMA. However, NZS 6806 specifically requires the application of a BPO approach and section 6.3 of NZS 6806 states that BPO for the purposes of NZS 6806 is the same as BPO as defined by the RMA.

NZS 6806 also lists 16 factors that should be considered in order to determine the BPO for mitigating noise from new and altered roads. These factors include compliance with noise criteria, consistency with the New Zealand Urban Design Protocol, and adherence to safety standards. They also include a 'catch-all' requirement to consider 'any other relevant matters'. Each of the 16 factors listed in

NZS 6806 were taken into account when determining the BPO for noise mitigation for each of the nine assessment sectors of the Waterview Connection project.

The NZTA does not agree that the NZS 6806 BPO test is 'rigid'. The NZTA believes the test to be very flexible and comprehensive, allowing a vast array of factors to be considered and balanced in order to develop an integrated noise mitigation solution.

Board concern – 3

Community economic well-being versus affected persons' social well-being

The Board suggested that NZS 6806 places 'disproportionate weight' on the community's economic, and possibly social, well-being relative to the social wellbeing and health of affected people. The NZTA does not believe this to be the case.

The Waterview Connection noise assessment considered operational road-traffic noise effects at every floor of every PPF (more than 500) within 100m of the project. Over 40 potential mitigation options were developed in accordance with NZS 6806 and presented by the NZTA for the nine assessment sectors across the project area. At least one option for each sector sought to comply with the most demanding noise criteria in NZS 6806 – Category A.

The option selected by the NZTA as that representing the BPO for noise mitigation in each sector was determined by balancing the 16 factors referred to above and prescribed in section 6.3 of NZS 6806. These factors included consideration of an extensive range of health, environmental, social, safety, cultural, economic and other matters.

Board concern – 4

Not a standard test or methodology

The Board stated that NZS 6806 did not provide a set test or methodology but instead offered guidance and recommendations. The NZTA acknowledges the non-mandatory status of the standard. Nevertheless, in the absence of any National Environmental Standard or equivalent national statutory provision, the NZTA believes that NZS 6806 reflects current best practice in New Zealand.

The NZTA remains committed to using NZS 6806 and is confident that the standard provides a robust, nationally consistent and standardised process for measuring, predicting, assessing and, where required, determining mitigation of road-traffic noise from new and altered roads, such as the Waterview Connection project.

Board's overarching concerns with NZS 6806

NZS 6806 was developed by a Standards New Zealand committee[2] that involved input from a wide range of stakeholders. Many of these stakeholders had the public's interest as their responsibility.

Others were acoustics experts, some of whom had over 20 years' experience and who considered and weighed the available evidence and then sought wider input through public submissions.

This is evidenced by the fact that, following discussion, the final expert witnesses caucusing report[4] in relation to noise provided to the Waterview Board of Inquiry unanimously endorsed the noise criteria contained NZS 6806.

The appropriateness of NZS 6806 is further reinforced though its alignment with the Transit NZ Noise Guidelines[11] which have been used to assess road traffic noise since 1994 and have been widely accepted and applied by the Environment Court. In many ways NZS 6806 is a re-formulation of these guidelines delivering similar but more integrated environmental and design outcomes.

Implications for other state highway projects

It is important to consider the Waterview Connection, the Board's decision and the final designation conditions in context. The project is located in the highly urbanised environment of west Auckland that has a relatively high-density residential population. It involves the construction of a new surface motorway link on SH20 that will carry more than 80,000 vehicles per day, as well as alterations to an existing section of the SH16 motorway carrying around 130,000 vehicles per day.

A large number of properties are to be acquired to accommodate the new section of SH20 and facilitate the alterations to the existing SH16. Without mitigation there would have been large numbers of PPFs assessed as being in Category B and Category C of NZS 6806.

In contrast to the Waterview Connection most other new and altered state highway projects:

- are typically located in peri-urban and rural environments
- are often set largely in open land
- are generally surrounded by relatively low-density residential populations and few PPFs
- carry fewer vehicles (in all instances outside of Auckland, numbers are less than 40,000 vehicles per day and often less than 25,000 vehicles per day)[12]
- require less properties to be acquired
- normally will have fewer constraints in terms of implementing practicable noise mitigation options to address external road-traffic noise.

Designation conditions

The NZTA has developed model designation conditions that it considers should be applied to new and altered state highway projects that are to be assessed and mitigated in accordance with the requirements of NZS 6806. These conditions are available in the NZTA's *Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects*[13] and the NZTA's Transport Noise website (www.acoustics.nzta.govt.nz).

As noted above the operational noise conditions ultimately imposed by the Waterview Connection Board of Inquiry on sectors 1-6 of that project, while different from the NZTA's model conditions, retain and reflect the intent of NZS 6806.

The operational noise conditions adopted by the Waterview Connection Board of Inquiry in its final report in relation to the new surface road section of the project in sector 9 might be appropriate if the NZTA were ever to seek to consent a new road carrying greater than 75,000 vehicles per day through a well-established, relatively densely populated, residential urban area with a low existing noise environment again in the future.

Further reading

Additional analysis of the Waterview Connection Board of Inquiry's concerns with NZS 6806 and application to other state highway projects can be found in:

- Memorandum of Counsel on behalf of the NZ Transport Agency providing Comments on the [Waterview Connection] Board's Draft Report and Decision – 23 June 2011[5]
- Notices of Requirement by the NZ Transport Agency to the Waipa District Council and the Waikato District Council to alter existing designations under section 181 of the RMA for the Cambridge Section of the Waikato Expressway: Supplementary evidence of Vince Dravitzki (Noise) on behalf of the NZ Transport Agency – 3 August 2011[14]

References

1 Waterview Connection Assessment of Operational Noise Effects (August 2010). http://waterviewapplication.nzta.govt.nz/eBooks/G12/

2 NZS 6806: 2010 Acoustics – Road Traffic Noise – New and Altered Roads. www.standards.co.nz

3 Final Report and Decision of the Board of Inquiry into the New Zealand Transport Agency Waterview Connection Proposal: Volume 1 (29 June 2011). www.epa.govt.nz/Resource-management/completed/waterview/Pages/report-and-decision.aspx

4 Board of Inquiry Waterview Connection Project, Second Expert Caucusing Joint Report to the Board of Inquiry – Noise (construction and operational) Final caucusing report (17 March 2011).

5 Memorandum of Counsel on behalf of the NZ Transport Agency providing Comments on the [Waterview Connection] Board's Draft Report and Decision (23 June 2011)

6 Draft Report and Decision of the Board of Inquiry into the New Zealand Transport Agency Waterview Connection Proposal: Volume 2 Proposed Conditions of Consent (23 May 2011). www.epa.govt.nz/Resource-management/completed/waterview/Pages/report-and-decision.aspx

7 Matamata Piako DC v Matamata Piako DC – 24 May 1996, A41/96, p. 4.

8 Ministry for Environment Local Government and Environment Select Committee Briefing – Resource Management (Simplifying and Streamlining) Amendment Bill RMA/MFE/3 (5 April 2009). www.parliament.nz/NR/rdonlyres/3D91BC36-8C22-4D25-83F5-E1054138867F/153617/49SCLGE_ADV_00DBHOH_BILL9045_1_A44623_Ministryfort.pdf

9 Final Report and Decision of the Board of Inquiry into the New Zealand Transport Agency Waterview Connection Proposal: Volume 2 Conditions of Consent (29 June 2011). www.epa.govt.nz/Resource-management/completed/waterview/Pages/report-and-decision.aspx

10 Waterview Connection Assessment of Environmental Effects: Appendix E (August 2010) http://waterviewapplication.nzta.govt.nz/eBooks/E1/

11 Transit NZ Guidelines for the Management of Road Traffic Noise – State Highway Improvements (1 December 1999). www.nzta.govt.nz/resources/planning-policy-manual/docs/planning-policy-manual-noise-guidelines-1999.pdf

12 NZTA State Highway Traffic Data Booklet 2006-2010. www.nzta.govt.nz/resources/state-highway-traffic-volumes/docs/SHTV-2006-2010.pdf

13 Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects. www.acoustics.nzta.govt.nz

14 Notices of Requirement by the NZ Transport Agency to the Waipa District Council and the Waikato District Council to alter existing designations under section 181 of the RMA for the Cambridge Section of the Waikato Expressway: Supplementary evidence of Vince Dravitzki (Noise) on behalf of the NZ Transport Agency (3 August 2011).

Appendix 1
SH20/SH16 Waterview Connection, Auckland, Final Designation Conditions (29 June 2011)

Noise (ON) Conditions – Operation	
ON.1	For the purposes of Conditions ON.2–ON.14 the following terms will have the following meanings: • Appendix E – means Appendix E to the Technical Report G.12 'Assessment of Operational Noise Effects' submitted with this application. • BPO – means Best Practicable Option. • Building Modification Mitigation – has the same meaning as in NZS 6806:2010. • Design Year – means a point in time that is 10 years after the opening of the Project to the public. • Emergency Mechanical Services – means mechanical services used for emergency situations only. • Habitable room – has the same meaning as in NZS 6806:2010. • Noise Criteria Categories – means groups of preference for time-averaged sound levels established in accordance with NZS 6806:2010 when determining the BPO mitigation option; i.e. Category A – primary noise criterion, Category B – secondary noise criterion and Category C – internal noise criterion. • NZS 6806:2010 – means NZS 6806:2010 Acoustics – Road-Traffic Noise – New and Altered Roads. • PPFs – means only the premises and facilities identified in green, yellow or red in Appendix E. • Structural mitigation – has the same meaning as in NZS 6806:2010.
ON.2	The NZTA shall implement the traffic noise mitigation measures identified as the 'Preferred Mitigation Options' in Appendix E as part of the Project, in order to achieve the Noise Criteria Categories indicated in Appendix E ('Identified Categories'), where practicable and subject to Conditions ON.3–ON.11 below.
ON.3	The detailed design of the structural mitigation measures of the 'Preferred Mitigation Options' (the Detailed Mitigation Options) shall be undertaken by a suitably qualified and experienced acoustics specialist approved by the Major Infrastructure Team Manager, Auckland Council prior to construction of the Project, and, subject to Condition ON.4, shall include, as a minimum, the following: a. Noise barriers with the location, length and height in general accordance with Appendix E and designed in accordance with the ULDF (Section B) (refer Schedule A, Row 38); and b. A requirement that Open Graded Porous Asphalt ('OGPA') or equivalent low-noise generating road surface be used on all surface roads throughout the Project, except at the Great North Road Interchange; and c. For the Great North Road Interchange, a requirement that Twin Layer Open Graded Porous Asphalt ('Twin Layer OGPA') or equivalent low-noise generating road surface be used as shown in Appendix E.

Noise (ON) Conditions – Operation	
ON.4	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 'Preferred Mitigation Options', either: a. If the design of the structural mitigation measures could be changed and would still achieve the same Identified Category at all relevant PPFs, and a suitably qualified expert approved by the Major Infrastructure Team Manager, Auckland Council, certifies to the Auckland Council that the changed structural mitigation measure would be consistent with adopting BPO in accordance with NZS 6806:2010, the Detailed Mitigation Options may include the changed mitigation measures; or b. If the 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 Major Infrastructure Team Manager, Auckland Council confirms that the changed structural mitigation measure would be consistent with adopting BPO in accordance with NZS 6806:2010, the Detailed Mitigation Options may include the changed structural mitigation measures.
ON.5	The Detailed Mitigation Options shall be implemented prior to completion of construction of the Project.
ON.6	a. **Sectors 1 to 8** – Prior to construction of the Project, a suitably qualified and experienced acoustics specialist approved by the Major Infrastructure Team Manager, Auckland Council shall identify those PPFs within 100m of the edge of the closest traffic lane of the motorway carriageway where, following implementation of all the structural mitigation measures included in the Detailed Mitigation Options: i. A noise level increase of 3 decibels or more will occur due to road-traffic noise from the Project; and ii. Habitable spaces are likely to receive in excess of 45 dB $L_{Aeq(24h)}$ from motorway operational noise with windows closed, in the Design Year. For those PPFs, following the process set out in Conditions ON.7 to ON.11, it shall be determined which Building Modification Mitigation is required to achieve 40 dB L_{Aeq} inside habitable spaces. b. **Sector 9** – Prior to construction of the Project, a suitably qualified and experienced acoustics specialist approved by the Major Infrastructure Team Manager, Auckland Council shall identify those PPFs within 100m of the edge of the closest traffic lane of the motorway carriageway where, following implementation of all the structural mitigation measures included in the Detailed Mitigation Options, habitable spaces are likely to receive in excess of 40 dB $L_{Aeq(24h)}$ from motorway operational noise with windows closed, in the Design Year. For those PPFs, following the process set out in ON.7 and ON.8, it shall be determined if Building Modification Mitigation may be required to achieve 40 dB L_{Aeq} inside habitable spaces. For those PPFs where Building Modification Mitigation is required to achieve 40 dB L_{Aeq} inside habitable spaces, this shall be implemented following the process set out in ON.9 to ON.11.

Noise (ON) Conditions – Operation	
ON.7	a. Prior to commencement of construction of any sector of the Project in the vicinity of a PPF identified under Condition ON.6, the NZTA shall write to the owner of each such building seeking access 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 building approve the NZTA's access to the property within 12 months of the date of the NZTA's letter (sent pursuant to Condition ON.7(a)), then no more than six months prior to commencement of construction in any sector of the Project, the NZTA shall instruct a suitably qualified and experienced acoustics specialist approved by the Major Infrastructure Team Manager, Auckland Council, to visit the building to measure internal noise levels and assess the existing building envelope in relation to noise reduction performance.
ON.8	Where a PPF identified under Condition ON.6 is identified, the NZTA shall be deemed to have complied with Condition ON.7 above where: a. The NZTA (through its acoustics specialist) has visited the building; or b. The owner(s) of the building approved the NZTA's access, but the NZTA could not gain entry for some reason after repeated attempts; or c. The owner(s) of the building did not approve the NZTA's access to the property within the time period set out in Condition ON.7(b) (including where the owner(s) did not respond to the NZTA's letter (sent pursuant to Condition ON.7(a) within that period); or d. The owner(s) of the 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 Building, the NZTA shall not be required to implement any Building Modification Mitigation at that Building
ON.9	Subject to Condition ON.8, within 6 months of the assessment required under Condition ON.7(b), the NZTA shall give written notice to the owner of each PPF identified under Condition ON.6~~)~~: 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 options for building modification mitigation is available, to advise which of those options the owner prefers.
ON.10	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 undertaking any required third party authorisation) in a reasonable and practical timeframe agreed between the NZTA and the owner. Building Modification Mitigation shall be to the standard specified in section 8.3.2 of NZS 6806:2010. *Advice note: The NZTA will be responsible for obtaining any necessary building consents or other approvals to undertake the above Building Modification Mitigation.*

Noise (ON) Conditions – Operation	
ON.11	Subject to Condition ON.8, where Building Modification Mitigation is required, the NZTA shall be deemed to have complied with Condition ON.10 above where: a. The NZTA has completed Building Modification Mitigation to the Building; or b. The owner(s) of the Building did not accept the NZTA's offer to implement Building Modification Mitigation prior to the expiry of the timeframe stated in Condition ON.9(b) above (including where the owner(s) did not respond to the Requiring Authority within that period); or c. The owner of the Building cannot, after reasonable enquiry, be found prior to completion of construction of the Project.
ON.12	The NZTA shall manage and maintain the Detailed Mitigation Options to ensure that, those mitigation works are maintained to retain their noise attenuation performance indefinitely.
ON.13	All mechanical services associated with the general operation of the tunnels shall be designed such that noise emissions do not exceed the following noise limits, when measured at or within the boundary of any residential-zoned site: Monday to Saturday 7 am to 10 pm 50 dB $L_{Aeq(15\ min)}$ Sunday & Public Holidays 9 am to 6 pm 50 dB $L_{Aeq(15\ min)}$ At all other times 40 dB $L_{Aeq(15\ min)}$ 75 dB L_{Amax}
ON.14	a. Prior to construction, the NZTA shall arrange for a suitably qualified and experienced acoustics specialist approved by the Major Infrastructure Team Manager, Auckland Council to undertake a minimum of 8 (eight) representative measurements of ambient noise levels. Measurements shall be undertaken in accordance with the requirements of Section 5.2 of NZS 6806:2010. b. Following completion of the work, the NZTA shall arrange for a suitably qualified and experienced acoustics specialist approved by the Major Infrastructure Team Manager, Auckland Council to undertake traffic noise monitoring at the same sites surveyed in Condition ON.14 (a) above, within 2 to 3 years following completion of construction of the Project. Measurements shall be undertaken in accordance with the requirements of Section 5.2 of NZS 6806:2010. c. The results of the noise level monitoring in accordance with ON.14(b) above shall be used to verify the computer noise model of the Detailed Mitigation Option. A report describing the findings of the verification shall be provided to the Major Infrastructure Team Manager, Auckland Council within one month of it being completed.